



Smart Phone Usability Preference among Older People

Kumru Didem ATALAY¹, Gülin Feryal CAN² and Feride Bahar KURTULMUŞOĞLU³

¹Başkent University Engineering Faculty, Industrial Engineering Department, Bağlıca Campus, Eskişehir path 20. Km, Etimesgut, Ankara, TURKEY, 06810, katalay@baskent.edu.tr

²Başkent University Engineering Faculty, Industrial Engineering Department, Bağlıca Campus, Eskişehir path 20. Km, Etimesgut, Ankara, TURKEY, 06810, gfcan@baskent.edu.tr

³Başkent University, Bağlıca Campus, Faculty Business and Administrative Science, Management Department, Eskişehir path 20. Km, Etimesgut, Ankara, TURKEY, 06810, bahar@baskent.edu.tr

ABSTRACT: The aim of this study was to investigate the usage and important usability features of smart phones among older people. Smart phone usability was assessed based on three factors, namely functionality/durability, convenience, and physical features. The importance attached to functionality/durability increased with increasing education level and decreasing age. Compared with women, men were found to attach higher importance to the physical features of smart phones. The most important reason for smart phone use among older people was communication. Individuals with a university degree reported playing games and making banking transactions as important uses of smart phones more frequently than did participants with lower education levels. The most important features in a smart phone are font size, battery life, and complexity of the smart phone interface. The wealthy and increasingly innovative older consumers of today constitute an important market for information communication technologies. The attitudes of older individuals toward technology are not homogenous. Although there has been a significant increase in smart phone use by older people, studies on this subject are limited. As such, research on smart phone usage and desired feature among older consumers is of utmost importance for producers.

Keywords: older people, usability, smart phone, aim of usage, gender, education

1. Introduction

Aging is an important social factor that shapes societies (Coughlin et al. 2007). Studies show that older people tend to be wealthy and innovative, comprising an important part of the consumption system (Carrigan and Szimigin 1999). Diamond (2005) reported that the financial responsibilities of older people are decreasing faster than their disposable income, which leads to a sense financial freedom for them. Although the market of older consumers is rapidly gaining importance (Lazer 1986; Sherman et al. 2001; Moschis 2003; Higgs and Hyde 2004; Stroud 2005; Medcalf 2006), most companies and marketing experts ignore it (Yoon and Cole 2008). The elderly market constitutes the least understood demographic market (Lazer 1986). They are regarded as a stereotypical group (Lazer 1986); however, this market is far from being homogenous (Cole and Houston 1987; Szimigin and Carrigan 2001). Marketing experts continue to

mistakenly base marketing strategies targeting older people on stereotypical profiles. However, this demographic comprises people with different thoughts, perspectives, and attitudes (Shortt and Ruys 1994; Caballero and Hart 1996; Moschis et al. 1997; Dychtwald 1997; Szimigin and Carrigan 2001).

Older people constitute an important segment of information communication technologies (ICT) consumers (Rogers and Fisk 2000; Vroman et al. 2015). Their attitudes toward the technology are also not homogenous (Ziefle and Bay 2005). Although older people are generally regarded as “invisible consumers” and are believed to generally avoid purchasing new, technologically complex products, they have an undeniable purchasing power (Visvabharathy and Rink 1986; Szimigin and Carrigan 2000; Trocchia and Janda 2000; Eisma et al. 2004; Reisenwitz et al. 2007). Older people show a tendency to accept new technological products provided that the cost does not surpass the usability (Lunsford and Burnett 1992; Mynatt et al. 2004; Rogers, Mayhorn, and Fisk 2004; Melenhorst et al. 2006; Yoon and Cole 2008).

The consumer acceptability of a product generally varies according to physical, mental and psychological factors. The term usability covers all the consumer interest and user-friendly features of a product (Kanis 1998). Usability is the ease with which users interact with a device (Dix et al. 1998), and it involves a combination of different product properties and attributes to meet the needs of the user (Wixon and Wilson 1997; Liljegen 2006). Given that usable products are sought out by consumers (Atalay and Eraslan 2014), designers aim to create products with high usability. Aesthetic design, learning ability, simplicity, intuitiveness, understandability, attractiveness, accessibility, memory capacity, flexibility, adaptability, and operability are the major aspects of usability (Baharuddin et al. 2012).

Smart phones have become one of the most popular and important communication tools (Huang et al. 2010). In addition, they have diverse uses and functions, as well as small displays (Leung and



Wei 2000). Today, the production value of the smart phone has surpassed that of personal computers and smart phones are leading products in the technological industry (Hu and Hu 2008). The rapid development of technology and increasing market competition are forcing producers to design and introduce new products to the market. The new functions of smart phones entail increasing design complexity and production costs. The majority of users do not require such complicated features (Norman 1988). Therefore, usability is a major factor in consumer preference of smart phones (Ketola 2002; Ziefle and Bay 2005; Ryu and Smith-Jackson 2006; Ji et al. 2006; Jokela et al. 2006). However, it is difficult to incorporate new complex functions without adversely affecting usability. Usability is related to many functions, including appealing and user-friendly applications, technological services, and consumer support.

Although smart phone use among older people has been increasing rapidly, there have been very few studies on this topic (Hardhill and Olphert 2012; Lee 2007). The studies show that older people use smart phones less frequently than other segments of society and prefer to use them mainly under emergency conditions. They also consider smart phones as a substitute, and not a complement, for landline phones (Coates 2001; Kurniawan 2008). Thus, older people are regarded as passive users who rely on smart phones when there are no alternatives (Hardill and Olphert 2012). Kurniawan (2008) reported that older people regard smart phones as a modern version of landline phones and they hardly use them for non-communicative purposes. The major uses of smart phones among older people are basic communication, security needs, and emergency calls (Malik and Azuddin 2013).

The attitudes of older people toward the use of smart phones have been examined in the literature, taking both the attractive factors and deterrents into account. Smart phone use among older people has been discussed in the context of the Technology Acceptance Model (TAM) (e.g., Mollenius et al. 2007; Van Biljon and Renaud 2008). TAM-based approaches show that ownership of a smart phone and the factors influencing the older people's smart phone use are based on demographic, socioeconomic, and personal preferences (e.g., Van Biljon and Renaud 2008; Conci et al. 2009).

Other studies focused on the usability of smart phones among older people. Piqueras-Fiszman et al. (2010) emphasized the importance of aesthetics and usability for older people. Usability problems related to the design and complexity of smart phones have been reported (Kurniawan 2008). Kurniawan (2008) showed that cognitive,

hearing, and visual impairments adversely affect learning smart phone use among older people. Nasir et al. (2008) reported that smart phones are too small to use and hold for older people (Zajicek 2004; Chen et al. 2013). Small buttons and screen size/text, as well as multilevel interfaces have been reported as barriers for the use of the device menu functions (Ziefle and Bay 2004). The difficulties encountered by older people in the use of smart phones are related mainly to becoming familiarized with the complex functions and physical interface (Chapman and Milham 2006; Eisma et al. 2003; 2004; Malik and Azuddin 2013). In terms of smart phone use, it was also reported that translation, dialing speed, inappropriate writing style in manuals, and health concerns are other difficulties encountered by older people.

Lee (2007) emphasized that the elderly market is not homogenous and that producers must take different needs and features into account when designing smart phones. Most smart phone producers simply decrease the number of features of the phones intended for the elderly market. This in turn decreases the effectiveness and the value of the phone (Renaud and Van Biljon 2010). The aim of this study is to analyze smart phone usage among older people and to determine the important usability features. This study comprises four main parts. The first part of this study investigates the major purposes for which people over 50 years of age use smart phones. The second part is an explanation of the methodology of the study. The third part is the evaluation of the data, and the final section summarizes the conclusions drawn from the data analysis.

2. Methodology

This study finds that usability dimensions gain importance with increasing age for people above 50 years of age. The dimensions of usability and the motivations for using smart phones are identified according to gender and the educational level of the participants. The data collected were evaluated using chi square, spearman correlation analysis, and factor analysis.

In total, 129 people above 50 years of age were selected using random sampling. Owing to the lack of a standard scale to define cultural, social, and personal attitudes and the lack of probability models by which determine the distribution of these expressions, it was not possible to calculate the sample size required for statistical power analysis. Given that the main purpose of qualitative research is not to generalize the data for the whole population, one or two cases are sufficient (Luborsky and Rubinstain 1995; Collins, Onwuegbuzie, and Jiao 2006; Onwuegbuzie and Leech 2007).



The sample in the present study comprised people aged 50 to 84 years with a mean age of 56.845 ± 6.18 . One-third (33.3%; 43 participants) of the participants were female and the remainder (66.7%; 86 participants) were male. In terms of education level, 5.4% of them had elementary schooling, 31.0% had a high school diploma, 57.4% had bachelor's degree, 5.4% had a master's degree, and 0.5% had a PhD.

The participants were subjected to 1-hour interviews with one expert working as a usability engineer and were asked questions related to their smart phone use. The interviews were videotaped with the consent of the participants. The answers were also recorded in written format. The participants were asked open-ended, easily understandable questions focused on the topic. Every person was given equal time to complete the interview. The utmost care was taken to prevent participant bias. The questionnaire also included alternatives and control questions.

The research questions were open-ended. Open-ended question-based interviews are a popular unstructured interview methodology (Chadwick et al. 1984). The open-ended questions made for a flexible research design. The questions covered topics that are closely related to the aims of this study. The interview method was chosen because this method encourages communication and interaction, and strengthens the validity and generalizability of the study. According to these criteria, the interview questions were as follows:

- What features must smart phones possess?
- What features need to be improved in order to increase the usability of smart phones?
- What is your main motivation for using a smart phone?
- What features of smart phones do you consider to be excessive, which would improve usability if they were absent?
- Which smart phone feature do you consider the most important in terms of ease of use?

The data analysis was carried out using the original format of the responses received. Meaningful classifications were used as subcategories for the aim of usage and usability of smart phones dimensions for older people using word-, sentence-, paragraph-, or pages-long statements (Weber 1990). In the first step, three coders reviewed the answers and determined the subcategories. In the second phase, the latter were coded based on the subcategories. In the study, themes were drawn from word and sentence units. Sentences are considered more reliable than other analysis units (Milne Adler 1999). The rule of

emergent probability was applied in the coding process (Stemler 2001). Basic word count was used to determine recurring words (Ryan and Bernard 2000). Together, these methods were used to determine the categories for usability and usage, and their respective subcategories. The authors reached consensus on the choice of categories/subcategories by determining them separately before discussing with the group until an agreement was reached. The number of items in the subcategories of usability and usage purpose was 377 and 248, respectively. The frequencies of the items for categories are shown in Tables 1 and 2 for the purpose of use and usability, respectively.

3. Results

The purposes of smart phone usage among older people were sorted under 11 categories: communication, Internet searching, banking transactions, playing games, navigation, information storage, listening to the radio or music, use as an alarm clock, use as a calculator, and lighting. The most frequently cited reason (90.7%) for using smart phones among the study participants was communication, followed by Internet searching (45%), and banking transactions (12.4%).

Table 1. The categories for the aims of mobile phone usage

| for the Aim of mobile phone usage | Number of answers who fall in this category | % of the answer who fall into this category (n=129) |
|-----------------------------------|---|---|
| Communication | 117 | 90.7 |
| Internet searching | 58 | 45 |
| Banking transactions | 16 | 12.4 |
| Playing games | 13 | 10.1 |
| Navigation | 12 | 9.3 |
| Information storage | 11 | 8.5 |
| Listening to the radio or music | 7 | 5.4 |
| Use as an alarm clock | 7 | 5.4 |
| Use as a calculator | 4 | 3.1 |
| Lighting | 3 | 2.3 |

The usability of smart phones was also analyzed using 13 categories: color, thinness, screen resolution, weight, adaptation, processing speed, camera quality, screen strength, battery life, memory, font size, sound level, and complexity of user interface. According to the study participants, the most important categories are font size (54.3%) and battery life (46.5%).



Table 2. The frequencies and percentages according to usability dimension

| Categories | The number of answers that fall in the related category | % of answers that fall in to the related category (n=129) |
|------------------------------|---|---|
| Color | 3 | 2.3 |
| Thinness | 4 | 3.1 |
| Screen resolution | 14 | 10.9 |
| Weight | 13 | 10.1 |
| Adaptation | 30 | 23.3 |
| Processing speed | 35 | 27.1 |
| Camera quality | 27 | 20.9 |
| Screen strength | 33 | 25.6 |
| Battery life | 60 | 46.5 |
| Memory | 11 | 8.5 |
| Font size | 70 | 54.3 |
| Sound level | 32 | 24.8 |
| Complexity of user interface | 45 | 34.9 |

The usability main categories were reduced to three major dimensions: physical features, functionality/durability, and convenience using factor analysis to determine the most important usability dimensions for older people. Accordingly, the three factors explain 15.88%, 12.05% and 11.86% of the variance, respectively (39.78% in total). The results of the factor analysis are given in Table 3.

The suitability of the data set was checked using the Bartlett and Kaiser–Meyer–Olkin tests. In the Bartlett test, $p = 0.00$; therefore, the H_0 hypothesis, assuming that the correlation matrix was a unit matrix, was rejected. The result obtained from the Kaiser–Meyer–Olkin test was 61%, which confirmed that the data set was suitable for factor analysis. The factor-obtaining method employed was principal components analysis. The rotation technique selected was varimax.

Table 3. Factor analysis results of the usability dimensions

| | Physical | Functionality/durability | Convenience |
|-------------------|----------|--------------------------|-------------|
| Physical | | | |
| Color | 0.71 | | |
| Thinness | 0.66 | | |
| Screen resolution | 0.62 | | |
| Weight | 0.60 | | |
| Functionality | | | |

| | Physical | Functionality/durability | Convenience |
|------------------------------|----------|--------------------------|-------------|
| /durability | | | |
| Adaptation | | 0.61 | |
| Processing speed | | 0.58 | |
| Camera quality | | 0.53 | |
| Screen strength | | 0.50 | |
| Battery life | | 0.37 | |
| Memory | | 0.27 | |
| Convenience | | | |
| Font size | | | 0.71 |
| Sound level | | | 0.68 |
| Complexity of user interface | | | 0.56 |

The most important dimension for the participants was found to be functionality/durability, at 76.7%, followed by convenience, at 69%, and physical features, at 18.6% (Table 4).

Table 4. The frequencies and percentages related to the usability dimensions

| Usability dimension | Number of answers which fall into related category | % Number of answers which fall into related category (n=129) |
|--------------------------|--|--|
| Physical features | 24 | 18.6 |
| Functionality/durability | 99 | 76.7 |
| Convenience | 89 | 69.0 |

To determine the relationship between smart phone usability dimension preferences and education level, the participants were divided into two groups: those with a university degree (82 people, 63.60%), and those without (47 people, 36.40%). The difference in functionality/durability according to education level was observed to be statistically significant ($p = 0.001$). The importance attached to functionality/durability was found to increase as the level of education increased. Of the participants with university degrees, 86.6% considered functionality/durability as an important factor compared with 59.6% of participants without. There was no statistically significant difference in the physical features or convenience dimensions according to the education level.





The only statistically significant difference observed in the physical features dimension was according to gender ($p = 0.042$). The percentage of males who found the physical features dimension important was more than twice that of females (23.3% vs. 9.3%, respectively).

There was a negative correlation ($r = -0.220$) between age and the perceived importance of functionality/durability ($p = 0.012$).

The percentage of participants who considered physical features dimension important was 18.6%. Among those participants, 66.7% were university graduates, and 83.3% were male. The mean of age was 56.5 ± 6.85 years. The percentage of those who responded that functionality/durability is important was 76.7%; among them, 71.7% were university graduates; 63.6% were male. The mean age of those participants was 56 ± 5.45 years. The percentage of participants who gave importance to the convenience dimension was 69%; 59.6% of them were university graduates, and 68.5% were male. The mean of age of that group was 57 ± 6.71 years.

When we examined the usage aim categories, we found a statistically significant difference for the educational level according to the importance given to playing games on smart phones ($p = 0.018$). The percentages of those who attached importance to playing games were 14.6% and 2.1% for those with a university degree and more and those without a university degree, respectively. There was also a statistically significant difference for the educational level according to the importance given to the banking transaction category ($p = 0.027$). The group without a university degree placed more importance on the banking transactions category (17.1%) compared with university graduates (4.3%).

The usage aim categories were investigated according to gender. The percentages of males and females who found the banking transactions category important were 16.3% and 4.7%, respectively. The difference was statistically significant ($p = 0.048$). There was no statistically significant difference in the other usage aim categories according to gender.

Finally, there was a lower negative correlation between the listening to the radio and music category and the age of participants ($r = -0.173$; $p = 0.049$).

4. Discussion and conclusion

Communication dimension was found to be the primary purpose for using smart phones among older people; this result is in good accordance with the concept of “episodic use” defined in the Crang

and Graham (2005) study. Their study mentions that people who use the smart phones in an episodic manner use them for the sole purpose of communication and hardly use the other features. Other studies corroborate that older people use smart phones mainly for communication (Selwyn et al. 2003; Crang et al. 2006; Lee 2007; Kurniawan 2008; Ling 2008; Beneke et al. 2011; Martinez-Pecino et al. 2012; Vroman et al. 2015). Melenhorst et al. (2001) reported that, according to older people, the main advantages of smart phones included the ability to “keep in touch with someone emotionally close who lives more than half an hour away”, “to set a time for a leisure activity with a friend,” and “to immediately share exciting or good news”. Osman, Ziefle, and Bay (2005) found that older people regard playing games on smart phones as a waste of time. However in this study, gaming was found to be among the top five aims of smart phones usage. This study also revealed that older people with a university degree give more importance to playing games compared with people with secondary education or less.

Older people with a university degree also reported that use of smart phones for banking transactions is important. Rose (2007), in his study on the use of banking technologies by older people, found that those with higher educational attainment prefer to make banking transactions using smart phones, particularly among men. Ramón-Jerónimo et al. (2013) reported that older men use the Internet much more easily compared with women.

In the present study, participants reported that—in order of importance— functionality/durability, convenience, and physical features are key smart phone usability dimensions. Dabholkar, Bobbitt, and Lee (2003) emphasized the importance of convenience in their study, where they investigated the motivation and behavior of people above 55 years of age using the scanning technique for wholesale purposes. Lee (2007) reported that convenience and functionality are the most important aspects of smart phones for older people. Kubik (2009) found ease of use and functionality to be priority features of smart phones among older age groups. The findings of this study correspond with those of Renaud and van Biljons’ study (2010) in terms of the effectiveness and accessibility dimensions of smart phones. The studies of Zhou et al. (2014) and Kurniawan (2008) also coincide well with the present study, particularly the results on the functionality/durability dimension. The findings reported by Hasegawa (2006) regarding the importance of font size, battery life, and user interface for older smart phone users also support the results obtained in this study. These findings are important for producers targeting older consumers.



This study revealed that educational level is only an effective predictor of smart phone functionality/durability preferences. There was a positive relationship reported in the literature between higher educational level and effective use of new technologies, including smart phones (Darian 1987; Venkatraman 1991; Sim and Koi 2002; Fernandez-Ardevol and Arroyo Prieto 2012; Vroman et al. 2015). The importance of the functionality/durability dimension decreases as the age of the participants increases. In addition, males give more priority to physical features compared with females. Kurniawan (2008) also found that males consider the shape and color of smart phones more important compared with females. Additionally, males prefer thinner and smaller smart phones compared with females. There were no gender-based statistically significant differences for the other usability dimensions. However, previous studies indicate that men are much more willing to accept new technologies compared with

women (Darian 1987; Venkatraman 1991; Sim and Koi 2002). Taken together, these results indicate that older people who prioritize usability dimensions are younger males and with a relatively high education level.

Designing a successful and profitable product design requires good understanding of customer demands (Swift 1997). As such, analyses and predictions of consumer behavior and preferences are of paramount importance for smart phone producers in order to develop new features in accordance with these preferences (Sandhusen 2000; Huang et al. 2010). The findings of this and previous studies show that smart phone user preferences largely depend on the age of the customer (Kotler and Keller 2006). Older consumers are steadily becoming an integral part of the smart phone market (Malik and Azuddin 2013). The findings of this study confirm that their preferences need to be taken into account in smart phone design.

References

- Abascal, J., and A. Civit. 2001. "Smart Communication for Older People: New Opportunities for Autonomous Life." *Workshop on Universal Accessibility of Ubiquitous Computing: Providing for the Elderly*, Alcacero do Sal, Portugal, May.
- Ahn, J. H., M. S. Kim, and D. J. Lee. 2005. "Learning from the Failure: Experiences in the Korean Telecommunications Market." *Technovation* 25: 69–82.
- Al-Razgan, M. S., H. S. Al-Khalifa, M. D. Al-Shahrani, and H. H. AlAjmi. 2012. "Touch-Based Smart Phone Interface Guidelines and Design Recommendations for Elderly People: A Survey of the Literature." *Neural Information Processes. Lecture Notes in Computer Science* 7666: 568–574.
- Beneke, J., N. Frey, R. Chapman, N. Mashaba, and T. Howie. 2011. "The Grey Awakening: A South African Perspective." *Journal of Consumer Marketing* 28(2): 114–124.
- Brosnan, M. 1998. *Technophobia*. London: Routledge.
- Caballero, M., and M. Hart. 1996. "Market Dynamics: Three-'S' Tourism and the Mature Single Lady." *International Journal of Contemporary Hospitality Management* 8(2): 10–13.
- Cameron, D., R. Marquis, and B. Webster. 2001. "Older Adults Perceptions, Experiences and Anxieties with Emerging Technologies." *Australasian Journal of Ageing* 20(2): 50–56.
- Carrigan, M. and I. Szimigin. 1999. "In Pursuit of Youth: What's Wrong with the Older Market?" *Marketing Intelligence and Planning* 17(5): 222-231, 1999.
- Chapman, C. N., and R. P. Milham. 2006. "The Persona's New Clothes: Methodological and Practical Arguments against a Popular Method." *Proceedings of the Human Factors and Ergonomics Society 50th Annual Meeting*: 634-636.
- Charness, N., D. C. Park, and B. A. Sabel. 2001. *Communication, Technology and Aging: Opportunities and Challenges for the Future*. New York: Springer Publishing Company, Inc.
- Chen, K., A. H. S. Chan, and S. N. H. Tsang. 2013. "Usage of Smart Phones Amongst Elderly People in Hong Kong." In *Proceedings of the Multiconference of Engineers and Computer Scientists 2013 Vol. 5*, S. I. Ao, O. Castillo, C. Douglas, D. Dagan Feng, and J. A. Lee, 1016–1019. Hong Kong: Newswood Ltd.
- Coates, H. 2001. "Smart Phone Users: A Small-Scale Observational Study." Accessed November 2016 /<http://www.aber.ac.uk/media/Students/hec9901.html>S.
- Cole, C. A., and M. J. Houston 1987. "Encoding and Media Effects on Consumer Learning Deficiencies in the Elderly." *Journal of Marketing Research* 24: 55–63.



- Conci, M., F. Pianesi, and M. Zancanaro. 2009. "Useful, Social and Enjoyable: Smart Phone Adoption by Older People." *Proceedings of the 12th International Conference on Human-Computer Interaction: Part I*, edited by T. Gross et al., 63–76. Berlin: Springer.
- Coughlin, J. F., L. A. D'Ambrosio, B. Reimer, and M. R. Pratt. 2007. "Older Adult Perceptions of Smart Home Technologies: Implications for Research, Policy and Market Innovations in Healthcare." *Conference Proceedings: 29th Annual International Conference of the IEEE Engineering in Medicine and Biology Society*, Lyon, France, August 23–26.
- Darian, J. C. 1987. "In-Home Shopping: Are There Consumer Segments?" *Journal of Retailing* 63(2): 163–186.
- Davis, F. D. 1989. "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology." *MIS Quarterly* 13: 319–339.
- Doughty, K. 2011. "SPAs (Smart Phone Applications) – A New Form of Assistive Technology." *Journal of Assistive Technologies* 5: 88–94.
- Dychtwald, M. 1997. "Marketplace 2000: Riding the Wave of Population Change." *Journal of Consumer Marketing* 14(4): 271–275.
- Eastman, J. K., and R. Iyer. 2004. "The Elderly's Uses and Attitudes Towards the Internet." *Journal of Consumer Marketing* 21(3): 208–220.
- Eisma, R., A. Dickinson, J. Goodman, A. Syme, L. Tiwari, and A. F. Newell. 2004. "Early User Involvement in the Development of Information Technology-Related Products for Older People." *Universal Access in the Information Society* 3(2): 131–140.
- Eisma, R., A. Dickinson, J. Goodman, O. Mival, A. Syme, and L. Tiwari. 2003. "Mutual Inspiration in the Development of New Technology for Older People." *Proceedings of Include 2003*, London, March 7: 252–259.
- Fernandez-Ardevol, M., and L. Arroyo Prieto. 2012. "Smart Telephony and Older People: Exploring Use and Rejection." *Interaction: Studies in Communication & Culture* 3: 9–24.
- Gilly, M., and V. A. Zeithaml. 1985. "Elderly Consumers and Adoption of Technology." *Journal of Consumer Research* 12(3): 353–357.
- Glasscock, N. F., and M. S. Wogalter. 2006. "Evaluating Preferences for Smart Phone Features." *Proceedings of the Human Factors and Ergonomics Society 50th Annual Meeting*: 1259–1263.
- Hardhill, I., and W. C. Olphert. 2012. "Staying Connected: Exploring Smart Phone Use Amongst Older Adults in the UK." *Geoforum* 43: 1306–1312.
- Hasegawa S., S. Matsunuma, M. Omori, and M. Miyao. 2006. "Aging Effects on the Visibility of Graphic Text on Smart Phones." *Gerontechnology* 4(4): 200–208.
- Hine, N., F. Petersen, and E. Zetterström. 2008. "Function Standards for Interfacing Smarts with Assistive Devices." *Gerontechnology* 7(3): 319–324.
- Hu, J.-L. and Y.-H. Hsu. 2008. "The More Interactive, the More Innovative? A Case Study of South Korean Cellular Phone Manufacturers." *Technovation* 28: 75–87.
- Huang, C.-Y., Y.-L. Yang, G.-H. Tzeng, S.-T. Cheng, and H.-Y. Lee. 2010. "4G Smart Phone Consumer Preference Predictions by Using the Rough Set Theory and Flow Graphs." *PICMET*, Bangkok, Thailand, July 18–22.
- Jastrzemski, T. S., and N. H. Charness. 2007. "The Model Human Processor and the Older Adult: Parameter Estimation and Validation within a Smart Phone Task." *Journal of Experimental Psychology: Applied* 13(4): 224248. doi: 10.1037/1076-898X.13.4.224.
- Joe, J., and G. Demiris. 2013. "Older Adults and Smart Phones for Health: A Review." *Journal of Biomedical Informatics* 465: 947–954.
- Kennett, P. A., G. P. Moschis, and D. N. Bellenger. 1995. "Marketing Financial Services to Mature Consumers." *Journal of Services Marketing* 9(2): 62–72.
- Kotler, P., and K. L. Keller. 2006. "Identifying Market Segments and Targets." In *Marketing Management*. 12th ed., 234. Singapore: Pearson Education.
- Kubik, S. 2009. "Motivations for cell phone use by older Americans." *Gerontechnology* 8(3): 150–164.
- Kurniawan S. 2008. "Older People and Smart Phones: Multi-Method Investigation." *International Journal Human-Computer Studies* 66: 889–901
- Kurniawan, S. 2008. "Older People and Smart Phones: A Multi-Method Investigation." *International Journal of Human-Computer Studies* 66: 889–901.
- Lazer, W. 1986. "Dimensions of the Mature Market." *Journal of Consumer Marketing* 3(3): 23–34.



- Lee, J. H., and J. Kim. 2014. "Socio-Demographic Gaps in Smart Use, Causes, and Consequences: A Multigroup Analysis of the Smart Divide Model." *Information, Communication & Society* 17: 917–936.
- Lee, Y. S., 2007. "A Survey of Smart Phone Use in Older Adults." *Proceedings of the Human Factors and Ergonomics Society 51st Annual Meeting*, Baltimore, Maryland, October 1–5.
- Ling, R. 2008. "Should We Be Concerned That the Elderly Don't Text?" *The Information Society* 24: 334–341.
- Lunsford, D. A., and M. S. Burnett. 1992. "Marketing Product Innovations to the Elderly: Understanding the Barriers to Adoption." *Journal of Consumer Marketing* 9(4): 53–63.
- Malik, S. A., and M. Azuddin. 2013. "Smart Technology for Older People: Use of Personas." *3rd International Conference on Research and Innovation in Information Systems*, Kuala Lumpur, Malaysia, November 27–28.
- Mallenius, S., M. Rossi, and V. K. Tuunainen. 2007. "Factors Affecting the Adoption and Use of Smart Devices and Services by Elderly People – Results from a Pilot Study." *Proceedings of 6th Annual Global Mobility Roundtable*, Los Angeles, CA, June 1–2.
- Martinez-Pecino, R., M. J. Lera, M. Martinez-Pecino. 2012. "Active Seniors and Smart Phone Interaction." *Social Behavior and Personality* 40: 875–880.
- Mathur, A., and G. P. Moschis. 1994. "Use of Credit Cards by Older Americans." *Journal of Services Marketing* 8(1): 27–36.
- Mayhorn, C. B., A. J. Stronge, A. C. McLaughlin, and W. A. Rogers. 2004. "Older Adults, Computer Training, and the Systems Approach: A Formula for Success." *Educational Gerontology* 30: pp. 185–203.
- Mayhorn, C. B., A. J. Stronge, A. C. McLaughlin, and W. A. Rogers. 2004. "Older Adults, Computer Training, and the Systems Approach: A Formula for Success." *Educational Gerontology* 30: 185–203.
- Melenhorst, A. S., W. A. Rogers, and D. G. Bouwhuis. 2006. "Older Adults' Motivated Choice for Technological Innovation: Evidence for Benefit-Driven Selectivity." *Psychology and Aging* 21(1): 190–195.
- Meuter, M. L., A. Ostrom, M. J. Bitner, and R. Roundtree. 2003. "The Influence of Technology Anxiety on Consumer Use and Experiences with Self-Service Technologies." *Journal of Business Research* 56: 899–906.
- Midford, R., and K. Kirsner. 2005. "Implicit and Explicit Learning in Aged and Young Adults." *Aging Neuropsychology and Cognition* 12(4): 359–387.
- Mikkonen M., S. Vayrynen, V. Ikonen, and M. O. Heikkila. 2002. "User and Concept Studies as Tools in Developing Smart Communication Services for the Elderly." *Personal and Ubiquitous Computing* 6 (2): 113–124.
- Moschis, G. P. 2003. "Marketing to Older Adults: An Updated Overview of Present Knowledge and Practice." *Journal of Consumer Marketing* 20(6): 516–525.
- Moschis, G., E. Lee, and A. Mathur. 1997. "Targeting the Mature Market: Opportunities and Challenges." *Journal of Consumer Marketing* 14(4): 282–293.
- Mynatt, E. D., A. S. Melenhorst, A. D. Fisk, and W. A. Rogers. 2004. "Aware Technologies for Aging in Place: Understanding User Needs and Attitudes." *IEEE Pervasive Computing* 3(2): 36–41.
- Nasir, M. H. N. M., H. Hassan, and N. Jomhari. 2008. "The Use of Smart Phones by Elderly: A Study in Malaysia Perspectives." *Journal of Social Sciences* 4: 123–127.
- Norman, D. 1988. *The Design of Everyday Things*. New York: Basic Books.
- NTT Docomo. 2001. "Smart Phones Increasingly Popular Among the Elderly." NTT Docomo Press Release 34. Accessed November 2016 /http://www.nttdocomo.com/files/presscenter/34_No11_Doc.pdfS.
- Ofcom. 2006. "Media Literacy Audit: Report on Media Literacy Amongst Older People." Ofcom. Accessed December 2016/http://www.ofcom.org.uk/advice/media_literacy/medlitpub/medlitpubrss/older/older.pdfS.
- Oksman, V. 2006. "Young People and Seniors in Finnish 'Smart Information Society'." *Journal of Interactive Media Education* 2: 1–21.
- Oumlil, M., and V. Williams. 2000. "Consumer Education Programs for Mature Consumers." *Journal of Services* 14(3): 232–243.
- Pahor, M., B. Domanjko, and V. Hlebec. 2009. "Spleti zdravja in bolezni: socialna omrežja starejših kot dejavnik zdravja." In *Starejši ljudje v družbi sprememb*, edited by V. Hlebec, 221–237. Aristej, Maribor.
- Piqueras-Fiszman, B., G. Ares, J. Alcaide-Marzal, and J. A. Diego-Más. 2011. "Comparing Older and Younger Users' Perceptions of Smart Phones and Watches Using Cata Questions and Preference Mapping on the Design Characteristics." *Journal of Sensory Studies* 26: 1–12.



- Plaza, I., L. Martin, S. Martin, and C. Medrano. 2011. "Smart Applications in an Aging Society: Status and Trends." *Journal of Systems and Software* 84, 1977–1988.
- Ramón-Jerónimo, M. A., B. Peral-Peral, and J. Arenas-Gaitán. 2013. "Elderly Persons and Internet Use." *Social Science Computer Review* 31(4): 389–403.
- Reisenwitz, T., R. Iyer, D. Kuhlmeier, J. Eastm. 2007. "The Elderly's Internet Usage: An Updated Look." *Journal of Consumer Marketing* 24(7): 406–418.
- Renaud, K., and J. van Biljon. 2010. "Worth-Centred Smart Phone Design for Older Users." *Universal Access in the Information Society* 9: 387–403.
- Rogers, W. A., and A. D. Fisk. 2000. "Human Factors." *The Handbook of Aging and Cognition*. 2nd ed., edited by F. I. M. Craik, and T. A. Salthouse, 559–591. Mahwah, NJ: Erlbaum.
- Rogers, W. A., C. B. Mayhorn, and A. D. Fisk. 2004. "Technology in Everyday Life for Older Adults" *Gerotechnology: research and practice in technology and aging*, edited by D. Burdick and S. Kwon, 3–17. New York: Springer.
- Rose, J. D. 2007. Predicting Mature Consumers' Attitudes Towards Use of Self-Service Technologies in the Financial Services Context." PhD diss. University of Southern Queensland.
- Ryan, G. W., & Bernard, H. R. (2000). Data management and analysis methods. McGrawhill: New York
- Sandhusen, R. L. 2000. Marketing. Hauppauge, New York: Barron's Educational Series, Inc.
- Sawchuk, K., and B. Crow. 2010. "Talking 'Costs': Seniors, Cell Phones and the Personal and Political Economy of Telecommunications in Canada." *Telecommunications Journal of Australia* 60, 55.1–55.11.
- Schiffman, L. G., and E. Sherman. 1991. "Value Orientation of New-Age Elderly: The Coming of an Ageless Market." *Journal of Business Research* 22(2): 187–194.
- Sherman, E., L. Schiffman, and A. Mathur. 2001. "The Influence of Gender on the New-Age Elderly's Consumption Orientation." *Psychology & Marketing* 18(10): 1073–1089.
- Shortt, G., and H. Ruys. 1994. "Hotel Security: The needs of the Mature Age Market." *International Journal of Contemporary Hospitality Management* 6(5): 14–19.
- Sim, L. L., and S. M. Koi. 2002. "Singapore's Internet Shoppers and their Impact on Traditional Shopping Patterns." *Journal of Retailing and Consumer Services* 9(2): 115–124.
- Smither, J. A.-A., and C. C. Braun. 1994. "Technology and Older Adults: Factors Affecting the Adoption of Automatic Teller Machines." *The Journal of General Psychology* 121(4): 381–389.
- Sudbury, L., and P. Simcock. 2009a. "A Multivariate Segmentation Model of Senior Consumers." *Journal of Consumer Marketing* 26(4): 251–262.
- Szmigin, I., and M. Carrigan. 2000. "The Older Consumer as Innovator: Does Cognitive Age Hold the Key." *Journal of Marketing Management* 16: 505–527.
- Szmigin, I., and M. Carrigan. 2001. "Time, Consumption, and the Older Consumer: An Interpretive Study of the Cognitively Young." *Psychology & Marketing* 18: 1091–1116.
- Szmigin, I., and M. Carrigan. 2001a. "Learning to Love the Older Consumer." *Journal of Consumer Behaviour* 1(1): 22–34.
- Trocchia, P. J., and S. Janda. 2000. "A Phenomenological Investigation of Internet Usage Among Older Individuals." *Journal of Consumer Marketing* 17(7): 605–616.
- Van Biljon, J., and K. Renaud. 2008. "A Qualitative Study of the Applicability of Technology Acceptance Models to Senior Smart Phone Users." *Lecture Notes in Computer Science* 5232, 228–237.
- Van Biljon, J., T. V. Dyk, and H. Gelderblom. 2010. Smart Phone Adoption: Optimising Value for Older Adults in a Developing Country IDIA 2010 Conference, Cape Town, South Africa 3-5 November 2010. 1-24
- Venkatesh, V., and H. Bala. 2008. "Technology Acceptance Model 3 and a Research Agenda on Interventions." *Decision Sciences* 39: 273–315.
- Venkatraman, M. P. 1991. "The Impact of Innovativeness and Innovation Type on Adoption." *Journal of Retailing* 67(1): 51–67.
- Visvabharathy, G., and D. R. Rink. 1986. "The Elderly: Still the 'Invisible and forgotten' market segment." *Academy of Marketing Science* 13(4): 81.
- Vroman, K. G., S. Arthanat, and C. Lysack. 2015. "'Who Over 65 is Online?' Older Adults' Dispositions toward Information Communication Technology." *Computers in Human Behavior* 43: 156–166.
- Weber, R. P. (1990). *Basic content analysis* (No. 49). Sage: New York
- Yoon, C. and C. A. Cole. 2008. "Aging and Consumer Behavior." In *Handbook of consumer psychology*, edited by C.P. Herr, and F.R. Kardes, 247-270 New York, NY: Lawrence Erlbaum Associates.



- Zajicek, M. 2004. "Successful and Available: Interface Design Exemplars for Older Users." *Interacting with Computers* 16: 411–430.
- Zhou, J., P.-L. Patrick Rau, and G. Salvendy. 2014. "Older Adults' Text Entry on Smartphones and Tablets: Investigating Effects of Display Size and Input Method on Acceptance and Performance." *International Journal of Human–Computer Interaction* 30: 727–739.
- Zhou, J., P.-L. Patrick Rau, and G. Salvendy. 2014. "Older Adults' Use of Smart Phones: An Investigation of the Factors Influencing the Acceptance of New Functions." *Behaviour & Information Technology* 33(6): 552–560.
- Ziefle M., and S. Bay. 2005. "How Older Adults Meet Complexity: Aging Effects on the Usability of Different Smart Phones." *Behaviour & Information Technology* 24(5): 375–389.
- Ziefle, M., and S. Bay. 2004. "Mental Models of a Cellular Phones Menu. Comparing Older and Younger Novice Users." In *Smart Human Computer Interaction*, edited by S. Brewster, and M. Dunlop, 25–37. Berlin: Springer.