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Elderly people in eHealth: who are they?

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Abstract

eHealth initiatives are constantly evolving, supporting consumers to take active control of their health and well-being through access to health information via the Internet. Although particularly elderly people could benefit from eHealth, they often pose resistance and anxiety towards new technologies. Since modern technologies become increasingly complex, elderly's mental models on how technology works might be not supported. Today's technologies are often designed without paying attention to the circumstances of elderly people, thereby limiting the technologies' intended effectiveness. As such it becomes apparent to understand who these 'elderly people' actually are and how individual characteristics shape elderly's perceptions and behavior in using eHealth. Consequently, we seek to investigate how broad personality traits (i.e. the 'big five') affect perceptions of elderly of being generally able to use the Internet (i.e. self-efficacy) in order to use the Internet for health-related purposes. By conducting a quantitative study among elderly people, we aim to contribute to the knowledge on relationships between personality traits and self-efficacy. We further expect to provide new insights on elderly's personality in order to design effective systems for the growing segment of older adults.

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1. Introduction

Electronic Health (eHealth) are measures to support healthcare through information and communication technologies (ICT)¹. Nowadays, eHealth is increasingly consumer-directed aiming to enable consumers to take

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active control of their health and well-being by making health resources accessible via the Internet^{1,2}. In its most basic form, eHealth offers information portals about diseases, symptoms, and treatment options¹. Consequently, the Internet has become a major source for health information and medical decision support for individuals³. For instance, in 2009, 61% of the adults in the United States used the Internet to access information about their illnesses and treatment options⁴. In Germany, the number of people using the Internet for health information nearly doubled from 34% in 2006 to 58% in 2013⁵.

In parallel to that, most developed economies face a significant shift in their age structure through steady increase of elderly people⁶. In Germany, the demographic change poses a tremendous challenge for the country's healthcare system as diseases, such as chronic illnesses, usually increase with age⁷. Subsequently, elderly people are usually the heaviest users of the healthcare system. In that respect, eHealth offerings seem to be ideally suited to improve health and well-being of elderly individuals while saving resources in the healthcare system.

However, elderly people often tend to resist accepting new information technology (IT)⁸ and possess anxiety towards novel technologies⁹. This becomes further amplified by the steady increase in complexity of today's technology and the simultaneous decrease of elderly's cognitive resources⁹. Consequently, modern technology might not be in support of elderly's mental models of how effective interactions with technology actually works^{9,10}.

Contemporary technologies are often designed without paying the necessary attention on these circumstances of elderly people, thereby limiting technologies' intended effectiveness⁹. As system designers often tend to be younger individuals, a large age gap between designers and older users frequently exists¹¹. In many cases, younger designers assume similarity with potential users thereby leading to unconsciousness of age-related differences^{9,11}. In addition, recent research indicates that 'the elderly' are indeed "no homogenous group"¹². Consequently, it is necessary to understand who these 'elderly' actually are and how their perceptions and behavior are shaped in order to design effective systems supporting their needs.

As such, the importance of individual differences in understanding interactions with technology has been recognized¹³. However, these individual differences have often been only superficially investigated among key demographic variables such as age, gender or education^{8,14-16}. Consequently, Thatcher and Perrewe¹⁷ state that "[a]lthough mounting evidence suggests individual differences influence IT use, more integrative research is needed to better understand the nomological net among individual differences that relate to IT acceptance and use".

In its most general sense, individual differences can be characterized by personality, which reflects an individual's characteristic pattern of behavior affecting cognitive, affective and behavioral reactions¹⁸. Personality is a broad research topic in various domains, especially in organizational settings¹⁹. Within the domain of technology use, however, "[p]ersonality has been largely ignored [...] over the past two decades"²⁰, although it has received increased scholarly attention²¹. In this vein, McElroy et al.¹³ reflect that "people dominated by different personality characteristics will use the Internet to varying degrees and for different purposes".

Personality traits can be examined on distinct dimensions²². Higher-order traits capture a the range of relatively stable, broad traits, such as extraversion or neuroticism, which are commonly classified as the 'big five'²³. Lower-level traits are more narrowly and derive from higher traits (e.g. 'anxiety' is a second-order trait of neuroticism). Within the context of information systems (IS), lower-level traits, such as computer anxiety or computer self-efficacy, have been found to influence perceptions and use of IT²². Especially the concept of computer self-efficacy, defined as the "judgment of one's capability to use a computer"²⁴, has received increased attention within IS research²⁵⁻²⁷. In the context of elderly individuals, computer self-efficacy has been found to be the key predictor of Internet use of people aged 65 and above^{12,28}.

In order to understand how personality traits relate to each other and affect behavioral decisions of individuals, Thatcher and Perrewe¹⁷ call for further research to examine how different higher-order traits (i.e. the big five) relate to constructs influencing IT use, such as computer self-efficacy. Following this call in the realm of understanding elderly's health-related Internet use, the research question for our study arises: *How do personality traits of elderly individuals affect their self-efficacy and their use of the Internet for health-related purposes?*

To address our research question, the rest of the paper is structured as follows. Within the next chapter we will provide background information on personality traits both in general (i.e. the 'big five') and in IT-related situations by focusing on self-efficacy. After that, we will propose our research model aiming to investigate how personality affects self-efficacy and how self-efficacy in turn affects elderly's eHealth use. Next, we will outline our current and upcoming research steps to be taken and finally, we will outline our expected outcome and contribution.

2. Background

Personality reflects the unique facets of an individual and is reflected in all thoughts and actions of an individual²⁰. It can be distinguished between general (i.e. big five) and specific (i.e. self-efficacy) traits²² as follows:

2.1. Broad, general personality traits: big five

The Five-Factor Model of Personality (FFM)²³ is considered as a “parsimonious and comprehensive framework of personality”²⁰ that captures an individual’s personality within five broad factors as follows^{13,20}. ‘Conscientiousness’ reflects the tendency of individuals to be organized, self-disciplined, persistent, deliberate, and reliable; conscientious individuals are intrinsically motivated to achieve, highly perform and to take actions to improve their performance. ‘Extraversion’ refers to the tendency of being sociable, gregarious, cheerful, ambitious and optimistic; individuals high in extraversion tend to seek new opportunities. ‘Neuroticism’ is reflected by emotional instability, insecurity, and anxiousness; neurotic beings have the tendency to be sad, distrustful, fearful, embarrassed and lack in managing stress. ‘Openness to experience’ refers to curiosity, tolerance and flexibility of thoughts and the willingness to explore new ideas; these individuals question authority, possess unconventional ideas and think up new ideas. ‘Agreeableness’ reflects the tendency of individuals of being cooperative, sympathetic, and forgiving; individuals with high agreeableness have a strong interpersonal orientation.

2.2. Self-efficacy as major situation-specific IT-related trait shaping elderly’s IT use

With respect to the above outlined broad traits of individual personality, research on personality and psychology argues that personality is linked to behavior through certain cognitive processes, which determine an individual’s engagement in a specific situation (i.e. eHealth use of an older individual)^{20,29}. As such, research considers self-efficacy (SE) as key determinant of human behavior^{30,31}, defined as “the belief in one’s capability to organize and execute the courses of action required to manage prospective situations”³¹.

SE has been incorporated into the domain of IS research²⁵ and has become widely accepted and empirically validated in a diversity of IS research contexts investigating the effect of SE on computer-related reactions of individuals^{8,32}. Thereby, the concept of computer self-efficacy (CSE) has been introduced, defined as the “judgment of one’s capability to use a computer”²⁴. CSE has been found to play a significant role in one’s computer use^{17,26,33}.

In the context of older individuals, research has generally reported that elderly people have less CSE compared to younger individuals^{34,35}. However, research indicates that CSE along with outcomes expectations are the strongest predictors of elderly’s Internet use intentions^{12,36}.

Although various determinants of CSE have been found in general, such as training, encouragement, experience, age or gender, Tams et al.⁹ call for further research specifically focusing on how SE among elderly is shaped. Similarly, Thatcher and Perrew¹⁷ call for further research to examine how different higher-order traits (i.e. the big five) relate to constructs influencing IT use, such as computer self-efficacy. Thus, it becomes apparent to investigate these relationships among elderly to understand their perception and behavior in the context of eHealth use.

3. Research model

In order to understand how personality traits determine perceptions and behavior of elderly’s health-related Internet use, we propose our research model as depicted in Figure 1. Based on established causal models^{25,36}, we propose that computer self-efficacy (CSE) and outcome expectations regarding Internet-based health information act as primary determinants of individual’s intention to use eHealth offerings. Moreover, we argue that the five broad personality traits directly affect elderly’s CSE.

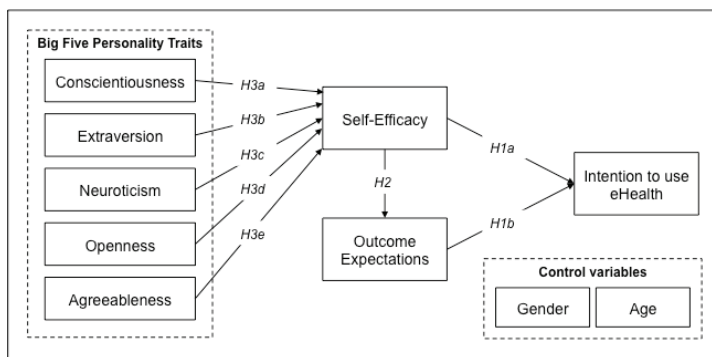


Fig. 1. Research model

'Intention to use eHealth' acts as dependent variable of our research model. In the context of our research, it is defined as an individual's intention to seek health information on the Internet.

Following established causal relationships in the context of CSE²⁵, we propose that elderly's intention to use eHealth is primarily shaped by outcome expectations and CSE (H1a, H1b). 'Computer self-efficacy' is hereto defined as judgment of one's capability to use websites²⁴, whereas 'Outcome Expectations' refer to the perceived likely consequences of an individual how using eHealth will positively impact one's health status and well-being²⁴. Self-efficacy judgments are considered as a direct determinant of one's outcome expectations, both, in general³⁷, as well as in the context of general IS behavior²⁵ and in the context of elderly's Internet use³⁶. Following prior evidence, we hypothesize, that higher CSE leads to higher outcome expectations (H2).

In addition to our proposed baseline model, we argue that an individual's higher personality traits (i.e. big five) are determinants of her/his computer self-efficacy perception as follows:

'Conscientiousness' describes an individual's degree of self-control and goal orientation, as well as one's need for achievement, order, thoroughness and persistence^{18,23}. An individual's conscientiousness has been found to be associated with one's general self-efficacy³⁸. It is further connected with one's motivation to learn and engage in behaviors helping one to succeed^{21,39}. In IS research, mixed results have been reported. Conscientiousness has been found to moderate the relationship between perceived usefulness and intention to use IT²⁰. A direct positive association has been found with IT use²¹. In light of IT-related traits, although no relationship has been found between conscientiousness and computer anxiety⁴⁰, Saleem et al.⁴¹ report a positive relationship with CSE. Thus, we propose that conscientiousness will be positively related to computer self-efficacy (H3a).

'Extraversion' reflects sociability, assertiveness, and gregariousness⁴². Extraverted individuals are associated with action-orientation, increased motivation to learn, have a higher tendency to try out new things and are faster in adapting to change^{18,41}. Empirical research indicates a positive relationship between extraversion and one's general self-efficacy³⁸. In the context of IS, extraverted people have a positive attitude and enjoyment of IT use⁴³. As direct antecedent of computer self-efficacy, Saleem et al.⁴¹ found extraversion to be the strongest of the big five traits. Consequently, we hypothesize that extraversion will be positively related to computer self-efficacy (H3b).

'Neuroticism' reflects the tendency of emotional instability and is regarded as the degree to which an individual is "anxious, depressed, angry, embarrassed, emotional, worried, and insecure"⁴². Individuals high on neuroticisms do not tend to seek out to learn new things³⁹. Individuals feeling anxious about novel situations, to which they haven't been exposed before, are rather prone to feelings of helplessness^{44,45}. Research indicates that neurotic individuals have less self-efficacy⁴⁶. Highly neurotic individuals feel higher anxiety, which in turn is negatively related to computer self-efficacy^{25,47}. Although it might be reasonable to suggest that neuroticism as a higher-order trait is negatively related to CSE, prior research could not confirm neuroticism as a direct determinant of CSE⁴¹. However, as further research is needed, we stay with prior indications between neuroticism and self-efficacy by hypothesizing that neuroticism will be negatively related to computer self-efficacy (H3c).

'Openness to Experience', or briefly openness, reflects an individual's trait of curiosity, originality and inquisitiveness⁴⁸. Similar to conscientiousness, openness is related to higher motivations to learn³⁹. However, research has not found a direct relationship between openness and one's general self-efficacy³⁸. In the context of IS

behavior, mixed relationships have been reported. For instance, McElroy et al.¹³ found a strong relationship between openness and Internet use of students. In contrast, Barnett et al.²¹ did not find any associations with technology use. Others found evidence associating higher openness with lower computer anxiety^{40,46}. Moreover, personal innovativeness in IT, which can be considered as a narrower situation-specific trait of openness, has been reported to positively affect computer self-efficacy¹⁷. As Saleem et al.⁴¹ found a direct positive relationship between openness and CSE, we hypothesize that openness to experience will be positively related to computer self-efficacy (H3d).

‘Agreeableness’ is related to characteristics such as fairness, unselfishness, tolerance and kindness⁴². Research on agreeableness has found only relatively weak relationships among a variety of tasks with mixed results²¹. For instance, Landers and Lounsbury⁴⁵ indicate that agreeableness was negatively related to Internet use in general. Barnett et al.²¹ did not find any associations with technology use. Varying results have been further reported for the IT-related trait of computer anxiety^{40,46}. Saleem et al.⁴¹ found a direct, yet negative and rather weak relationship between agreeableness and CSE. Although we expect that agreeableness has only minor to non-significant effects, we hypothesize that agreeableness will be negatively related to computer self-efficacy (H3e).

4. Next research steps and expected contribution

In order to test our research model and the proposed hypotheses, we carry out a quantitative study among elderly individuals aged 55 and above located in southern Germany through a paper-based field survey approach. To that end, a measurement instrument was developed and pre-tested with the target group on the basis of established measurement scales. Data collection currently takes place and is scheduled until end of July 2015 aiming at a sample size of at least 100 respondents. After that, the collected data will be analyzed using Partial Least Squares (PLS), including validity and reliability assessments.

The primary goal of our research is to advance knowledge on individual differences of the elderly population in the context of eHealth. We expect that awareness about individual differences of the elderly population and how these differences affect behavior in health-related IT use enables managers and system designers to build effective systems supporting elderly in their autonomous use of modern technology for health-related information needs. For instance, based on our findings, system designers and developers can create effective user profiles and personas helping them to understand the target group of older adults. Despite our practical contribution, our results are expected to contribute to theory by following the call of Thatcher and Perrewe¹⁷ to examine the relationships between broad, general personality traits and situation-specific traits (i.e. self-efficacy). These results, in turn, contribute to the overall research on personality in technology acceptance and use.

References

1. Rozenkranz N, Eckhardt A, Kühne M, Rosenkranz C. Health Information on the Internet. *Bus Inf Syst Eng*. 2013;5(4):259-74.
2. Agarwal R, Gao G, DesRoches C, Jha AK. Research commentary-The digital transformation of healthcare: current status and the road ahead. *Inf Syst Res*. 2010;21(4):796-809.
3. Kummervold PE, Chronaki CE, Lausen B, Prokosch H-U, Rasmussen J, Santana S, Staniszewski A, Wangberg SC. eHealth trends in Europe 2005-2007: a population-based survey. *J Med Internet Res*. 2008;10(4).
4. Fox S, Jones S. The Social Life of Health Information 2009 [February 23, 2015]. Available from: http://www.pewinternet.org/files/old-media/Files/Reports/2009/PIP_Health_2009.pdf.
5. EUROSTAT. Individuals using the internet for seeking health-related information 2014 [February 23, 2015]. Available from: <http://ec.europa.eu/eurostat/tgm/table.do?tab=table&plugin=1&language=en&pcode=tin00101>.
6. OECD. OECD Employment Outlook 2013 Paris, France: OECD Publishing; 2013 [February 23, 2015]. Available from: http://dx.doi.org/10.1787/empl_outlook-2013-en.
7. Robert-Koch-Institut. Gesundheit in Deutschland. Gesundheitsberichterstattung des Bundes, Berlin; 2006
8. Agarwal R, Prasad J. Are individual differences germane to the acceptance of new information technologies? *Decis Sci*. 1999;30(2):361-91.
9. Tams S, Grover V, Thatcher J. Modern information technology in an old workforce: Toward a strategic research agenda. *J Strategic Inf Syst*. 2014;23(4):284-304.
10. Ziefle M, Bay S. How older adults meet complexity: aging effects on the usability of different mobile phones. *Behav Inf Technol*. 2005;24(5):375-89.
11. Hawthorn D. Interface design and engagement with older people. *Behav Inf Technol*. 2007;26(4):333-41.
12. Niehaves B, Plattfaut R. Internet adoption by the elderly: employing IS technology acceptance theories for understanding the age-related digital divide. *Eur J Inf Syst*. 2014;23(6):708-26.

13. McElroy JC, Hendrickson AR, Townsend AM, DeMarie SM. Dispositional factors in internet use: personality versus cognitive style. *Manag Inf Syst Q.* 2007;809-20.
14. Gefen D, Straub DW. Gender differences in the perception and use of e-mail: An extension to the technology acceptance model. *Manag Inf Syst Q.* 1997;389-400.
15. Venkatesh V, Morris MG. Why don't men ever stop to ask for directions? Gender, social influence, and their role in technology acceptance and usage behavior. *Manag Inf Syst Q.* 2000;115-39.
16. Venkatesh V, Morris MG, Davis GB, Davis FD. User acceptance of information technology: Toward a unified view. *Manag Inf Syst Q.* 2003;425-78.
17. Thatcher JB, Perrewe PL. An empirical examination of individual traits as antecedents to computer anxiety and computer self-efficacy. *Manag Inf Syst Q.* 2002;26(4):381-96.
18. Venkatesh V, Sykes TA, Venkatraman S. Understanding e - Government portal use in rural India: role of demographic and personality characteristics. *Inform Syst J.* 2014;24(3):249-69.
19. Funder DC. Personality. *Annu Rev Psychol.* 2001;52:197-221.
20. Devaraj S, Easley RF, Crant JM. Research note-how does personality matter? Relating the five-factor model to technology acceptance and use. *Inf Syst Res.* 2008;19(1):93-105.
21. Barnett T, Pearson AW, Pearson R, Kellermanns FW. Five-factor model personality traits as predictors of perceived and actual usage of technology. *Eur J Inf Syst.* 2014.
22. Maier C, editor Personality within Information Systems Research: a literature Analysis. ECIS; 2012.
23. Costa PT, McCrae RR. Revised NEO Personality Inventory (NEO-PI-R) and NEO Five-Factor Inventory (NEO-FFI) Professional Manual. Odessa, FL: Psychological Assessment Resources; 1992.
24. Compeau DR, Higgins CA. Computer self-efficacy: Development of a measure and initial test. *Manag Inf Syst Q.* 1995;19(2):189-211.
25. Compeau D, Higgins CA, Huff S. Social cognitive theory and individual reactions to computing technology: A longitudinal study. *Manag Inf Syst Q.* 1999;23(2):145-58.
26. Marakas GM, Yi MY, Johnson RD. The multilevel and multifaceted character of computer self-efficacy: Toward clarification of the construct and an integrative framework for research. *Inf Syst Res.* 1998;9(2):126-63.
27. Karsten R, Mitra A, Schmidt D. Computer self-efficacy: A meta-analysis. *J Organ End User Comput.* 2012;24(4):54-80.
28. Niehaves B, Plattfaur R, editors. The MATH of Internet Adoption: Comparing Different Age-Groups. *Wirtschaftsinformatik*; 2011: Citeseer.
29. Barrick MR, Stewart GL, Piotrowski M. Personality and job performance: test of the mediating effects of motivation among sales representatives. *J Appl Psychol.* 2002;87(1):43.
30. Bandura A. Self-efficacy mechanism in human agency. *Am Psychol.* 1982;37(2):122-47.
31. Bandura A. Self-Efficacy: The Exercise of Control. New York: Freeman; 1997.
32. Hsu M-H, Chiu C-M. Internet self-efficacy and electronic service acceptance. *Decis Support Syst.* 2004;38(3):369-81.
33. Thatcher JB, Zimmer JC, Gundlach MJ, McKnight DH. Internal and external dimensions of computer self-efficacy: An empirical examination. *IEEE T Eng Manage.* 2008;55(4):628-44.
34. Mead SE, Sit RA, Rogers WA, Jamieson BA, Rousseau GK. Influences of general computer experience and age on library database search performance. *Behav Inf Technol.* 2000;19(2):107-23.
35. Czaja SJ, Charness N, Fisk AD, Hertzog C, Nair SN, Rogers WA, Sharit J. Factors predicting the use of technology: findings from the Center for Research and Education on Aging and Technology Enhancement (CREATE). *Psychol Aging.* 2006;21(2):333-52.
36. Lam JCY, Lee MKO. Digital Inclusiveness-Longitudinal Study of Internet Adoption by Older Adults. *J Manage Inform Syst.* 2006;23(4):177-206.
37. Bandura A. Reflections on self-efficacy. *Adv Behav Res Ther.* 1978;1(4):237-69.
38. Judge TA, Jackson CL, Shaw JC, Scott BA, Rich BL. Self-efficacy and work-related performance: the integral role of individual differences. *J Appl Psychol.* 2007;92(1):107.
39. Major DA, Turner JE, Fletcher TD. Linking proactive personality and the Big Five to motivation to learn and development activity. *J Appl Psychol.* 2006;91(4):927.
40. Powell AL. Computer anxiety: Comparison of research from the 1990s and 2000s. *Comput Human Behav.* 2013;29(6):2337-81.
41. Saleem H, Beaudry A, Croteau A-M. Antecedents of computer self-efficacy: A study of the role of personality traits and gender. *Comput Human Behav.* 2011;27(5):1922-36.
42. Barrick MR, Mount MK. The big five personality dimensions and job performance: a meta - analysis. *Pers Psychol.* 1991;44(1):1-26.
43. Hunsinger M, Poirier CR, Feldman RS. The roles of personality and class size in student attitudes toward individual response technology. *Comput Human Behav.* 2008;24(6):2792-8.
44. Marakas GM, Johnson RD, Palmer JW. A theoretical model of differential social attributions toward computing technology: when the metaphor becomes the model. *Int J Hum-Comput St.* 2000;52(4):719-50.
45. Landers RN, Lounsbury JW. An investigation of Big Five and narrow personality traits in relation to Internet usage. *Comput Human Behav.* 2006;22(2):283-93.
46. Korukonda AR. Differences that do matter: A dialectic analysis of individual characteristics and personality dimensions contributing to computer anxiety. *Comput Human Behav.* 2007;23(4):1921-42.
47. He J, Freeman LA. Understanding the formation of general computer self-efficacy. *Communications of the Association for Information Systems.* 2010;26(1):12.
48. McCrae RR, Costa PT. A five-factor theory of personality. In: Pervin LA, John OP, editors. *Handbook of personality: Theory and research.* 2nd ed. New York: Guilford Press; 1999. p. 139–53.