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DISSERTATION

Titel der Dissertation

„Ein psychologisches Erklärungsmodell für Technikakzeptanz
im Alter“

Verfasserin

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Angestrebter Akademischer Grad

Doktorin der Naturwissenschaften (Dr.rer.nat.)

Wien, 2013

Studienkennzahl lt. Studienblatt: A 091 298

Dissertationsgebiet lt. Studienblatt: Psychologie

Betreuerin: o. Univ. Prof. Dr. Ilse Kryspin-Exner

Für Alexander & Eva

Acknowledgments

First of all I would like to thank my family. Without the encouragement and support of my husband and my parents it would not have been possible to achieve the submission of this dissertation. Completing a dissertation represents a long time span with changing life events and priorities. Besides phases with huge research enthusiasm there were also times with minor motivation and shifted priorities. Despite all different resistances I felt responsible to finish what I had begun and I am very glad to have succeeded.

Further, I want to thank my dissertation supervisor Univ. Professor Dr. Ilse Kryspin-Exner who had awakened my interest for the gerontopsychology literature and especially for the issue of technology and aging. She was the one who recognized very early the significance of this topic for psychological and ethical research questions and was highly engaged in presenting the psychological point of view in various expert rounds and committees and introduced myself as a young researcher.

With regard to methodological support I would like to thank Mag. Dr. Ulrich Tran. I remember well the rich discussions we had concerning the right interpretation of the results and I appreciate his statistical intellect.

Last but not least I want to thank all the older adults I have met in my dissertation survey and in user studies in the context of my working field. Their engagement and interest to participate in such studies motivates me to investigate the issue of technology acceptance in old age beyond my dissertation in order to gain more relevant insights and to develop more user centric technology for the future.

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1 Introduction

In recent years technology acceptance in old age has not only become a research field but also a policy issue since life expectancy is increasing and the demand for care institutions will grow. Therefore, aging in place with the support of technology has become a prevalent future scenario with a huge variety of related research projects and technology innovations and prototypes. Major goal of these concerns is to improve the quality of life of older adults by enabling to live independently at home as long as possible and to foster social participation and inclusion.

Literature review demonstrates that older people are willing to use new technologies but they have to experience subjective benefit from the technology. Following chapters will show the impact of the Technology Acceptance Model in the technology adoption literature, related research gaps in association with technology use in old age and investigated psychological models in the context of this dissertation which are hypothesized to contribute to technology acceptance.

The present dissertation consists of three articles:

1. **Article I, “Technology in old age from a psychological point of view”:** First occupation with the technology and aging issue by discussing psychological dimensions such as cognitive, motivational and emotional factors with regard to acceptance and usability of technology devices in old age.
2. **Article II, “Motivation and needs for technology use in old age”:** Description of the theoretical concepts and research questions of the dissertation study. This article does not contain any results of the study and was published while the survey was conducted online.
3. **Article III, “Evaluation of the Technology Acceptance Model in old age and the impact of psychosocial factors on Internet use”:** Presentation of the final dissertation study including all relevant theoretical concepts, methodology and results.

2 Technology use in old age

2.1 Influencing factors on technology use in old age

Studies on technology use in old age have shown that a number of factors influence technology adoption. First of all, cognitive abilities have to be considered. In geronpsychology the model of Crystallized and Fluid Intelligence is frequently discussed (Lehr, 2003). Research studies found that *Crystallized Intelligence*, which refers to the knowledge and life experience of a person, takes until old age and even can be increased. *Fluid Intelligence* refers to reasoning and concentration and decreases with old age and simultaneously the ability to cope with new and complex situations. Since technology adoption usually demands for learning new skills and complex cognitive task solving, use of technology requires especially fluid intelligence (Czaja et al., 2006). However, these cognitive parts can be maintained or improved by cognitive training. Furthermore, even motivation to use a technical device can be enhanced by training of needed special skills in order to make the older users more comfortable and self-confident in using the system. However, the better a technology is matched with the cognitive level of the users, the higher the acceptance of the technology and consequently motivation to use will be (Holzinger, 2007).

Besides cognitive abilities, experience with technology seems to be a significant factor. Findings of the CREATE project demonstrate that general use of technology was an important predictor of computer and Internet use. Czaja et al. (2006) conclude that older adults with general knowledge about technology and related task experiences are more likely motivated to use different technologies. Closely linked with technology experience are attitudes related with technology. Computer anxiety and self-efficacy are very common investigated factors in association with technology use and play a major role in the CREATE model of technology adoption.

In addition to the already mentioned factors sociodemographic variables such as age, education, and socioeconomic status influence technology use in old age. These factors will be discussed in the next section.

2.2 Internet use old age

The Internet has become a major information source as well as a huge social network system including Facebook, Skype or E-Mail to mention just the most common. Various areas of life can be assisted by the Internet such as communication, e-government, shopping, or organization and booking of journeys (Vaccaro et al., 2007). Though, usability of computer and software components is rather low for older adults. In the context of the UTOPIA project in Scotland participants from age 50 to 85 were interviewed about use of technology and computer in particular. Only 33% had chosen their computer on their own. The majority had been assisted in buying a computer by relatives and friends. Information seeking in the Internet was one of the most popular application area, followed by E-Mail communication and shopping. Age had a significant influence on use of Internet and E-Mail communication. According barriers with computer use the participants reported problems with short cuts, missing age specific computer assistance and the participants felt unable to cope with the richness, complexity and intransparency of Internet information (Goodman, Syme & Eisma, 2003). Nevertheless following statistical data will show that Internet use in old age has changed enormously in the last 12 years and older adults have integrated Internet use more and more in their daily lives.

In Austria 61% of the people from age 60 to 69 and 33% of seniors age 70 and older use the Internet (GfK Austria Media, 2012). The Internet has rapidly grown since 2000. Remarkable is especially the increase of Internet users from 1996 to 2007: 1996 only 9% of Austrian people used the Internet, in the year 2000 already 40%, and in 2007 65% used the Internet. Figure 1 shows that the growth of Internet users from 2000 to 2011 is highest in users age 50 and older.

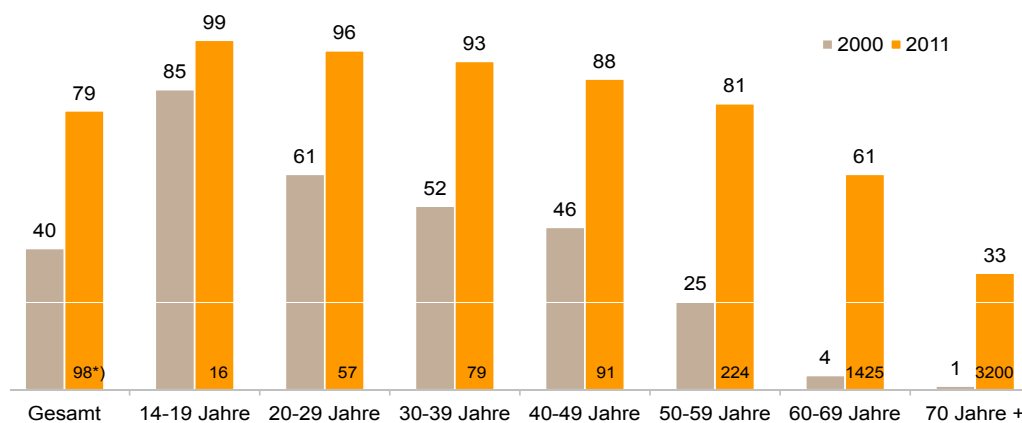


Figure 1. GfK Online Monitor 4th Quartal 2011: Percentage of Internet users in Austria

79% of Austrian people age 14 and 65 use the Internet already regularly. In comparison to other European countries, Internet use is only higher in Island (95%), Norway (95%), Denmark (92%), Finland (89%), Switzerland (89%), Netherlands (87%), Ireland (83%), Slovenia (81%), England and Scotland (80%). Statistical data show that there is a considerable gap between north and south European countries. Whereas countries like Island or Norway have the highest Internet use rate, Mediterranean countries like Italy (52%), Portugal (57%) or Spain (58%) have rather low rates similar to France (60%). The Balkan states have the lowest Internet use rates, for example Albania (20%), Yugoslavia (45%), and Bosnia Herzegovina (48%) (GfK Austria Media, 2012).

Data of Statistik Austria (Statistik Austria, 2012) demonstrate that in the age groups 45 to 74, information seeking is the most frequent used application of Internet use. At least even 19.4% of users age 65 to 74 use videophone or telephone via Internet and more than half of the users age 45 to 54 (55.1%) use Internet banking. Detailed information for Internet use patterns can be seen in Table 1.

Merkmale	Personen mit Internet-nutzung in den letzten drei Monaten	Finden von Informationen über Waren oder Dienstleistungen	Lesen oder Herunter-laden von Online-Nachrichten, Zeitungen, Online Zeitschriften oder Magazinen	Nutzen von Internet-Banking	Nutzen von Angeboten oder Leistungen für Reisen oder Reiseunterkünfte	Chatten oder Nachrichten in Social Networking Sites, Blogs, News-groups oder Online-Diskussionforen oder Nutzen von Instant-Messaging	Nutzen zum Spielen oder Herunter-laden von Spielen, Bildern, Filmen oder Musik	Nutzen zum Hören von Web-Radio oder zum Sehen von Web-Fernsehen	Nutzen zum Upload von selbst-erstelltem Inhalt auf Websites	Telefonieren über Internet oder Video-anrufe mit Webcam über Internet
Alter	in 1.000					in %				
45 bis 54 Jahre	1 100,5	88,5	53,5	55,1	57,3	28,2	26,4	25,0	22,7	25,3
55 bis 64 Jahre	614,5	84,6	58,7	44,1	53,6	21,2	25,4	19,3	20,2	22,7
65 bis 74 Jahre	309,1	83,4	57,5	34,7	45,8	15,4	25,5	15,5	18,4	19,4

Table 1. Internet activities of Austrian older adults

2.2.1 Reasons for Non-Use

Accessibility and Usability are in combination with technology and Internet use frequent discussed and investigated terms. The W3C Web Accessibility Initiative defines accessibility as an encompassing requirement for people with different disabilities who are able to perceive, understand, navigate and interact with and contribute to the Web. If a website meets

accessibility criteria also other people like older adults with changing abilities will benefit (Henry, 2006).

The International Organization for Standardization (1998) has defined usability in this way: „The extent to which a product can be used by specified users to achieve goals with effectiveness, efficiency and satisfaction in a specified context of use“.

The discussion about accessibility and usability is significantly important since especially people with disabilities are discriminated if they are not able to use all existing applications of the Internet or other technologies. Besides, also older adults, people of rural regions, people with lower income or education level and ethnic minorities belong to this risk group (Weist, 2004), also discussed under the term „Digital Divide“. Older adults are often concerned with more than one risk factors to be discriminated by the Internet. Especially seniors with low income, education and hardly technology experience, avoid financial costs of a computer and related intellectual demands. Nevertheless, only barrier-free design of Internet websites will influence use behavior of this group (Erkert et al., 1998). 2003 UN General Secretary Kofi Annan had claimed an „organization of an open information society“ at the first World Information Summit. Finally, the Riga Declaration concluded that disadvantages because of low socioeconomic status or disabilities as well as social, educational and regional disadvantages should be moderated by information and telecommunication technologies. The declaration was signed by 34 European ministers which all aimed the so called E-Inclusion in order to overcome the digital divide until 2010, enable risk groups Internet access to barrier free public websites until 2010 and increase overall Internet use in Europe up to 90% (EU-Commission, 2006). One example of European effort to overcome these barriers is the non-profit organization EURAG which stands up for quality of life of 50 plus people and aims to overcome barriers of the Internet and to facilitate computer use for older adults (EURAG, 2012).

3 Technology Acceptance Old Age

Simultaneously with the development of innovations in technology, researchers have begun to investigate the question why individuals do or not use technology. One of the most cited and probably most simple model for explanation of technology adoption is the Technology Acceptance Model (TAM) by Davis (1989), see Figure 2, and later modified by Venkatesh and Davis (2000), see Figure 3. Its origin goes back to the 1980's when innovative information technologies (IT) were not used by workers and organizations were interested in increasing IT acceptance and use. TAM follows the Theory of Reasoned Action and the extended Theory of Planned Behaviour which assert that subjective attitudes towards an action, normative beliefs (subjective norm) and motivation to comply influence individual behavioural intention and finally actual behaviour. TAM reasons that two main factors are necessary for technology acceptance: perceived usefulness (PU) and perceived ease of use (PEOU). PU is defined as the extent to which a person believes using a system will enhance (job) performance. PEOU explains the person's estimation if using a technology is related to effort or not. The original TAM assumes that PU is also influenced by external variables such as subjective norm, computer self-efficacy or job relevance.

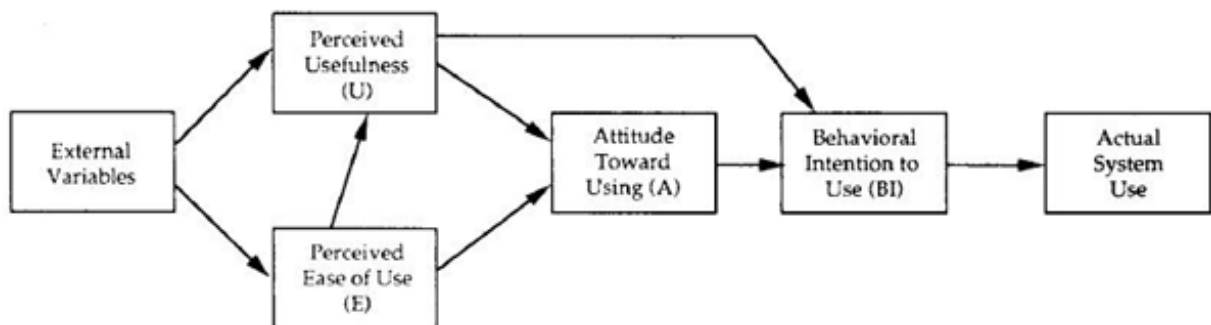


Figure 2. TAM

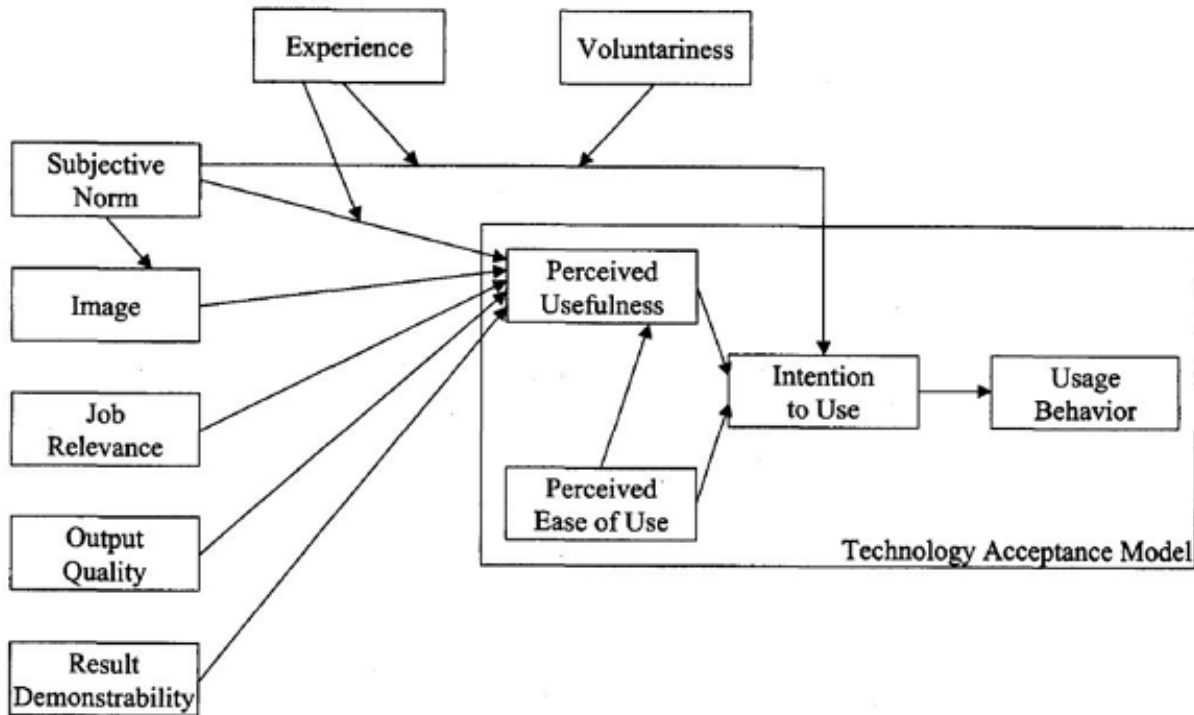


Figure 3. TAM2

Since studies using TAM in a sample of older adults are rare (Chen, Lu, Chen & Liu, 2011; Pijpers, Bemelmans, Heemstra & van Montfort, 2001; Rose & Fogarty, 2006), this dissertation study is based on the first TAM using the basic external variables subjective norm and personal innovativeness, which were widely used in TAM research.

3.1 Subjective Norm

Subjective norm is defined as a determinant of perceived usefulness and describes the person's perception if significant others think that he/she should use the system. Schepers' and Wetzels' (2007) metaanalysis about 63 articles could demonstrate a significant influence of subjective norm on perceived usefulness and behavioral intention to use.

3.2 Personal Innovativeness

Besides the basic TAM variables, impact of individual differences regarding use of technology was commonly investigated during the 1990s. Individual factors argued to influence technology use were personality, situational and demographic variables (Thatcher & Perrewé, 2002). Agarwal and Prasad (1998) have defined the construct of personal innovativeness as the degree to which an individual is willing to try out any new information

technology. Personal innovativeness is expected to be a stable trait which means that it is stable across different situations. Early adoption of technology is strongly linked with positive beliefs about the concerned technology and finally personal innovativeness. Personal innovativeness is analysed as an external variable of the TAM model with direct impact of perceived ease of use on perceived usefulness.

3.3 Limitations of TAM and related psychosocial variables

Different meta-analysis (King & He, 2006; Legris, Ingham & Colletette, 2003; Schepers & Wetzels, 2007) demonstrated that the majority of TAM studies focused on employees and managers in companies, professionals or students. Further, there are moderating effects on the relationships between the factors in the model due to group characteristics (namely student groups) and type of technology. Although TAM has been revised through the model Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, Morris, Davis & Davis, 2003) and TAM 3 (Venkatesh & Bala, 2008), empirical studies with older adults are not in the focus of recent research. Nevertheless, the elderly population is due to the Ambient Assisted Living (AAL) Joint Program¹ of the European Commission and the Seventh Framework Program (FP7)² of the European Commission in focus of a variety of international projects investigating innovative technology solutions for the elderly, related user needs and expected technology adoption.

3.3.1 User Needs

Evaluation of user needs before starting with the technology development is a main requirement of every user centred technology study and for a successful adoption of the final prototype. Particularly older adults represent an extremely heterogeneous group with different levels of physical and mental health and accordingly different needs with regard to

¹ The Ambient Assisted Living Joint Programme, a funding activity running from 2008 to 2013, aims to enhance the quality of life of older people and strengthen the industrial base in Europe through the use of Information and Communication Technologies (ICT). The programme is financed by the European Commission and involves 23 European countries. Overall budget is of 700 Million € (AAL, 2012).

² The EU's Seventh Framework Programme for Research (FP7) is a 8.1 billion euro funded research initiative, running from 2007 to 2013 with research themes such as health, information and communication technologies, energy or environment (European Commission, 2012).

independent living and autonomy – main research goals of AAL projects. About 40% of people older than 50 have a degree of activity limitation because of health problems (Comyn et al., 2005). Thus, evaluation of health needs and health related quality of life is necessary in order to gain information about the requested user group and finally provide conditions for acceptance and use of the developed technology. For this reason the theoretical concept of health needs and quality of life by the WHO was used as an extension of the TAM. The WHO defines quality of life as „an individual’s perception of their position in life in the context of the culture and value systems in which they live, and in relation to their goals, expectations, standards and concerns“ (WHOQOL Group, 1994).

Besides health needs, psychological needs have to be analysed in order to obtain a complete picture of human motivation. In this context the Self-Determination theory by Deci and Ryan (2000) was used for the dissertation research model. The authors distinguish between intrinsic and extrinsic motivation. Intrinsic motivation defines behaviour which seeks autonomy, competence and relatedness, and is not connected to an external reward system which would mean extrinsic motivation. Autonomy refers to the feeling that one’s behavior is self-chosen and meaningful. Competence is defined as the self-perception to be effective and able in one’s behavior. Relatedness consists of the perception being connected to important others. Satisfaction of intrinsic motivated behavior and the defined three basic needs autonomy, competence and relatedness, is a relevant factor of mental health and subjective well-being whereas the opposite is true for external motivated goals. The relationship between needs satisfaction and well-being was investigated in nursing home residents (Kasser & Ryan, 1996). Correlations between both autonomy support and relatedness could be demonstrated with lower depression, increased well-being, vitality and life satisfaction. Regarding well-being, perceived autonomy even explained up to one third of the variance in regression analyses. Further, residents with higher autonomy motivation levels were more likely to be alive at the 13-month follow up.

3.3.2 Selection, Optimization and Compensation (SOC)

Developmental and life span changes determine a shift in personal resources. Thus, older people have to face more resource losses than resource gains due to increased physical and cognitive health, diminishing social networks and other stressful life events (Riediger, Li & Lindenberger, 2006). Therefore, a main task in life span psychology is the investigation how individuals deal with these resource losses and manage to achieve desirable goals or levels of

functioning (Freund & Riediger, 2003). Furthermore, following the presumptions of the *Selection, Optimization and Compensation* model, successful management of gains and losses through life span is a key factor for well-being. Paul and Margret Baltes (1990) proposed the SOC Model for successful aging over the entire life span, postulating that even in old age adoption of changing personal, social and geographical condition is possible if a certain level of resources is available or possible to expand. The SOC model assumes that in order to minimize and avoid negative outcomes/losses and to attain a maximum of positive and desired outcomes people select certain domains (goals) of functioning (Selection) since due to time, energy or physical limitations (e.g. illness) not all opportunities can be pursued. Further, people aim for optimization in these selected domains and allocate and refine internal or external resources to achieve higher levels of functioning (Optimization). Finally, if a loss of resources or a decline of goal-relevant means are expected, compensatory processes are needed to maintain a given level of functioning in the selected domain (Compensation).

Melenhorst, Rogers and Bouwhuis (2006) suggest that the theory of Selection, Optimization and Compensation (SOC) by Baltes and Baltes could also partly explain technology adoption of older persons.

SOC mechanisms become evident in motivational and volitional processes and could be therefore a key factor in explaining technology acceptance in old age. Recent research has demonstrated that older adults are not in general avoidant of new technologies or computer use in particular. Related literature (Hawthorn, 2007; Rosseau and Rogers, 1998) shows that older people have learned to avoid making errors by limiting tasks they attempt to perform. Referring to the SOC model, older people would selectively choose to use fewer applications due to decreased cognitive capabilities. Other studies (Eisma et al., 2004; Melenhorst & Bouwhuis, 2004; Melenhorst et al. 2006) stress the influence of technology benefit perception to technology use. Melenhorst et al. (2006) particularly discuss the lack of research on motivational factors in older adults' technology use. A longitudinal study (Kahana, Kahana, Lovegreen & Seçkin, 2006) reports older adults' computer use (E-Mail, Internet) in order to compensate losses due to illness, disabilities or old age and to maintain independent living. The authors interpret the results of their case studies according to the model proposed by Baltes and Baltes.

4 Research Model and Objectives

Literature research has shown the need for a validation of the TAM for older adults. Although majority of studies with the TAM focused on employees and managers in companies, professionals or students, meta-analysis support the significance of the model. Nevertheless, studies focusing on older adults and technology use explained by the TAM are rare (Chen, Lu, Chen & Liu, 2011; Pan & Jordan-Marsh, 2010; Rose & Fogarty, 2006) or have methodological restrictions (King & He, 2006). Therefore, main objective of this dissertation study was to investigate whether application and use of the TAM and according questionnaire is indicated for the sample of older adults. This objective seems to be significant according to the high interest in AAL research and related national and international projects which give and will give recommendations how to prolong independent living and deal with the challenge of industrialized countries facing a growing population of older adults with care needs.

Integration of psychological theories and models in the TAM was the second objective. Research on studies about older adults using technology, barriers and usage behavior have led to the hypothesis that consideration of further aspects is necessary and important for explanation of technology acceptance. Since methodical feasibility and participants' reasonability should be assured, the study focused on the most significant variables according to the literature research: user needs and motivational processes in old age.

The contribution to these hypotheses is shown in the dissertation research model (Figure 4).

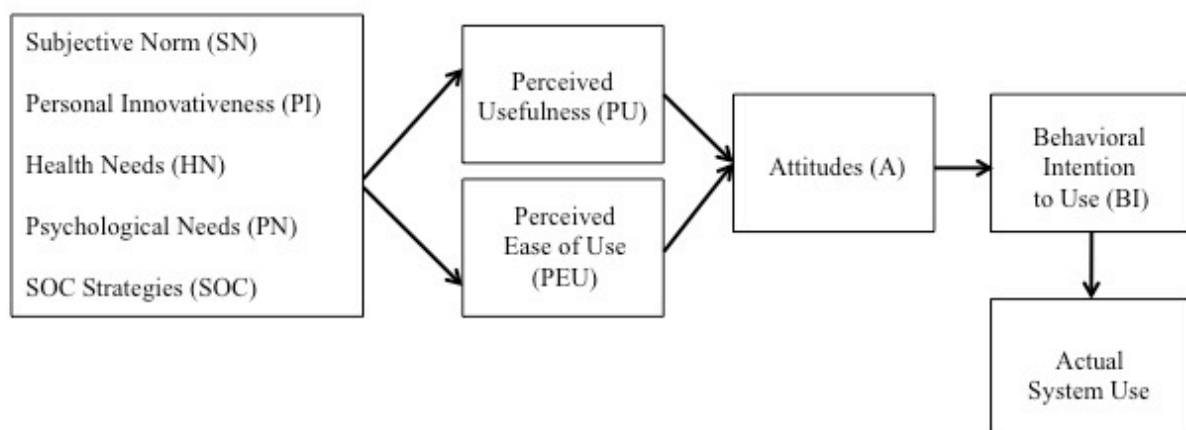


Figure 4. Dissertation research model

5 Methods and Results

Overall 620 Internet users started to answer the questionnaire and finally 471 older persons aged 60 to 84 years ($M = 67.42$, $SD = 6.23$) could be included in the study. 43.9% were from Austria, 41.8% from Germany, 10.9% from Switzerland and 3.5% from other countries. Participants were contacted via various German Online Senior platforms such as Seniorkom (<http://www.seniorkom.at/>), 50plus (<http://www.50plus.at/>), Webheimat (www.webheimat.at) EURAG Austria (<http://www.eurag.at/>), Seniorweb.Ch (<http://www.seniorweb.ch/>), and various smaller Senior Internet groups.

Participants were asked about demographic data and Internet use and answered the standardized questionnaires: TAM with Social Norm and Personal Innovativeness items, WHOQOL-BREF and WHOQOL-Old (measuring health needs and quality of life), Basic Psychological Needs Scale (measuring psychological needs) and the SOC questionnaire (measuring motivation strategies). All items and scales are listed in the supplement section and are described in detail and referenced in Article III.

Data analysis was performed using structural equation modelling (SEM) and a variance maximization approach. For computation of all SEM models, AMOS 7.0 and maximum likelihood estimation was used. Results were contrasted in cases with complete and partially missing data (using AMOS's missing data option). For all relevant results see section 5 in Article III.

6 Conclusion and Outlook

The present dissertation study focused on older adults' use of Internet and related technology acceptance. Since diverse study results (Agarwal & Karahanna, 2000; Cheung & Vogel, 2013; Holden & Karsh, 2010; Liaw & Huang, 2003; Pai & Huang, 2011) support the significance of the Technology Acceptance Model this concept was used to explain technology use in old age. Literature research has shown that the TAM was mainly used in a business context or with student samples. Consequently a major issue of this dissertation was to evaluate the TAM and its applicability for older adults. Further psychological variables from the motivation literature were chosen in order to extend the TAM and gain more insight into the motivation and needs of older adults in the context of Internet use.

First, results show very similar relationships of the original TAM variables compared to the three major meta-analysis (King & He, 2006; Legris, Ingham & Colletette, 2003; Schepers & Wetzels, 2007). Therefore the original TAM variables' relationships could be confirmed and it can be concluded that the TAM is a useful model for explaining technology use in older adults.

Moreover, the hypothesized external variables Social Norm, Personal Innovativeness as well as the introduced psychological variables Needs competence, Needs Internet, and SOC Strategies contributed significantly to the TAM.

The influence of the variable Social Norm can be interpreted based on international project findings and related user requirement studies for innovative technologies (AALuis, 2013; Buiza et al. 2010). Publications and deliverables of these projects report a social influence of family members related to actual technology use, buying decisions for already acquired technologies and support of new technology products.

Further, personal innovativeness played a major role in the presented dissertation research model. This result can be found in studies including rather younger and more educated older adults who seem to be less timid of new technologies and are in general more open and interested in trying innovative products (AALuis, 2013; Buiza et al. 2010). Since the present sample represented a rather young and active group of older adults, the significance of Personal Innovativeness in technology acceptance also fits with this explanation.

Research on motivational factors was a major issue of this dissertation. While articles discussing this aspect in the gerontechnology literature are rare (Melenhorst & Bouwhuis, 2004; Melenhorst, Rogers & Bouwhuis, 2006; O'Brian, Knapp, Thompson, Craig & Benett, 2013) the present study could verify the influence of perceived Internet competence (Needs Internet) on Perceived Usefulness and self-determinant behavior (Needs Competence) on Perceived ease of use. Results show that the Internet is estimated as easy to use if the persons experience themselves as competent and capable to use the Internet on their own without support from others. This could be a significant finding with regard to the development of innovative technologies for older adults with a decreased health or cognitive status. The findings highlight the importance of users' subjective perception of personal competence and self-independence with regard to technology use. This also strengthens the importance of easy to use devices which do not demand for learning multiple new skills in order to increase older adults' compliance for using the device.

Whereas psychological needs could significantly contribute in the explanation of technology acceptance in old age, health needs played a minor role in the investigated research model. This could be explained due to the high levels of subjective health and quality of life reported by the study participants. 83.8% rated their quality of life as good or very satisfying and 70.2% were satisfied or very satisfied with their health level. Therefore, subjects had hardly health problems and were not restricted by these in their technology acceptance process. Thus, future research should involve older adults groups with a more heterogeneous level of health status and needs in order to investigate the impact of health needs on technology acceptance.

Finally, the strategy to select, to optimize, and to compensate (SOC) because of age-related losses was found to have an influence on Perceived Usefulness and Behavioral Intention. Interpreting the results, the Internet users of this study represent a target-oriented and focussed user group who had chosen the Internet and computer use as one strategy to achieve subjective important goals such as information seeking or social exchange in Internet forums. Nevertheless, this study provides no further information about other relevant specific strategies and related goals in the older adults' lives. Since this was the first study dealing with the role of SOC on technology use, further research is needed to investigate a broader impact of SOC strategies in the context of Internet and computer use in terms of goal prioritization and the position of Internet/computer use compared to other life relevant goals.

Regarding the limitations of this study, representativeness of the sample is a major aspect. The present sample consists of very healthy and technology engaged older adults. Since the participants were mostly recruited from Internet platforms and forums which require already intensive occupation with the Internet, the study sample consists of frequent Internet users who use a variety of Internet and computer applications and are therefore already very familiar with Internet use. This cannot be generalized for all older adults and is therefore a restriction of this study. Nevertheless the research model and its statistical analysis required for a rather huge sample size which was only guaranteed by an online survey.

Further, this study used a large amount of different variables. However, this aspect had no consequences to the response rate of the online survey (nearly 60%) which is compared to other studies quite high (Deutskens, de Ruyter, Wetzels, & Oosterveld, 2004). Wagner, Hassanein & Head (2010) illustrate in their review article that there are hardly any studies in the research of older adults' computer use which investigate relationships of two variables more than once. Hence, the results of this study have to be strengthened by further research to investigate reliability and validity of the relationships of the tested variables.

Besides the reported restrictions of this study, results can contribute to a better understanding of technology acceptance in old age. Particularly evaluation of the TAM for older adults is a major impact of this dissertation because of the low amount of literature dealing with this issue (Chen, Lu, Chen & Liu, 2011; Pan & Jorden-Marsh, 2010; Rose & Fogarty, 2006). Moreover this study focused on further psychological variables such as needs and motivation which are necessary to explain the complex issue of technology adoption in old age.

7 Abstract

Research in technology acceptance of older adults has been enhanced by political and economic issues such as growing life expectancy and related increased needs for care as well as the detected purchasing power of the senior population.

The Technology Acceptance Model (TAM) is one of the most cited and probably most simple model to explain technology adoption focussing on five core variables: Perceived Usefulness, Perceived Ease of Use, Attitudes, Behavioural Intention to use and Actual System Use. Since the majority of TAM literature focused on employees, managers, professionals or students this study investigated the validity of the TAM for older adults and the contribution of further variables such as health and psychological needs and motivational strategies.

471 older persons aged 60 to 84 years mainly from Austria, Germany and Switzerland participated in the online survey. Factorial validity of the used measures was evident in respective structural analyses. Results of the Structural Equation Model (SEM) confirm expected relationships between original variables of the TAM. Besides validity of the TAM for older adults, influence of the hypothesized variables Social Norm, Personal Innovativeness, psychological needs and motivational strategies could be demonstrated. Since the majority of participants reported high levels of subjective health and quality of life, health needs only played a minor role with regard to the TAM.

In order to validate the presented results further studies are necessary with different groups of older adults testing the applicability of the dissertation research model to various technologies. Nevertheless results of this study will contribute to a better understanding of technology adoption of older adults. Influence of the tested psychological variables motivation and needs has demonstrated that not only the classical TAM variables are necessary to explain the complex issue of technology acceptance. Since this study provides no information about other life relevant goals in the context of the SOC model besides Internet use, further research is needed to highlight the relevance of Internet use compared to other subjective relevant goals in old age.

Zusammenfassung

Die wissenschaftlich Auseinandersetzung mit Technikakzeptanz im Alter wurde vor allem durch politische und wirtschaftliche Themen angeregt: zum einen wachsende Lebenserwartung und damit verbundener Anstieg an Pflegebedarf und zum anderen die Wahrnehmung der älteren Generation als potentielle wirtschaftliche Kaufkraft.

Das Technik Akzeptanz Model (TAM) ist eines der am meist zitierten und angewandten Modelle um Technikanpassung zu erklären. Es besteht aus fünf Hauptvariablen: Wahrgenommene Nützlichkeit, Wahrgenommene Benutzerfreundlichkeit, Einstellung gegenüber dem System, Verhaltensintention in Bezug auf Nutzung und Aktuelle Nutzung des Systems. Da sich die Mehrheit der TAM Literatur mit Angestellten, Managern, Berufstätigen und Studenten befasst, untersucht die vorliegende Dissertationsstudie die Gültigkeit des TAM für ältere Person sowie den Einfluss weiterer Variablen wie gesundheitliche und psychische Bedürfnisse sowie motivationale Strategien.

471 ältere Personen zwischen 60 und 84 Jahren, vorwiegend aus Österreich, Deutschland und Schweiz stammend, nahmen an der Onlinebefragung teil. Die faktorielle Validität der verwendeten Verfahren konnte mittels Strukturanalysen nachgewiesen werden. Die Ergebnisse des Strukturgleichungsmodells (SEM) zeigen erwartete Zusammenhänge zwischen den Originalvariablen des TAM. Neben der Gültigkeit des TAM für ältere Personen, konnte der Einfluss der untersuchten Variablen Soziale Norm, Persönliche Innovationsbereitschaft sowie psychische Bedürfnisse und motivationale Strategien bestätigt werden. Da die Mehrheit der Probanden über einen hohen Status an Gesundheit und Lebensqualität verfügten, hatten gesundheitliche Bedürfnisse kaum Relevanz in Hinblick auf das TAM.

Um die Ergebnisse dieser Dissertation auf ihre Validität hin zu überprüfen sind weitere Studien mit verschiedenen Gruppen älterer Personen und deren Verwendung verschiedenster Technologien notwendig. Dennoch ist zu erwarten, dass die Ergebnisse dieser Studie zu einem besseren Verständnis von Technikakzeptanz älterer Personen beitragen werden. Der Einfluss der getesteten psychologischen Variablen Motivation und Bedürfnisse konnte zeigen, dass nicht nur die klassischen TAM Variablen relevant sind um das komplexe Gefüge von Technikakzeptanz zu verstehen. Da diese Studie keine Aussagen zu anderen Lebenszielen im

Sinne des SOK Modells über Internetverwendung hinaus machen kann, ist es notwendig die Relevanz von Internetverwendung in Bezug auf weitere subjektiv wichtige Ziele im Alter zu erforschen.

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9 Article I

Technology in old age from a psychological point of view

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Status: Published 2007

Oppenauer, C., Preschl, B., Kalteis, K. & Kryspin-Exner, I. (2007). Technology in old age from a psychological point of view. *Lecture Notes in Computer Science*, 4799, 133-142.

Abstract

The aim of this paper is to foster interdisciplinary research on technology use in old age by including psychological theories and dimensions such as cognitive, motivational and emotional factors which referring to recent re- search studies highly influence acceptability and usability of technical devices in old age. Therefore, this paper will focus on psychological theories in the con- text of ageing with regard to attitudes towards technology use, acceptability and the importance of user involvement at the very beginning of technological product development and design.

Keywords: Gerontopsychology; Assistive Technology; Usability; Accessibility; Home-Care.

1 Introduction

Internationally, the number of old people and consequently of people needing health care is increasing. Nevertheless, so far it is unsure how to deal with this problem especially because financial costs for traditional health care systems be- come more and more unaffordable. At the same time there is a trend towards single households, and private care systems within the families will eclipse even more in the future. These facts promote technical support and compensation for financial and personal resources of our societies in order to prolong an independent life in old age [20, 33].

Because of age related changes in functional abilities such as psychomotor, perceptive and cognitive skills older people often have difficulties in using “general” technology [35]. Multidisciplinary research on the technology-gerontology interface is of prime importance for a better understanding why technology is difficult to use, how to adapt technology to the needs of older people, and how to train the elderly to use technology [10]. This paper focuses on psychological research and theories which contribute to a better understanding of the needs and difficulties of older people due to technology use.

2 Psychological Theories in the Context of Aging and Technology

2.1 Cognitive Theory of Aging

A main domain in gerontopsychology is the discussion about cognitive functions and performances in old age. Over the years research studies generated a different picture of intelligence and cognitive functions and found that *Crystallized Intelligence*, which refers to the knowledge and life experience of a person, takes until old age and can be well trained. On the opposite *Fluid Intelligence* referring to reasoning and concentration decreases with old age and simultaneously the ability to cope with new and complex situations. To conclude, cognitive performances can not be generalized and differ from person to person and are connected with mental activity resources, education and genetic factors [23].

Certainly the use of technical systems requires not only Crystallized but also Fluid Intelligence. According to the facts mentioned above cognitive functions in old age show a high *cognitive plasticity*: by cognitive training it is possible to increase or maintain cognitive functions as memory, attention, concentration or problem solving [20]. Moreover, the motivation to use a technical device can be enhanced by training of special skills which are necessary for use of a technical system [18].

As a result technical solutions should be designed and developed in cooperation with the end users and their needs to assure that the product fits with the cognitive level of the end users and to achieve high motivation for use [18].

2.2 Successful Aging with Technology

Concerning psychological theories about abilities basic competences and expanded competences can be distinguished [3, 4]. Basic competences are *Activities of Daily Living (ADLs)* such as personal hygiene, food preparation etc. *Instrumental Activities of Daily Living*

(*IADLs*) are important for independent living as well as for social functioning and include for example preparing meals, money transfers, shopping, doing light or heavy housework or using a telephone. Old people have to deal with a decline in these capabilities. Plenty of technical devices support independent living of the elderly. Mollenkopf et al. [30] distinguish *technology of every day life* from technical systems which should compensate for impaired (psycho)motor and cognitive skills, so called *Assistive Technology (AT)*. Furthermore, these technological devices can be divided into *high and low technology* [30]. Security handle bars or ramps are examples for the latter. Technology based on microelectronics (e.g. safety alarm systems, and monitoring devices) is called High Technology.

Referring to Baltes and Baltes [2, 3] successful ageing is a process of *Selective Optimization with Compensation*. Because of age related losses people select areas of life to optimize these domains and to increase capacity, e.g. by cycling in stead of taking the bus to train psychomotor abilities. Furthermore, when optimization is no longer feasible older people face the challenge to find compensatory alternatives. The consequence is a restricted but effective way of life.

According to this model old people could use the help of AT in order to optimize or maintain activities of daily living and leisure activities [32].

2.3 Personal Competences and Environmental Demands

Psychological theories of environment and ageing are relevant in this context because a technological product is always embedded in a person's environment [30]. In the *Competence–Press Model* by Lawton [22] for instance, personal competences face challenges by aspects of the environment on the individual (environmental press). Depending on whether individual competences and environmental press fit together coping with new situations in old age is more or less successful.

2.4 Theories of Control

Theories of Control as for example the Locus of Control Theory by Rotter [7] have a high impact on many areas of human life. Ideally humans should have a high internal locus of control in their life in order to interpret life events as a consequence of their own behaviour. Research studies show that people with a high internal locus of control are more successful in dealing with technologies [7].

Behaviour, needs and capabilities can be enhanced or ignored by the environment. Furthermore the environment sometimes leads to dependency and loss of capacity in case of overprotective care or disrespect towards a person's autonomy. According to Baltes, there are two main models dealing with loss of independency in old age: *Learned Dependence* and *Learned Helplessness* [1, 39]: If assistance is provided in situations with which a person would be able to cope on his/her own, this ability will vanish by and by. Because of the overprotection (e.g. by a caretaker) it becomes redundant for the person to carry out an activity anymore and finally due to missing training the person will unlearn it – the person is losing independency in this situation. The phenomenon of learned dependency is often observed in health care and family systems because claims of independency and autonomy of the elderly are ignored by caregivers and family members. A reason for this is that caregivers' perception focus on deficits and ignore competences [1, 21, 33].

These concepts are especially relevant in the context of monitoring technologies in health care systems. Monitoring technologies bear the danger of fostering external control beliefs and could in last resort lead to learned dependency and helplessness [32].

Another theory according to perceived control is the concept of *self-efficacy* by Bandura [6]. Perceived self-efficacy subsumes people's beliefs about their capabilities to influence situations and life events. These beliefs strongly determine emotional, cognitive and motivational structures as well as psychological well-being. People with strong self-efficacy perception interpret difficult or new tasks rather as challenging than threatening. Failures are more likely attributed to insufficient effort or lacking knowledge. Consequently persons with high self-efficacy are less vulnerable for depression or other affective disorders. For the impact of self-efficacy on technology use see 3.3 Research Studies.

2.5 A Multidisciplinary Approach

A multidisciplinary approach (following the Competence-Press Model by Lawton), including gerontology, technology and psychology is adopted by the Center for Research on Aging and Technology Enhancement (CREATE) [10]. The so called *Human Factors Approach* (see Fig.1) helps study ageing and technology while examining the relationships between demands of the technical system on the one hand and cognitive, psychomotor and perceptual capabilities of the user on the other hand.

The degree of fit between these components determines performance on the technical system, attitudes and self-efficacy beliefs about using technical devices, acceptance and usability of

the system. A main goal of this research program is developing theoretically and empirically driven design guidelines for technical systems including aspects of the user system interface (hardware, software and training) [10]. In the following, results of the most recent research including these components are illustrated.

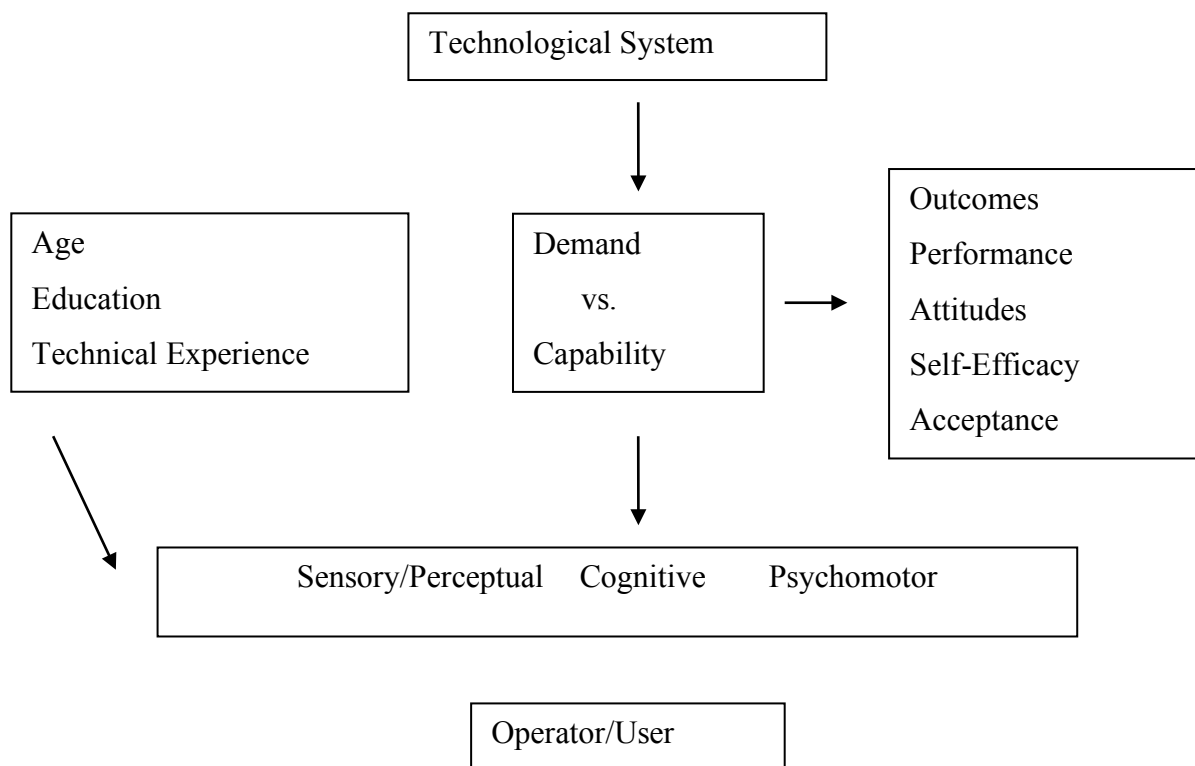


Fig. 1. Human Factors Approach by Czaja et al. [10]

3 Older People and Technology Use

3.1 Assisted Living in Old Age

According to Cowan and Turner-Smith [9] Assisted Technology can be defined as ‘any device or system that allows an individual to perform a task that they would otherwise be unable to do, or increases the ease and safety with which the task can be performed’. Consequently AT can prolong independence and autonomy of the elderly in order to stay in their own home. Of course, this is only possible if AT is developed according to the needs of old people and if the technical device supports their feeling of being independent and does not stigmatize. In fact, AT has the potential to partially substitute various social and health care

interventions or at least assist them. Findings of interviews in England and Scotland show that the acceptability of AT depends on the felt need for assistance (individual need and home environment lead to a felt need for assistance), the recognition of the product quality (efficiency, reliability, simplicity and safety of the device) and on availability and financial costs [25].

Kleinberger et al. [19] postulate three factors which should be met if AT is used by old people and support them staying longer independent: 1. Assisted technologies should be ambient, which means that they offer their service in a very sensitive way and are integrated in daily environment (e.g. movement sensors in the wall, which are invisible). 2. They have to be adaptive to the individual needs and capabilities of the elderly. 3. AT services have to be accessible.

3.2 Usability

In recent projects and research articles usability of technical devices or systems is a very common discussed term. Although it is obvious that use and acceptance of a system are major conditions for the success of a new product, user involvement has not always been the current method to guarantee this. To avoid additional costs and technical problems evaluation of usability should take place at the very beginning of product development. Seal, McCreddie, Turner-Smith and Tinker [38] postulate three main reasons for involving older users in assistive technology research: First, applications and further problems may be avoided. Second, stereotypes of technology minimizing older peoples' handicaps are reduced. Third, cost-effective technology, "Design for all" products, can be developed with the participation of the elderly.

There are many ways to evaluate usability of a technical system. One distinction can be made in *inspection* and *test methods*. Inspection methods do not involve end users themselves but the judgment of usability specialists and work with cognitive techniques like heuristic evaluation, cognitive walkthroughs and action analysis. Despite the possibility of usability evaluation at an early stage and a very analytical style of this method, needs of end users are only anticipated. On the contrary, test methods like thinking loud, field observation and questionnaires gain information directly from the user and provide needs, preferences but also individual problems and concerns. Finally, both approaches should be combined when usability is evaluated to guarantee both subjective view of the user and expert opinion [14].

Another possibility for user involvement is focus groups. In focus groups interviews about a particular topic are coordinated by a moderator. This method is especially relevant if interactions within a group are relevant for the product development. Focus groups can be used at different project phases: for exploration in identifying creative new solutions to well known problems at an early stage of a project or for detailed information at late time proceeded stages [38].

In the UTOPIA project (Usable Technology for Older People – Inclusive and Appropriate) needs for new ICT products were identified and concepts relating to these needs were developed. Information about needs of elderly people was gained by questionnaires, interviews, focus groups and workshops. In home interviews showed how technical devices matched with the user's life and in which situations these were used. The stereotype that older people less likely than younger people use technology was approved. However this result was not true for all technologies and even can not be reduced to the complexity of a technology. Concerning the fear of technologies, old users regard their fear of a product as the fault of themselves and not of the product design and development [11].

Involving users in the design and development process of technologies has become state of the art in recent European projects dealing with Assistive Technology. Within the FORTUNE Project even a curriculum framework was developed for teaching users about the project principles in order to increase involvement in future research activities [38]

User involvement in the development of patient oriented systems e.g. for touch screen panel PCs in hospitals are essential and lead to high acceptance. Practice with touch screen technology is compared to other input devices easy to learn even for people with little knowledge about computers. One of the advantages of touch screens is that the input device is output device too. Because of the direct eye-hand coordination users are able to experience their sense of touch, sense of sight and sense of hearing which encourages a sense of immersion [40]. According to the motto *less is more* design of such systems should be simple and easy [15, 16]. Mobile computers in medicine provide the opportunity for economic working for medical staff as well as economic time for patients.

Patients with handicaps in their visual or motor functions often experience problems in filling out personal data related questionnaires. In the MoCoMed Graz project (Melanoma Precare Prevention Documentation) patients could login with a code at a touch based Tablet Pc and complete the questionnaires for the clinical information system and for a scientific database for research in skin cancer. The project acted on a User-Centered Design (UCD) approach

[31] including four levels: paper mock-up studies, low-fi prototypes, hi-fi prototypes and the system in real life. Low-fi level was conducted with the paper mock-up which meant that screen designs and dialogues based on paper elements. The high-fi level already worked with a full functional prototype of the touch screen and in the end the final version was tested in real life. Of course this procedure is very time consuming but a precondition for user acceptance [17].

3.3 Interdisciplinary Research Studies

In the last ten years research concentrated on the difficulties of older adults when using technologies [5, 27, 29, 35, 36, 43]. For age related decline in vision and hearing and compensational strategies in conjunction with product guidelines see for instance Fozard [12] and Schieber [37].

In Japan, a quantitative study about computer attitudes, cognitive abilities and technology usage among older adults showed that higher *cognitive abilities* were related to the use of products whose usage ratio was high (e.g. computer, copier, fac similes and video recorder) [42]. The European Mobilate survey also exhibited a correlation between technology use (ATM) and cognitive functioning [41].

Mollenkopf regards technical systems as socio-culturally-shaped artefacts [26, 27]. Societal stereotypes influence the development and design of technologies as well as the acceptance or rejection by potential user groups. The findings of a qualitative study in Germany indicated that the fear about what is new, motivation to use a technical device, the ease of use and advice and training are linked to acceptance or rejection of a technical system (e.g. household technology, safety alarm systems, wheel chairs and medical technology) [27].

According to Rogers et al. older people are – contrary to stereotypes – willing to use new technologies [36]. Their level of acceptance even increases if older adults receive adequate training and if the benefits of the technical device are clearly understood. The results of another German representative survey show that some devices (e.g. microwave, washing machine, hearing devices, blood pressure meter, video recorder and computer) are associated with fear, bad experiences and the need for easier use [28]. The findings of the Japanese study indicated that positive computer *attitudes* were related to greater usage of computers as well as to greater usage of computerized products (e.g. car navigation system, ATM and mobile phone) [42]. A quantitative study carried out by the authors indicated that *motivational*

aspects heavily influenced Safety Alarm System's use, i.e. higher motivation was related to higher system use [34].

Finally, *self-efficacy beliefs* about capabilities to use technical devices have to be mentioned. Results of a German study on digital wristwatch use showed that higher internal locus of control significantly coincided with higher coping strategies relating to technical problems [7]. Findings of the already mentioned European Mobilate survey indicated that higher technology use is related to higher internal locus of control and lower external locus of control [41]. Correlations showed a slight tendency that technology users feel less controlled by external circumstances and that they generally feel empowered concerning their own life.

4 Outlook and Discussion

Technical support and compensation for financial and personal resources in health care systems do not only require new technical solutions but also inclusion of the elderly in the design and development process. From a psychological point of view it is significant to consider age-related losses in cognitive and psychomotor functions as well as resources and capabilities of the elderly [21]. In gerontechnological research user participation in design process is a fundamental premise to develop products that are suitable for people of all ages (design for all) [13]. Nevertheless, population of the elderly is as heterogeneous as other age groups and in the end only consideration of individual needs will lead to acceptability and motivation to use. From a technical point of view, it is particularly important to focus on the user to tap the full technological potential and to avoid that this potential remains unrealized [24]. Ideally user involvement and therefore usability evaluation should start as soon as possible in product development to avoid financial and technical disadvantages [38]. Special training programs, information giving and counselling following cognitive theories of aging may increase acceptance and reduce anxiety towards a technical product [18, 21, 25]. According to the Competence-Press Model by Lawton [22] family members and significant others also play a major role whether a person will use technology. Thus, it is essential to provide information not only to the person concerned but also to the social environment.

Further research is needed in the context of motivational aspects that lead to acceptance or decline of a technical product. Additionally, ethical aspects - especially in the context of monitoring devices and old people with dementia have to be taken into account. In this regard, elderly people have to be entitled to their own decision, in favour of a technical product or against it. Therefore it is significant that a person is well informed about the

product and has the ability for informed choice making and consent [8]. According to Mollenkopf et al. this “informed consent” must be guaranteed [30].

Technical support can make a vital contribution to professional health care systems. But cost analyses including quality of life and evaluation of technical devices should be taken into account [32]. Technical devices always have to be seen in relationship to human care and will never replace human support [25]. This offers the opportunities to future investigations of the interactions between technical and human support in health care systems.

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10 Article II

Motivation and needs for technology use in old age

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Status: Published 2009

Oppenauer, C. (2009). Motivation and needs for technology use in old age. *Gerontechnology*, 8 (2), 82-87.

Abstract

Technology use in old age is influenced by a variety of factors such as age, education, socioeconomic status, cognitive abilities and attitudes. Furthermore, motivation to use technology in later life is an important issue for a better understanding of technology acceptance. A very prevalent approach to explain technology use is the Technology Acceptance Model (TAM). Nevertheless, there are some limitations of transferring results of present TAM studies to technology use in old age. Finally, a study about Internet use in old age including an extension of the TAM with health and psychological needs and motivation strategies is presented.

Key words: technology acceptance, old age, needs, motivation, psychology

The number of research studies and funded national and international projects dealing with technology for older people and development of prototypes has become remarkable. In the current Ambient Assisted Living Joint Programme, financed by the European Community, approximately seven hundred million Euro will be invested for the period of 2008-2013¹. There is a large variety of systems and products from different technology disciplines with different technological impacts^{2,3}. The imbalance of younger and older people in industrial countries and the decrease of financial health care resources ask for new solutions in order to provide independent living for older adults.

Influencing factors of technology use in old age

It is argued that technology can have a significant contribution to quality of life in old age^{3,4}. Nevertheless, research in gerontechnology indicates that older people have more problems than younger persons in dealing with new technology and that adoption of technology is a complex issue including a variety of influencing factors. As a consequence, older adults are less able to benefit from innovations in technology, which has negative implications on their daily lives and levels of quality of life⁵.

Beside age differences, factors such as education, socioeconomic status, attitudes towards technology, access to and costs of technology have an effect on technology use and acceptance⁵. The Pew Internet and American Life Project showed that lesser use of computer and Internet was related to higher age, lower education and socioeconomic status, minorities and people with disabilities⁶. However, a mini-review by Broady, Chan and Caputi conclude that there are more similarities between younger and older adults concerning computer use than differences⁷. The authors hypothesize that older people would perform as well as younger persons if they receive adequate training and if they had enough time to master new skills. A study investigating age differences in computer performance showed that computer performance became insignificant if the level of computer experience was similar within the age groups⁸. Thus, the level of experience and training of new skills seems to have more influence on computer performance than age and age related attitudes.

Cognitive abilities such as attention, memory, speed of processing and problem solving are highly relevant for successful use of technology in old age^{9,10}. A Japanese study showed a correlation between computer attitudes, cognitive abilities and technology use among older adults: higher cognitive abilities were related to the use of products whose usage ratio was high (e.g. computer, copier, facsimile and video recorder). But also positive attitudes played a major role¹¹. The European Mobilate survey confirmed this correlation between technology use and cognitive functioning¹². There is evidence that in old age cognitive training is at least for a short-term period efficient¹³⁻¹⁵. Nevertheless, evidence is more unclear for long-term effects and generalization of training¹⁶. Consequently, training of specific necessary skills may enhance use and acceptance of technology.

Moreover variables such as attitudes and self-efficacy have been investigated and results have shown that these factors influence technology use in old age. Ellis and Allaire found a negative correlation between age and computer knowledge and computer interest, and also a positive correlation between age and computer anxiety. Since not all of the age related

variance in computer interest was explained by computer knowledge and computer anxiety, the authors argued that self-efficacy could be a mediator variable¹⁷.

A study about Internet use in older adults showed that benefit perception has an impact on Internet use. In interviews with older adults who use the Internet, the perceived benefit of the medium depended on the purpose of use, in particular the goal of communication, the prevalence of the technology in the social environment and on user characteristics such as Internet experience and appreciation^{18,19}. In another study the importance of perceived benefit in the context of early user involvement could be illustrated: interviews with older people in focus groups showed that awareness of benefits of the technology was more important than the know-how about how to use the technology²⁰.

Technology Acceptance Model

The Technology Acceptance Model (TAM) by Davis²¹ and later modified by Venkatesh²² is a well known model in order to explain technology use especially of information technology and use in the workplace. TAM mainly follows the Theory of Reasoned Action²³ and the extended Theory of Planned Behavior²⁴ which asserted that attitudes towards an action, normative beliefs (subjective norm) and motivation to comply influence individual behavioural intention and finally actual behavior. According to the theory, people evaluate behavior positively if they think their significant others want them to perform this behavior. Thus, motivation to perform certain actions or behavior is strongly influenced by subjective attitudes and significant others, such as relatives or friends. TAM reasoned two main factors necessary for technology acceptance: perceived usefulness (PU) and perceived ease of use (PEOU). PU is defined as the extent to which a person believes using a system will enhance (job) performance. PEOU explains the person's estimation if using a technology is related to effort or not. TAM assumes that PU is also influenced by external variables such as subjective norm or the image of technology (*Figure 1*).

Although TAM is sometimes consulted for technology use in old age there are hardly any existing empirical studies according to three meta-analysis²⁵⁻²⁷. The meta-analysis by Schepers and Wetzels including 63 articles, demonstrates that the majority of studies focused on employees and managers in companies, professionals and students. Moreover moderating effects on the relationships between the factors in the model due to group characteristics, namely student groups and type of technology were revealed. The significance of PU and PEOU towards attitude and behavioural intention to use technology was supported²⁷. King

and He concluded in their meta-analysis that TAM correlations have considerable variability and presume significance of moderator variables explaining these effects. According to their analysis, the experience level of users was a moderator in several research studies. In addition, again type of technology was a moderating factor: Internet study results were different from job task applications, general use and office application²⁵. Consequently generalization of results to other technology use is not recommended.

Since the TAM hardly accounts for more than 40% of variance in use the impact of other variables should be investigated²⁶. Although the TAM has already experienced several revisions and numerous external variables were added, studies including external variables differ and the group of older adults tends to be either rather small or includes persons from age 50 which still does not represent a senior group^{28,29}. Therefore an adoption of the TAM by consideration of psychological variables is discussed below.

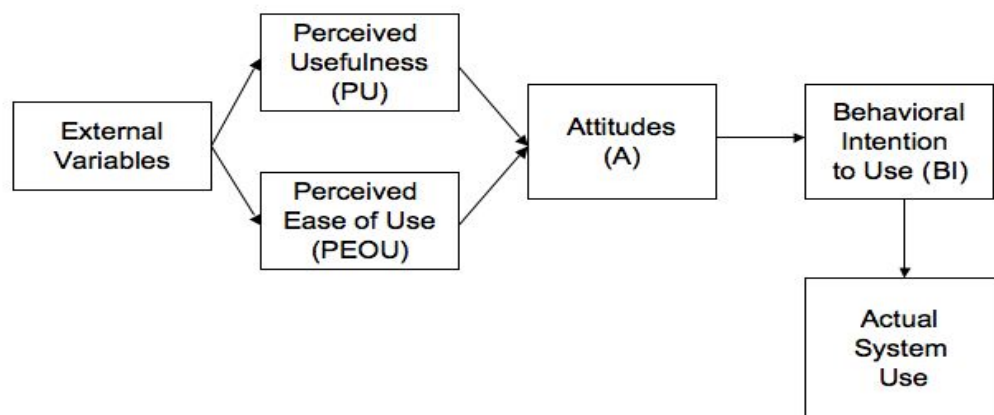


Figure 1. Technology Acceptance Model (TAM)^{7,8}

Impact of motivation and needs in later life on technology use

In gerontology two popular theories concerning motivation have to be mentioned: First, the theory by Carstensen who suggested that social contacts play a major role in old age: subjective perception of limited future time, motivates older people to aim primary for maintenance of social contacts in order to maximize social and emotional gains. On the other hand, motivation for knowledge and information acquisition decreases and older persons are less willing to spend their time with emotionally negative connected goals. In accordance with Carstensen social relatedness is a significant factor in later life^{30,31}.

The theory of Selection, Optimization and Compensation (SOC) by Baltes and Baltes assumes that each phase of life is defined by gains and losses. Commonly people aim for a balance of gains and losses in their lives. Due to a variety of changes and losses in old age this balance is at risk. In order to manage gains and losses throughout lifespan flexibility and management of resources are necessary in order to minimize losses. Successful management and minimizing of losses is characterized by three components: selection of activities and related aims, optimization by activating resources in order to achieve the selected aims and compensation in selected areas if resources are limited. Selection, optimization and compensation are seen as life management strategies that have a high impact on personal development and well-being³²⁻³⁴.

The already mentioned study by Melenhorst et al. suggested that the SOC model could have a contribution to technology adoption in old age and motivational factors of selection of technology could be explained by the components in the model^{18,19}. In a study investigating computer use in disabled older adults and related benefits such as increased autonomy and independence, results are discussed with the components of the SOC model³⁵. Broady et al.⁷ discuss an impact of the SOC model on computer use in later life in their review of the literature: in comparison with younger adults older adults tend to avoid making errors by limiting the amount of performance tasks³⁶. Similarly, a study by Rosseau and Rogers found that older university faculty staff members use selectively fewer software applications³⁷.

User needs are highly linked to motivation and technology adoption in gerontechnology literature^{20,38}. Physical and mental health problems in later life are relevant risk factors for limited autonomy and independent living. Thus, health needs and health related quality of life in later life provide important information for unmet needs and consequently for possibilities of technology use³⁹. The WHO distinguishes four domains for quality of life: physical health, psychological/bodily image and appearance, social relationships and environment⁴⁰. In the WHO QOL-Old module six further aspects were investigated: sensory abilities, autonomy, past, present and future activities, social participation, death and dying, and intimacy⁴¹.

Additionally to health needs, psychological needs are argued to determine human motivation and behavior. The Self-Determination Theory by Deci and Ryan distinguishes between intrinsic and extrinsic motivation⁴². Intrinsic motivation includes behavior which aims for autonomy, competence and relatedness and is therefore not connected to an external reward system or drive satisfaction. If a person behaves in a certain way due to the expected consequences s/he is extrinsic motivated. Following Deci and Ryan intrinsic and extrinsic

motivation are connected to mental health and subjective well-being. Satisfaction of needs for competence and autonomy are relevant conditions for psychological well-being⁴³. In a study with nursing-home-residents the impact of autonomy and relatedness on psychological well-being was supported⁴⁴.

In a study by Hagger et al. the authors linked the concept of psychological needs with the theory of planned behavior and found significant total effects of psychological need satisfaction on intentions and behavior⁴⁵.

Outlook and Conclusion

The models and empirical studies briefly reviewed above indicate that potentially important psychological factors in older adults, related to technology use and acceptance, need further study. Furthermore, studies focusing on older adults and technology use explained by the TAM are rare or have methodological restrictions. Therefore, at the University Vienna a current online survey investigates Internet use among adults from age 60 involving the TAM (see

<http://homepage.univie.ac.at/claudia.oppenauer/limesurvey/index.php?sid=84311&lang=de>).

It is hypothesized that health and psychological needs and SOC strategies are valid components of the TAM and contribute to the explanation of Internet use in old age (Figure 2). The online questionnaire, including items of all relevant variables, is linked at senior web pages and forums in Austria, Germany and Switzerland. Results of the study are expected by the end of 2009. For further information please contact the author

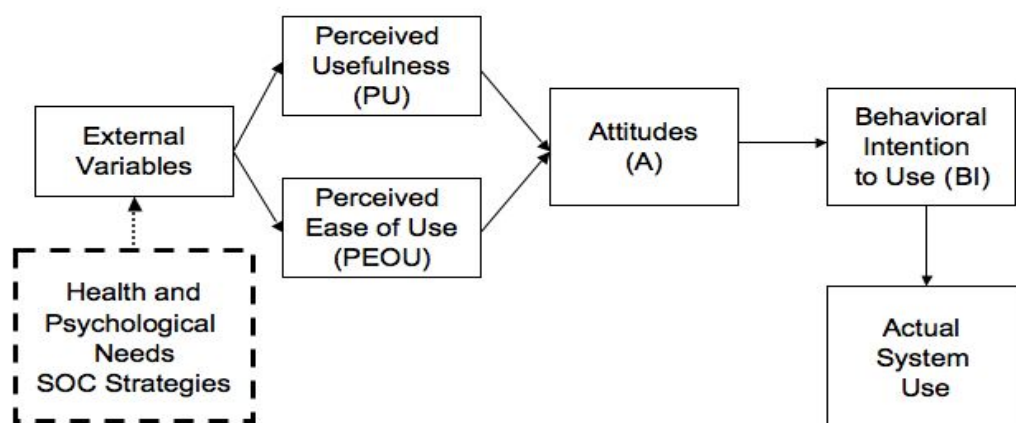


Figure 2. Adoption of TAM

Acknowledgements

This contribution has been presented in a symposium (Gerontechnology for optimal health in a multidisciplinary context) at the 19th IAGG World Congress of Gerontology and Geriatrics in Paris, July 2009.

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11 Article III

Evaluation of the Technology Acceptance Model in old age and the impact of psychosocial factors on Internet use

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Status: Submitted 05/2013 to the Journal of Information and Management

Oppenauer-Meerskraut, C., Tran, U. & Kryspin-Exner, I. (submitted). Evaluation of the Technology Acceptance Model in old age and the impact of psychosocial factors on Internet use. *Journal of Information and Management*.

Keywords: Technology acceptance model; old age; Internet use; needs; motivation

Abstract

In recent years technology acceptance in old age has become a major research field especially in the context of innovative technologies. We evaluated the Technology Acceptance Model (TAM) in older adults and investigated the impact of further psychological variables in an extended version of the TAM. Hypotheses were tested with structural equation modelling using quantitative data from 471 older persons. We could confirm the usefulness of the original TAM but found that variables essential to theories of psychological needs and motivation were also important with regard to technology acceptance in older adults.

1 Introduction

Demographic changes in industrialized countries together with the need for independent living on the one hand and decreased institutionalized care on the other hand

have asked for a focus on technology research and development for elderly persons. New technologies are rapidly permeating different domains of living and the elderly have become an important economic target group as potential consumers of innovative technologies [33]. Further, innovative technologies are also a political and economic issue as life expectancy but also the risk of developing or suffering from chronic diseases, such as dementia or stroke, are increasing in old age and nursing homes have to be rebuilt in order to reduce costs. Therefore, increasing attention is given to technologies capable of supporting older people in living independently at home as long as possible. In spite of the broad range of possible technologies, some essential factors have been found to influence technology use and acceptance: age (linked with physical and mental health condition), education, socioeconomic status, attitudes towards technology, and access to and costs of technology products [11,45]. Moreover motivational aspects such as perceived benefits and costs of technology products play a major role in technology adoption in old age [35].

In general, older people have more problems in dealing with new technology than younger people. Older people are disadvantaged due to cognitive, sensory, and motoric restrictions. As a consequence, older adults are less able to benefit from innovations in technology which negatively impacts the quality of their daily lives. Nevertheless, research shows that the longer technology innovations are available the more are buying patterns, levels of competence in dealing with the technology, and attitudes towards the specific technology between the generations the same [33].

In 2006, European Union ministers finalized the Riga Declaration, committing member states to an inclusive and barrier-free information society in order to halve the gap in Internet usage by 2010 for groups at risk of exclusion such as older people, people with disabilities and unemployed persons. Official debates like this fostered a huge amount of national and international projects and campaigns in order to increase Internet use by elderly [17].

Social connectedness is a known factor promoting successful aging but older people are at risk of social isolation because of age-related life events, such as retirement, illness or death of significant others. The Internet may serve as a potential resource for the elderly to maintain social inclusion, thus preventing loneliness. Whereas rather older research literature discusses negative effects of the Internet on social connection in old age [29,59], newer studies report that the Internet can prevent loneliness in old age and increase well-being and feelings of control and self-esteem [25]. The study of Sum et al. [55] revealed that the hours

spent and the reasons of using the Internet are important factors with regard to loneliness and well-being. Using the Internet for communication with relatives decreased loneliness whereas using the Internet for communication with unknown people had the opposite effect.

A Pew Internet report from 2012 [39] shows that 53% of American adults aged 65 and older go online while 82% of the general population use the Internet or E-mail. While 2010 only 38% of adults aged 65 and older used the Internet, this percentage has increased about 13% in only two years and it is the first time that more than half of the population of older adults go online. For the group of elderly aged 76 and older 34% are online – main Internet activities are E-mail and search. Another Pew Internet study demonstrates that a minor use of computers and the Internet is related to higher age, lower education and socioeconomic status, minority status, and disability [40]. Similar results can be found in a survey based on the Eurobarometer of 2011 [18] for European citizens: 32-38% of the senior non-users lack the opportunity to use the Internet. Concerning the regional aspect, people in the North of Europe have the highest number of computer and Internet users. In general, about 20% of the senior population (aged 60 and older) in Europe [38] have a computer and 17% use the Internet. Further the presence of the Internet already decreases with the age of 55. In Austria, where 44% of the online sample of the present study was recruited (see below), 61% of people aged 60-69 years and 33% of seniors age 70 and older use the Internet [21]. Older people mainly use the Internet for information seeking. This process seeks high levels of cognitive functions such as memory, problem solving and special knowledge about search engines [12]. Concerning use of social media an increase of older Internet users could be observed: Whereas 2009 only a minority of older adults used social media [40], social networking has grown by 150%, from 13% in 2009 to 33% in 2011.

Finally, the perceived benefit of technology has an impact on the likelihood of technology use. If users perceive subjective advantages of a system or device depends on various factors: purpose of use, in particular the goal of enhancing communication, the prevalence of the technology in the social environment and on user characteristics such as Internet experience and appreciation [34,35]. The importance of perceived benefit in the context of early user involvement could also be illustrated: interviews with older people in focus groups showed that awareness of benefits of the technology was more important than the know-how required to use the technology [16].

2 Theoretical Framework

2.1 Technology Acceptance Model

The Technology Acceptance Model (TAM) by Davis [13] and later modified by Venkatesh [57] is a well-known approach for explaining technology use especially in the workplace. TAM follows the Theory of Reasoned Action and the extended Theory of Planned Behaviour [19] which assert that subjective attitudes towards an action, normative beliefs (subjective norm), and motivation to comply influence the individual behavioural intention of technology use and the actual behaviour with regard to technology use. Within TAM it is reasoned that two main factors are necessary for technology acceptance: perceived usefulness (PU) and perceived ease of use (PEOU). PU is defined as the extent to which a person believes that using a system will enhance (job) performance. PEOU describes a person's expectation whether using a technology demands an effort or not. TAM suggests that the Behavioral Intention (BI) to use the system determines Actual System use (Figure 1).

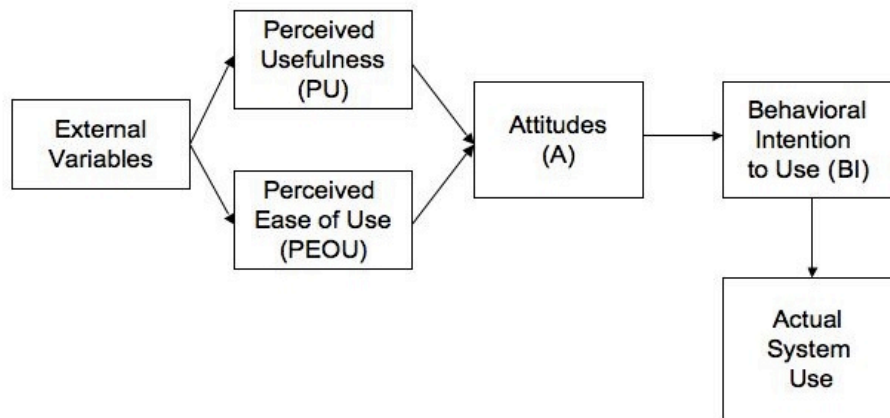


Fig. 1. Technology Acceptance Model

The revised TAM2 [57] included as external variables the subjective norm besides image, job relevance, output quality, and result demonstrability. Subjective norm was defined as a determinant of perceived usefulness and describes the target person's perception whether significant others think that he/she should use the system. Schepers and Wetzels [50] verified a significant effect of subjective norm on PU and BI in a meta-analysis of the TAM.

Although the TAM is utilized to describe technology use in old age, only few empirical studies exist supporting this use. The meta-analysis conducted by Schepers and Wetzels [50], including 63 studies, revealed that the majority of studies focused on employees

and managers in companies, professionals or students. Moreover, group characteristics (namely student groups) and type of technology [27,50] moderated the relationships between the factors in the model. Since the TAM accounts for slightly more than 40% of technology use variance [30], further variables need to be examined with regard to their contribution.

2.2 Personal Innovativeness

In information technology research interest in the impact of individual differences regarding use of technology has grown during the 1990s. Individual factors argued to influence technology use are personality, situational and demographic variables. Besides personal innovativeness, self-efficacy, computer playfulness, and dynamic, situation-specific individual differences were investigated [56]. Agarwal and Prasad [3] defined the construct of personal innovativeness as the degree to which an individual is willing to try out new information technology. Further, personal innovativeness is expected to be stable across different situations. Innovative persons adopt innovations earlier and have more positive beliefs about technology use. Personal innovativeness is seen as an external variable of the TAM model with direct impact on perceived ease of use and on perceived usefulness. In general, personal innovativeness has been used as an antecedent to computer self-efficacy [4,28,56], computer anxiety [56] and to the variables perceived ease of use and perceived usefulness of the TAM [28,31,32].

2.3 Health and Psychological Needs

User needs are highly linked to motivation and technology use in the gerontechnology research field [16,36]. Since physical and mental health problems such as cognitive, visual or hearing impairments or diseases like dementia or depression increase with old age, the group of older users is very heterogeneous and user needs vary significantly with regard to independent living and autonomy. It is estimated that 40% of people older than 50 have a degree of activity limitation because of health problems. EU projects such as SHARE (Survey of Health, Aging and Retirement in Europe) and ESAW (European Study of Adult Well-Being) have clustered and specified needs and well-being in the older population [10]. The WHO distinguishes four domains for quality of life: physical health, psychological/bodily image and appearance, social relationships and environment. In further research spirituality,

religiousness and personal beliefs were added in a supplemental questionnaire to the basic WHOQOL-100 [61]. In the quality of life questionnaire for older adults, WHOQOL-Old, six further aspects are investigated: sensory abilities, autonomy, past, present and future activities, social participation, death and dying, and intimacy. The questionnaire was tested in 22 centres from around the world in order to investigate gaps in the coverage of the WHOQOL-100 [42].

Besides health needs, psychological needs determine human motivation and behavior. Research in motivational psychology has shown that there are basic psychological needs across the life span which must be achieved for well-being. Self-determination theory (SDT) [14,49] postulates three basic psychological needs in terms of nutriment that are important for growth, integrity, and health and that are essential for the process of goal pursuit: need for autonomy, competence, and relatedness. Competence describes the self-perception of being effective and able with regard to one's behavior. Autonomy refers to the feeling that one's behavior is self-chosen and meaningful, and relatedness consists of the perception of being connected with important others. SDT hypothesizes that autonomous and intrinsic motivated goal pursuit is associated with better performance and mental health, whereas extrinsically controlled and motivated goals correlate negatively with mental health and well-being. Finally, opportunities to satisfy the three intrinsic needs increase self-motivation and effective functioning. In a study about fundamental psychological needs [52] the three need components autonomy, competence, and relatedness could be found among the top four needs rated by the participants.

Several studies showed the strong link between satisfaction of autonomy, competence, and relatedness to well-being [43,53]. Kasser and Ryan [26] investigated the relationship of needs satisfaction and well-being in nursing home residents and found correlations between both autonomy support and relatedness with lower depression, increased well-being, vitality, and life satisfaction. Perceived autonomy alone explained up to one third of the variance in regression analyses. These findings strengthen the assumption that autonomy is a main form of psychological nurturance for well-being. Further, residents who felt more autonomously motivated throughout the day were more likely to be still alive at the 13-month follow up. Baard et al [5] investigated SDT in employees and found that autonomous causality orientation and perception of their managers' autonomy support was a predictor of employees' satisfaction of intrinsic needs. Further, intrinsic need satisfaction predicted performance and psychological adjustment.

Physical and mental health problems in later life are relevant risk factors that limit autonomy and independent living. Thus, health needs and health related quality of life in later life provide information for technology use options. In addition to health needs, psychological needs determine human motivation and behavior [16].

2.4 Selection Optimization Compensation (SOC)

Human development is closely connected to the range of opportunities and biological, psychological, and contextual constraints. Individuals are assumed to differ in their access to resources in order to deal with these constraints. However, the availability of resources does not only differ between individuals but also in the same individual with regard to developmental and life span changes. Older people face a shift to less resource gains and more resource losses. An older person might have a high social status, knowledge, and professional expertise but physical fitness, health or multitasking abilities decrease with age [44]. Therefore, a main task in life span psychology is the investigation of how individuals deal with these resource losses and manage to achieve desired goals or levels of functioning [20].

Paul and Margret Baltes [6] proposed the model of selection, optimization, and compensation for successful aging over the entire life span. The SOC model assumes that in order to minimize and avoid negative outcomes/losses and to attain a maximum of positive and desired outcomes, people select certain domains (goals) of functioning (*Selection*) since due to time, energy or physical limitations (e.g., illness) not all opportunities can be pursued. The SOC model assumes that adaptive development is the result of interaction of three general mechanisms for generating, releasing, and allocating resources. Further, people aim for optimization in these selected domains and allocate and refine internal or external resources to achieve higher levels of functioning (*Optimization*). Finally, if loss of resources or a decline of goal-relevant means are expected, compensatory processes are needed to maintain a given level of functioning in the selected domain (*Compensation*). Baltes and Baltes developed the SOC model as a general life span developmental model. However, in old and very old age people have to face more health-related constraints and other stressful life events, so that the dynamics of the model become more evident. Accordingly, following the presumptions of the SOC model, successful management of gains and losses through life span is a key factor for well-being. Besides the sensorimotor-cognitive functioning domain, SOC

framework research has been most active in motivational-volitional processes [44]. Moreover, the authors demonstrated that SOC mechanisms become evident in motivational and volitional processes. The selection mechanism is a main factor for goal selection, optimization for goal pursuit and compensation for goal-relevant resource losses. Riediger et al [44] recommended to use the SOC framework in future research on motivational and volitional aspects of developmental regulation.

Recent research has demonstrated that older adults are not in general avoidant of new technologies or computer use in particular. Hawthorn [22] showed that older people may avoid making errors by limiting the tasks they attempt to perform. Another study by Rosseau and Rogers [48] found that older university staff members used fewer software applications because they simply needed fewer programs. SOC strategies could explain why older people tend to avoid new technologies even if benefits would be high for them (e.g., E-mail, videophone by computer applications, internet shopping). Referring to the SOC model, older people would selectively choose to use fewer applications due to decreased cognitive capabilities. Eisma et al. [16] concluded that older people would be willing to be more involved with technology if they were more aware of the benefits for them. Discussions in focus groups showed that the combination of not understanding of how to use the technology and not being aware of the advantages of a technology were major barriers for not using technology. Participants expressed their willingness to use technology once these barriers were reduced. Other studies [34,35] showed benefit-related considerations referring to Internet use independent from computer experience. Melenhorst et al [35] also stress that studies on motivational factors in older adults' technology use are lacking. The majority of studies focus on technology barriers [46] and linked increased performance and cognitive abilities of older people [11,51].

Another example in line with the SOC model is given by the longitudinal study by Kahana et al. [24]. Participants used computers to compensate losses due to illness, disabilities or old age and to maintain independent living. Computer were mostly used for E-mail and Internet, in particular gathering relevant health information.

3. Hypotheses Development

A majority of studies with the TAM focused on employees and managers in companies, professionals or students. As meta-analytical results support the significance of

PU and PEOU for attitudes and behaviour, the TAM seems to be a useful model for the explanation of technology use. Nevertheless, studies focusing on older adults and technology use that actually used the TAM are rare [9,37,47], focus on rather younger older adults [41] or suffer from methodological restrictions [27]. Other psychological variables that may explain technology use in old age also need more empirical support and need to be contrasted with the TAM. Thus, we are the first not only interpreting technology adoption results of older adults according to the already described psychological models but also implementing an extended version of the TAM with a sample of older adults using the Internet.

3.1 Subjective Norm

Subjective Norm (SN) is one of the original external variables of the TAM. We investigated its usefulness in older adults, hypothesizing:

H1: SN is positively related to PU.

H2: SN is positively related to PEOU.

3.2 Personal Innovativeness

Personal Innovativeness (PI) is a common investigated variable related to the TAM. We investigated its usefulness in older adults, hypothesizing:

H3: PI is positively related to PU.

H4: PI is positively related to PEOU

3.3 Health and Psychological Needs

Since user needs are highly linked with technology use in old age (see Section 2.4), we hypothesize that Health Needs (HN), measured with the WHOQOL-Old, and Psychological Needs (PN), measured with the Basis Psychological Needs Scale (BPNS), are predictors of the TAM variables PU and PEOU. We expected that:

H5: HN are positively related to PU.

H6: HN are positively related to PEOU.

H7: PN are positively related to Perceived Usefulness PU.

H8: PN are positively related to Perceived Ease of Use PEOU.

3.4 SOC Strategies

According to Melenhorst et al. [34,35] and Kahana et al. [24] the SOC model could have a significant contribution in explaining technology adoption of older adults. We therefore hypothesized:

H10: SOC strategies are positively related to PEOU

3.5 Original Variables of the TAM

In order to test validity of the TAM for technology use in old age, the following hypotheses were investigated:

H11: PU is positively related to A.

H12: PEU is positively related to A.

H13: A is positively related to BI.

Figure 2 shows the intercorrelations of the variables with the TAM in our proposed extended model.

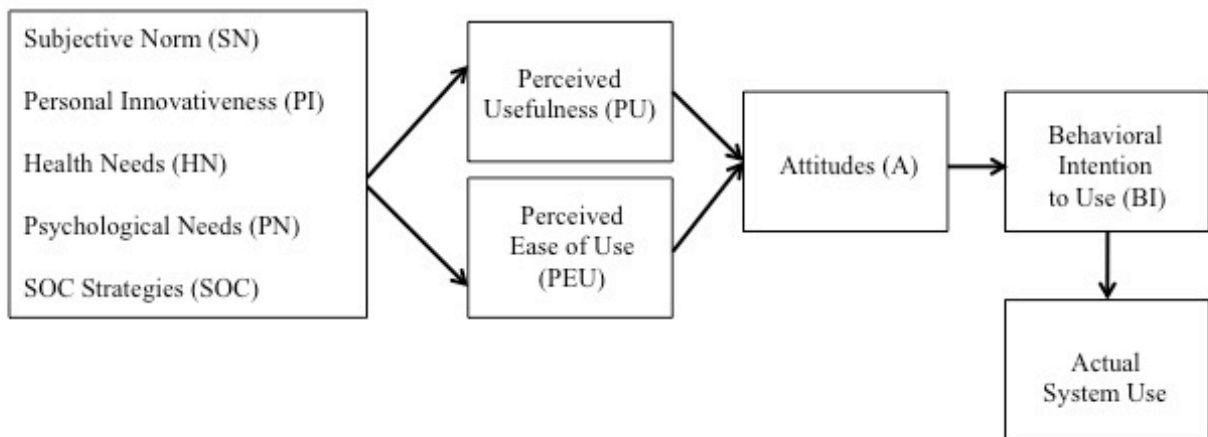


Fig. 2. Research Model

4. Methodology

4.1 Study Design

Participants were contacted via various German Online Senior platforms in Austria, Germany and Switzerland such as Seniorkom (<http://www.seniorkom.at/>), 50plus (<http://www.50plus.at/>), Webheimat (www.webheimat.at) EURAG Austria (<http://www.eurag.at/>), Seniorweb.Ch (<http://www.seniorweb.ch/>), and various smaller Senior Internet groups. Participants had to be 60 years or older and had to use the Internet at least for

three months. They were asked to fill out an online questionnaire which was pre-tested in a sample of $N = 12$ senior relatives (aged 55 to 80) of graduate students of Psychology at the university of Vienna with regard to readability and understandability. 620 persons started to fill the questionnaire. 57.6% of the questionnaires were answered completely, 21.1% were deemed invalid (with major parts of the questionnaire missing) and 21.1% were answered with only minor missings (single items missing).

Data analysis was performed using structural equation modelling (SEM) and a variance maximization approach. For computation of all SEM models, AMOS 7.0 and maximum likelihood estimation was used. We contrasted results in cases with complete and partially missing data (using AMOS's missing data option) and report on both in the following.

4.2 Instruments

Participants were asked about demographic data and Internet use, and had to fill out a number of questionnaires necessary to investigate the hypotheses: TAM with Social Norm and Personal Innovativeness items, WHOQOL-BREF, WHOQOL-Old, Basic Psychological Needs Scale, and a SOC questionnaire. All items and scales are listed in the appendix.

4.2.1 TAM

This study used the variables of the original TAM with the frequently used external variable Social Norm (2 Items) with Cronbach alpha (α) ranging from 0.81 to 0.94. Further all relevant TAM variables were used: Perceived Usefulness (6 Items; α ranging from 0.67 to 0.98), Perceived Ease of Use (5 Items; α ranging from 0.63 to 0.98), Attitude (5 Items; α ranging from 0.69 to 0.95) and Behavioral Intention to Use (2 Items; α ranging from 0.62 to 0.97). All items were measured on a seven-point Likert scale from 1 = *strongly disagree* to 7 = *strongly agree* [27].

4.2.2 Personal Innovativeness Scale

Agarwal and Prasad [3] developed a four items Likert scale. The items refer to the individual's risk to experiment with existing and new information technologies on a scale of 1 to 7. A study by Agarwal and Karahanna [2] reports composite reliability = 0.87.

4.2.3 WHOQOL-BREF

The WHOQOL-BREF is a 26 items instrument with four domains: physical health (7 items), psychological health (6 items), social relationships (3 items), and environment health (8 items). The WHOQOL-BREF is a shorter version of the WHOQOL-100 instrument [54]. All items are scored on a five-point Likert scale. Cronbach Alpha for the subscales range from 0.68 to 0.82.

4.2.4 WHOQOL-Old

The WHOQOL-Old Module has 24 items with six different domains: Sensory Abilities ($\alpha = 0.84$), Autonomy ($\alpha = 0.72$), Past, Present and Future Activities ($\alpha = 0.74$), Social Participation ($\alpha = 0.79$), Death and Dying ($\alpha = 0.84$), and Intimacy ($\alpha = 0.88$). All items are measured on a five-point Likert Scale [60].

4.2.5 Basic Psychological Needs Scale (BPNS)

According to the theory of SDT, Deci and Ryan [14] developed the BPNS. The scale had been adapted from the Basic Need Satisfaction at Work Scale and consists of 21 items concerning three different need domains: needs for competence, autonomy, and relatedness. For all three scales scores are calculated, there is no general need satisfaction score. Values of internal consistency range from $\alpha = 0.61$ to 0.81 for the autonomy subscale, $\alpha = 0.60$ to 0.86 for the competence subscale, and $\alpha = 0.61$ to 0.90 for the relatedness subscale [23]. Besides, in the present study an Internet Needs scale with eight items referring to feelings of competence and self-determination when using the Internet was developed and used for the online survey.

4.2.6 SOC

A 12-items version of the SOC questionnaire [7] with the domains elective selection, loss-based selection, optimization and compensation was used. Each domain has three items. The questionnaire builds on proposing two opposite strategies: one related to the target process of

life management (SOC) and the other one referring to an alternative, non-SOC reflecting, strategy. Participants are asked to choose the statements which describe them best. For data analysis, statements referring to SOC are counted. Thus, overall scores range from 0 to 12, Cronbach alpha ranging from $\alpha = 0.51$ to 0.55.

5. Results

5.1 Study Sample and Descriptives

471 older persons aged 60 to 84 years ($M = 67.42$, $SD = 6.23$) participated in the study. 43.9% were from Austria, 41.8% from Germany, 10.9% from Switzerland and 3.5% from other countries. 56.9% were female, 54.6% lived in a partnership or were married. 88.7% were already retired, and 97.1% lived independently at home. 65.4% had chosen their computer on their own and 88.3% used the computer for more than three years. 69.8% had already used a computer for professional reasons. Concerning Internet use, 42.2% had gained expertise with regard to Internet use on their own, 19.4% had learned internet use in their job, 18.3% had completed a computer course and 17.2% had learned how to use the internet from a family member. 95.9% agreed to the statement that the potential of the Internet could compensate for mobility restrictions in old age. 58.3% agreed that they could image to do a great part of social communication on the Internet. 56.4% reported that they had already met new people on the Internet. The majority of participants received support from family members (37.1%) or friends (30.4%). Besides, 63% expressed the view that they did not need more support for Internet use. With regard to Internet use, 89.1% used the Internet daily. Most of the respondents (33.3%) surfed between 30-60 minutes on average per day, 23.4% for one to two hours, and only 4.5% surfed for more than four hours (Table 1).

Table 1

Computer/Internet support and Internet use

Computer/Internet support		Percentage
Support by family members		37.1
Support by friends		30.4
Professional support		13.9
Nobody supports		18.6
Average Internet Session Duration		Percentage
15 minutes		4.0
30 minutes		13.7
30-60 minutes		33.3
1-2 hours		23.4
2-3 hours		14.2
3-4 hours		7.0
More than 4 hours		4.5

5.2 Tests for validity and reliability of measures

Reliabilities of the multi-item measures are given in Table 2. Factorial validity (i.e., unidimensionality) of these measures was evident in respective structural analyses (principal components analysis, using both the Scree test and parallel analysis to ascertain the number of components to retain; details omitted for brevity).

Table 2

Psychometric Properties of the Measures

Measures	Cronbach α	M (SD)
<i>TAM constructs</i>		
Perceived usefulness (6 items)	.79	32.97 (5.925)
Perceived ease of use (5 items)	.81	27.91 (5.225)
Attitude (5 items)	.82	31.03 (4.158)
Intention to use (2 items)	.60	12.22 (2.003)
<i>External variables included in the final model</i>		
Needs: Competence (5 items)	.68	31.22 (5.484)
Needs: Internet score (6 items)	.84	37.46 (9.003)
Personal innovativeness (4 items)	.85	15.73 (3.429)
SOK (12 items)	.75	7.55 (2.870)

5.3 Test of the Research Model

5.3.1 TAM without External Variables

In a first step, associations of TAM constructs were examined without implementing any external variables. Results of this analysis were used as a baseline, against which the expanded model (see below) was compared. Setting the path of PU to BI to zero (to gain one degree of freedom; see also the intercorrelations of the TAM constructs in Table 3), the model (depicted within the dashed lines in Figure 3) showed a perfect fit on the data of all $N = 400$ participants ($\chi^2 < 0.01$, $df = 1$, $p = .976$, CFI = 1.00, RMSEA = .000, SRMR < .001). Standardized path coefficients were as follows: PEOU $\rightarrow$ PU .34, PEOU $\rightarrow$ ATT .24, PU $\rightarrow$ ATT .56, ATT $\rightarrow$ BI .46, PU $\rightarrow$ BI .13 (all $ps < .001$, but for the latter $p = .021$). Squared multiple correlations (SMCs) were: PU .12, ATT .46, and BI .30.

Table 3 Intercorrelations of variables with Cronbach Alpha in the main diagonal

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1) Perceived Usefulness (TAM)	0.79	0.36	0.63	0.41	0.31	0.34	0.11	0.13	0.15	0.04	0.02	0.07	0.24	0.15	0.16	0.49	0.23
(2) Perceived Ease of Use (TAM)		0.81	0.42	0.23	0.07	0.26	0.19	0.26	0.19	0.12	0.09	0.14	0.38	0.34	0.24	0.19	0.06
(3) Attitude (TAM)			0.82	0.54	0.26	0.23	0.18	0.12	0.18	0.10	-0.03	0.10	0.26	0.29	0.22	0.42	0.17
(4) Behavioral Intention to Use (TAM)				0.61	0.16	0.16	0.03	0.01	0.16	0.07	-0.06	0.10	0.20	0.16	0.13	0.30	0.16
(5) Subjective Norm					n.a.	0.15	0.05	0.00	0.10	0.05	-0.06	0.11	0.10	0.12	0.04	0.19	0.10
(6) Personal Innovative- ness						0.85	-0.05	0.06	0.02	-0.05	-0.06	-0.05	0.00	0.04	-0.01	0.18	0.07
(7) Sensory Abilities (WHOQOL- Old)							0.83	0.29	0.24	0.23	0.14	0.14	0.30	0.37	0.27	0.05	0.08
(8) Autonomy (WHOQOL- Old)								0.63	0.49	0.36	0.19	0.33	0.42	0.55	0.39	0.07	0.12
(9) Past. Present and Future Activities (WHOQOL- Old)									0.75	0.62	0.22	0.53	0.48	0.45	0.44	0.15	0.15

(10) Social Participation (WHOQOL- Old)										0.72	0.18	0.42	0.38	0.32	0.35	0.02	0.14
(11) Death and Dying (WHOQOL- Old)											0.82	0.12	0.21	0.21	0.22	-0.06	0.05
(12) Intimacy (WHOQOL- Old)												0.92	0.36	0.28	0.47	0.14	0.15
(13) Competence (BPNS)													0.72	0.54	0.52	0.22	0.22
(14) Autonomy (BPNS)														0.76	0.54	0.18	0.15
(15) Relatedness (BPNS)															0.75	0.26	0.18
(16) Internet (BPNS)																0.86	0.13
(17) SOC																	0.75

5.3.2 TAM with External Variables

External variables were implemented in a stepwise fashion, guided by the pattern of zero-order correlations (see Table 3) and utilizing modification indices as provided by AMOS. The final model included only variables with significant paths to at least one of the TAM constructs. All external variables were allowed to correlate. Figure 3 is a graphical representation of the obtained final model. Fit in the sample of participants with complete data in all of the involved final variables ($N = 330$) was excellent ($\chi^2 = 18.21$, $df = 18$, $p = .442$, CFI = 1.00, RMSEA = .006, 90%-CI = [.000, .050], SRMR = .045).

Fit of this model in the total sample ($N = 400$) was equally satisfying ($\chi^2 = 23.34$, $df = 18$, $p = .178$, CFI = .99, RMSEA = .027, 90%-CI = [.000, .055], no SRMR due to partially missing data). Social Norm, SOC, Personal Innovativeness, Needs: Internet, and Needs: Competence were found to be the most important variables of those investigated in the context of the TAM. Standardized path coefficients and SMCs in the total sample are given in Figure 3. Intercorrelations of the external variables were as follows: Social Norm with Personal Innovativeness and Needs: Internet, $r_s = .15$ and $.18$; Needs: Competence with SOC and Needs: Internet, $r_s = .19$ and $.18$; Needs: Internet with Personal Innovativeness, $r = .16$ (all $ps < .01$).

The external variables showed associations with PU, PEOU, and ATT. Importantly, the proportion of explained BI variance was not expanded in the augmented model compared to the baseline model (see above; 29% vs. 30%). Moreover, the external variables contributed most in explaining PU variance (38% vs. 12%), and less in explaining PEOU variance (18%). Explained variance of ATT was comparable to the baseline model (47% vs. 46%).

Indirect Effects of External Variables on BI

Needs: Internet exerted the largest effect (standardized indirect effect = .19; note that indirect and total effects are the same in this case, as the external variables had no direct paths to BI) on BI, followed by Personal Innovativeness and Social Norm (both .10), Needs: Competence (.07), and SOC (.04).

Correcting for Unreliability of BI Scores

As BI was measured with only two items, measurement precision was rather low (see Table 3). In order to correct for unreliability, BI was implemented as a latent variable (instead of using manifest BI scores). Fit of this modified model appeared acceptable ($\chi^2 = 38.34$, $df = 25$, $p = .043$, CFI = .99, RMSEA = .037, 90%-CI = [.007, .059], no SRMR). Accordingly, explained BI variance more than doubled to 63%. Correcting for unreliability did not change

the ordering of the external variables with respect to exerted indirect effects on BI: Needs: Internet (.27), Social Norm (.15), Personal Innovativeness (.14), Needs: Competence (.10), and SOC (.06).

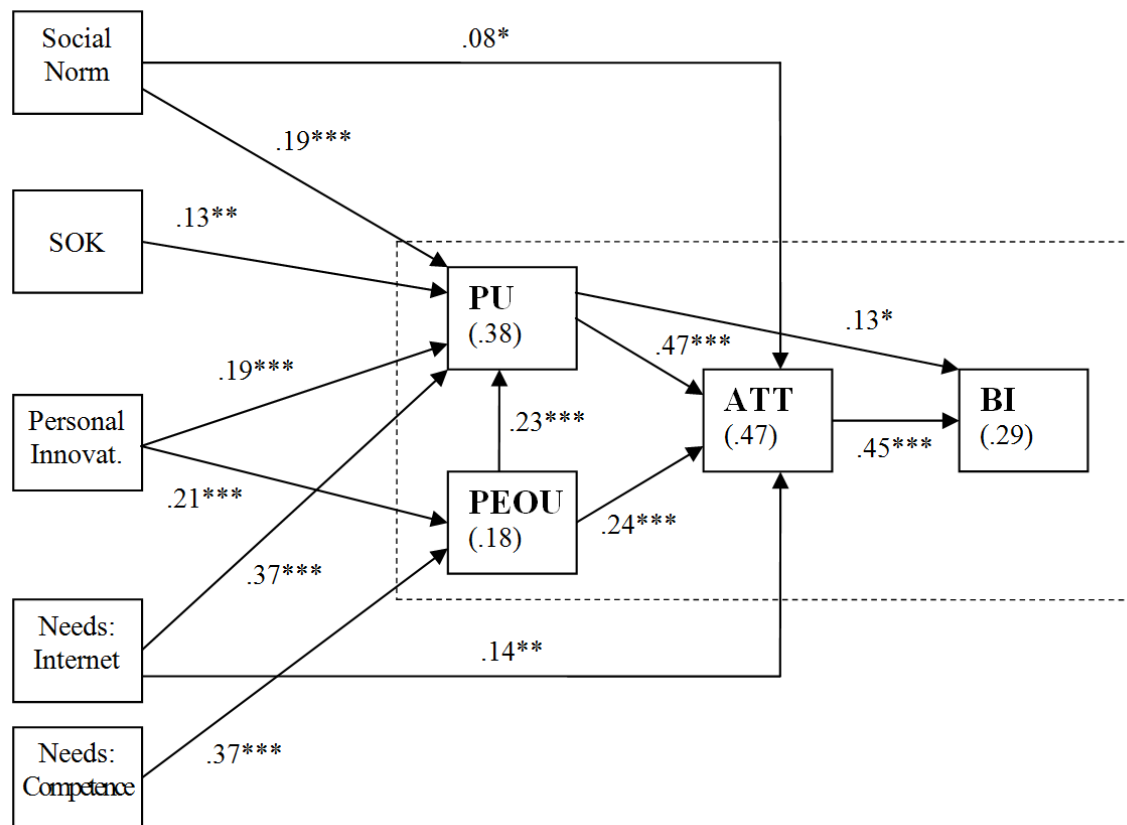


Fig 3. Final path model. The basic TAM without external variables is depicted within dashed lines. * $p < .05$, ** $p < .01$, *** $p < .001$.

6. Discussion

The present study successfully tested the applicability of the TAM regarding older adults' Internet use. Values of relationships between original variables of the TAM were very similar to those reported in the meta-analysis by Schepers and Wetzels [50]. This indicates that the original TAM relationships could be confirmed without even minor variations and that the TAM is a useful model for explaining technology use in older adults.

Moreover, we could not only confirm the usefulness of the original TAM without any external variables in this context but, moreover, found that hypothesized psychological external variables contributed significantly to the TAM. The external variables Social Norm, Personal Innovativeness, Needs competence, Needs Internet, and SOC Strategies contributed most in explaining Perceived Usefulness and Behavioral Intention (after correcting for

unreliability). Our findings are in line with reports and publications from various EU-Projects [1,8] focusing on older adults' use of innovative technologies where social influence of family members related to technology use, involving buying decisions and further support of new technology products, was a significant indicator of technology use and adoption. Further, personal innovativeness is a factor observed in related projects [1,8]: younger and more educated older adults are less timid of new technologies and are in general more open and interested in trying innovative products. Since our sample represented a rather young and active group of older adults, the significance of Personal Innovativeness in technology acceptance also fits with this explanation. While Melenhorst et al. [35] highlighted a lack of research on motivational factors in older adults' technology use, we could demonstrate the influence of perceived Internet competence (Needs Internet) on Perceived Usefulness and self-determinant behavior (Needs Competence) on Perceived ease of use. Our results show that the Internet is perceived as easy to use if the persons perceive themselves as competent and capable to use the Internet on their own without support from others. This could be a significant finding with regard to the development of innovative technologies for older adults with decreased health or cognitive status. Providing a vast array functions in a new device or system requires the learning of multiple new skills and will therefore likely decrease the compliance of dealing with this new technology. Our findings highlight the importance of users' subjective perception of competence and self-independence with regard to technology use. Furthermore, the strategy to select, to optimize, and to compensate (SOC) because of age-related losses was found to have an influence on Perceived Usefulness and Behavioral Intention. Interpreting our results, participants using the Internet represent a target-oriented and focussed user group who had chosen the Internet as one way to support themselves in achieving their goals. However, we have no information about other relevant strategies besides Internet use participants have nor which importance the Internet has related to general goal orientation and compensation. Since this was the first study dealing with the role of SOC on technology use, further research should focus more on the impact of SOC on a broader scale (covering other relevant life goals) in the context of technology use.

Health Needs only played a minor role with regard to the TAM. Participants in our study reported high levels of subjective health and quality of life (WHO-QOL-BREF, WHO-QOL-Old). 83.8% rated their quality of life as good or very satisfying and 70.2% were satisfied or very satisfied with their health level. Consequently, health needs related to health problems and restrictions in daily life assumedly were not significant in the participants' lives

and could thus not impact the technology acceptance process. Studies with more heterogeneous populations are needed to assess the impact of health needs more accurately.

Finally, we want to discuss some limitations of our study. First, representativeness of the sample was limited and should be improved in further studies. Studies with different old age groups related to Internet experience, health status and independent living should be conducted. Our sample was very homogenous with regard to physical health and Internet use which appeared advantageous with regard to testing a new research model, but foreclosed the generalization of obtained results to the broader population of all older adults using the Internet. It is well known that the group of older adults is very heterogeneous and technology adoption depends on a variety of factors [11]. Moreover, participants were mostly recruited from Internet platforms which already require intensive occupation with the Internet. Consequently, the participants were frequent users of the Internet and aware of various aspects and applications of the Internet. Investigating groups with less Internet expertise could further improve the understanding of technology adoption. However, with regard to the present study, where participants were recruited over the Internet, some Internet expertise in participants was inevitable. Another limitation is related to the number of tested variables. The response rate of our online survey was with nearly 60% very high, including further more than 20% questionnaires with only minor missings [15]. Although research of factors influencing computer use by older adults has increased in the last years, Wagner et al. [58] illustrated in their review that there were hardly any studies investigating the relationship between the same two variables more than once. Similar criticisms can be found about the research on technology use of older adults in general. Consequently, comparable studies are necessary in order to verify our results. Besides, the results of our study have to be validated by further research dealing with a more heterogeneous group of older adults and with different technologies to test reliability of our results.

Since there is a lack of studies investigating technology acceptance in old age with regard to existing research models like the TAM, results of our study will contribute to a better understanding of technology adoption of older adults. Influence of the tested psychological variables motivation and needs has demonstrated that not only the classical TAM variables are necessary to explain the complex issue of technology acceptance and further studies are needed to gain more information about the relevance of motivation strategies in old age.

Appendix Survey Instruments

A1. Technology Acceptance Model

Perceived Usefulness

Using the Internet facilitates finishing tasks of every day life.

In general, I find the Internet to be useful in my life.

Using the Internet gives me more control in my life.

Using the Internet enables me to search quickly for needed information.

Using the Internet enables me to maintain social contacts

Information in the Internet is very useful to make decisions (e.g. Shopping, Travelling)

Perceived Ease of Use

To learn how to use the Internet was easy for me.

Mostly I can use the Internet to get the information I want.

My interaction with the Internet is clear and understandable.

I find the Internet easy to use.

Using the Internet does not require a lot of my mental effort.

Attitude

I like to use the Internet and functions such as E-Mail

It makes fun to use the Internet and functions such as E-Mail.

I do not want to disclaim the Internet and functions such as E-Mail.

I find it reasonable to use the Internet and functions such as E-Mail.

I think that using the Internet has improved my quality of life.

Intention to Use

I intend to use the Internet regularly in the future.

I will recommend the Internet to other seniors.

A2. Social Norm

People who influence my behaviour think that I should use the Internet and related functions such as E-mail.

A3. Personal Innovativeness

If I heard about a new information technology, I would look for ways to experiment with it.

Among my peers, I am usually the first to try out new information technologies.

In general, I am hesitant to try out new information technologies.

I like to experiment with new information technologies.

A4. Health Needs WHOQOL-Old

Sensory Abilities

To what extent do impairments to your senses (e.g. hearing, vision, taste, smell, touch) affect your daily life?

How would you rate your sensory functioning (e.g. hearing, vision, taste, smell, touch)?

To what extent does loss of for example, hearing, vision, taste, smell or touch affect your ability to participate in activities?

To what extent do problems with your sensory functioning (e.g. hearing, vision, taste, smell, touch) affect your ability to interact with others?

Autonomy

How much freedom do you have to make your own decisions?

To what extent do you feel in control of your future?

To what extent are you able to do the things you'd like to do?

How much do you feel that the people around you are respectful of your freedom?

Past, Present and Future Activities

How happy are you with the things you are able to look forward to?

To what extent are you satisfied with your opportunities to continue achieving in life?

How much do you feel that you have received the recognition you deserve in life?

How satisfied are you with what you have achieved in life?

Social Participation

How satisfied are you with the way you use your time?

How satisfied are you with your level of activity?

To what extent do you feel that you have enough to do each day?

How satisfied are you with your opportunity to participate in community activities?

Death and Dying

How concerned are you about the way in which you will die?

How much are you afraid of not being able to control your death?

How scared are you of dying?

How much do you fear being in pain before you die?

Intimacy

To what extent do you feel a sense of companionship in your life?

To what extent do you experience love in your life?

To what extent do you have opportunities to love?

To what extent do you have opportunities to be loved?

A5 Psychological Needs/Basic Psychological Needs Scale

Autonomy

I feel like I am free to decide for myself how to live my life.

I feel pressured in my life.

I generally feel free to express my ideas and opinions.

In my daily life, I frequently have to do what I am told.

People I interact with on a daily basis tend to take my feelings into consideration.

I feel like I can pretty much be myself in my daily situations.

There is not much opportunity for me to decide for myself how to do things in my daily life.

Competence

People I know tell me I am good at what I do.

Often, I do not feel very competent.

I have been able to learn interesting new skills recently.
Most days I feel a sense of accomplishment from what I do.
In my life I do not get much of a chance to show how capable I am.
I often do not feel very capable.

Relatedness

I really like the people I interact with.
I get along with people I come into contact with.
I pretty much keep to myself and don't have a lot of social contacts.
I consider the people I regularly interact with to be my friends.
People in my life care about me.
There are not many people that I am close to.
The people I interact with regularly do not seem to like me much.
People are generally pretty friendly towards me.

Internet

When using the Internet...
I feel like a competent person.
Because of using the Internet I have learned new skills.
I am proud of being capable using the Internet.
I feel self-determinant.
I feel like I can pretty much be myself.
I feel like I am free to decide for myself.
I feel close to the people I contact by E-Mail or panels.
I do not feel alone.
There are close social contacts I am cultivating through the Internet.

A6 Selection Optimization Compensation Model

Target	Distractor
<i>Elective Selection</i>	
I concentrate all my energy on few things.	I divide my energy among many things.
I always focus on the one most important goal at a given time.	I am always working on several goals at once.
<i>Loss-based Selection</i>	
When things don't go as well as before, I choose one or two important goals	When things don't go as well as before, I still try to keep my goals.
When I can't do something important the way I did before, I look for a new goal.	When I can't do something important the way I did it before, I distribute my time and energy among many other things.
When I can't do something as well as I used to, I think about what exactly is important to me.	When I can't do something as well as I used to, I wait and see what comes.
<i>Optimization</i>	
I keep working on what I have planned until I succeed.	When I do not succeed right away at what I want to do, I don't try other possibilities for very long.
I make every effort to achieve a given goal.	I prefer to wait for a while and see if things will work out by themselves.
If something matters to me, I devote myself fully and completely to it.	Even if something matters to me, I still have a hard time devoting myself fully and completely to it.
<i>Compensation</i>	
When things don't go as well as they used to, I keep trying other ways until I can achieve the same results I used to.	When things don't go as well as they used to, I accept it.
When something in my life isn't working as well as it used to, I ask others for advice or help.	When something in my life isn't working as well as it used to, I decide what to do about it myself, without involving other people.
When it becomes harder for me to get the same results, I keep trying harder until I can do it as well as before.	When it becomes harder for me to get the same results as I used to, it is time to let go of that expectation.

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12 Supplements

Welcome Text of the Online Questionnaire

Die vorliegende Studie wird im Rahmen der Dissertation von Claudia Oppenauer an der Fakultät für Psychologie der Universität Wien durchgeführt. Thema der Studie ist Internetnutzung im Alter. Es interessiert uns, welche Faktoren Internetnutzung im Alter begünstigen sowie allgemeine Einstellungen zu Technik und Internet. Nachdem das Internet und andere technische Entwicklungen in Zukunft noch mehr an Bedeutung gewinnen werden, ist es wichtig auch Sie, als älteres Mitglied der Gesellschaft, bestmöglich in diese Prozesse einzubinden. Nur so ist es vorstellbar, dass neue Medien wie propagiert eine Erleichterung für den Alltag bringen und so einen Beitrag für die Lebensqualität im Alter leisten. Die Ergebnisse dieser Studie werden mit Experten aus der Technik diskutiert werden, um zu gewährleisten, dass Technik in Zukunft für Ältere besser zugänglich und verständlich ist.

Wenn Sie das Internet seit mindestens ca. 3 Monaten verwenden und über 60 Jahre alt sind, sind Sie herzlich dazu eingeladen den vorliegenden Fragebogen auszufüllen. Das Ausfüllen des Fragebogens wird ca. 45 Minuten Zeit in Anspruch nehmen. Nehmen Sie sich dafür genügend Zeit, und kreuzen Sie die Antworten an, die am ehesten für Sie als passend erscheinen. Es gibt kein richtig oder falsch. Uns interessiert Ihrer persönlich Meinung und Ihre Einstellungen zu bestimmten Themen.

Ihre Teilnahme an der Studie ist freiwillig. Sie haben das Recht jederzeit das Ausfüllen des Fragebogens abubrechen oder einfach Pausen zu machen. Ihre Antworten werden anonymisiert ausgewertet und natürlich vertraulich behandelt.

Wenn Sie Fragen zu der Studie haben oder über Ergebnisse der Studie informiert werden möchten, zögern Sie bitte nicht mit mir Kontakt aufzunehmen:

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General Internet Use Questions

Ich habe den Umgang mit dem Internet gelernt...

- ☐ von einer gleichaltrigen Person
- ☐ von einer Person aus der Familie
- ☐ in einem Computerkurs
- ☐ selbst angelernt
- ☐ in meinem Beruf

Ich habe Zugang zu einem Computer...

- ☐ bei mir Zu Hause. Ich besitze einene eigenen Computer
- ☐ bei meiner Familie. Ich besitze keinen eigenen Computer
- ☐ in einem Verein

Ich habe beruflich bereits einen Computer verwendet.

- ☐ Stimmt
- ☐ Stimmt nicht

Ich habe beruflich bereits das Internet verwendet.

- ☐ Stimmt
- ☐ Stimmt nicht

Gibt es jemanden in ihrem unmittelbaren Umfeld, den sie um Unterstützung bei Fragen/Problem zur Internetnutzung bitten können?

- ☐ Ja, jemanden in meiner Familie
- ☐ Ja, jemanden in meinem Freundes/Bekanntenkreis
- ☐ Ja, ich hole mir professionelle Unterstützung.
- ☐ Nein.

Haben Sie bereits neue Bekanntschaften durch das Internet gewonnen?

- ☐ Ja
- ☐ Nein

Gibt es eine Webseite, die sie regelmäßig im Internet besuchen? Wenn ja welche?

- ☐ Ja und zwar:
- ☐ Nein

Können Sie sich vorstellen, dass bei Mobilitätsverlust im Alter die Möglichkeiten des Internets an Wichtigkeit für Sie gewinnen?

- ☐ Ja, auf jeden Fall.
- ☐ Vielleicht, bin mir nicht sicher.
- ☐ Nein, auf keinen Fall.

Können Sie sich vorstellen einen Großteil ihrer sozialen Kommunikation über das Internet abzuhalten?

- ☐ Ja, auf jeden Fall.
- ☐ Vielleicht, bin mir nicht sicher.
- ☐ Nein, auf keinen Fall.

Welche Freizeitaktivitäten nutzen Sie regelmäßig?

- ☐ Tanzen
- ☐ Kinobesuche
- ☐ Diverse Angebote eines Seniorenvereins
- ☐ Sport
- ☐ Reisen, Ausflüge
- ☐ Ehrenamtliche Tätigkeiten
- ☐ Sonstiges und zwar:

Technology Acceptance Model (TAM) Questionnaire

1. Wenn ich von einem neuen Technikprodukt höre, suche ich nach Wegen dieses auszuprobieren.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

2. In meiner Altersgruppe, bin ich gewöhnlich die Erste/ der Erste, die/der neue Technikprodukte ausprobiert.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

3. Im Allgemeinen, bin ich zögerlich neue Technikprodukte auszuprobieren.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

4. Ich mag es neue Technikprodukte auszuprobieren.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

5. Menschen, die mein Verhalten beeinflussen, sind der Ansicht, dass ich das Internet und damit verbundene Funktionen wie E-Mail verwenden sollte.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

6. Menschen, die wichtig für mich sind, sind der Ansicht, dass ich das Internet und damit verbundene Funktionen wie E-Mail verwenden sollte.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

7. Die Verwendung des Internets ermöglicht es mir Aufgaben schneller zu bewältigen.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

8. Die Verwendung des Internets erleichtert das Bewältigen von Aufgaben des täglichen Lebens.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

9. Im Allgemeinen finde ich, dass die Verwendung des Internets sehr nützlich in meinem täglichen Leben ist.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

10. Die Verwendung des Internets gibt mir mehr Kontrolle über mein Leben.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

11. Die Verwendung des Internet ermöglicht ein schnelles Finden von gesuchten Informationen.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

12. Die Verwendung des Internet erleichtert das Aufrechterhalten von sozialen Kontakten.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

13. Informationen aus dem Internet sind sehr nützlich für mich um bestimmte Entscheidungen zu treffen.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

14. Zu lernen wie man das Internet verwendet ist einfach für mich.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

15. Ich kann das Internet so verwenden, dass ich zu meinen gewünschten Informationen komme.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

16. Die Verwendung des Internets ist selbsterklärend und leicht verständlich.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

17. Insgesamt finde ich, dass es einfach ist das Internet zu verwenden.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

18. Die Verwendung des Internets strengt mich gedanklich nicht sehr an.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

19. Ich mag es das Internet und Funktionen wie E-Mail zu verwenden.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

20. Es macht Freude das Internet und Funktionen wie E-Mail zu verwenden.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

21. Ich möchte auf das Internet und dessen Funktionen nicht mehr verzichten.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

22. Ich möchte auf das Internet und dessen Funktionen nicht mehr verzichten.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

23. Ich finde es sinnvoll, dass Internet und Funktionen wie E-Mail zu verwenden.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

24. Ich finde, dass die Verwendung des Internets meine Lebensqualität verbessert.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

25. Ich beabsichtige für die Zukunft, das Internet regelmäßig zu verwenden.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

26. Ich werde das Internet auch anderen Senioren/Seniorinnen weiterempfehlen.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

27. Wie oft verwenden Sie das Internet im Durchschnitt?

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Nie/Fast Nie	Weniger als einmal im Monat	Ein paar Mal im Monat	Einmal in der Woche	Einige Male in der Woche	Einmal Täglich	Mehrmals Täglich

28. Wenn Sie das Internet verwenden, wie viel Zeit nimmt das in Anspruch?

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Ca. 15 Minuten	Weniger als 30 Minuten	30-60 Minuten	1-2 Stunden	2-3 Stunden	3-4 Stunden	Mehr als 4 Stunden

29. Bitte geben Sie an, in welchem Ausmaß Sie folgende Funktionen des Internets verwenden:

a) Informationssuche

☐	☐	☐	☐	☐
1	2	3	4	5
Überhaupt nicht	Ein wenig	Mittelmäßig	Ziemlich	Äußerst

b) Nachrichten lesen (z.B. auf ORF.at, Kurier.at, usw.)

☐	☐	☐	☐	☐
1	2	3	4	5
Überhaupt nicht	Ein wenig	Mittelmäßig	Ziemlich	Äußerst

c) Produktinformationen/Produktunterstützung

☐	☐	☐	☐	☐
1	2	3	4	5
Überhaupt nicht	Ein wenig	Mittelmäßig	Ziemlich	Äußerst

d) Einkaufen

☐	☐	☐	☐	☐
1	2	3	4	5
Überhaupt nicht	Ein wenig	Mittelmäßig	Ziemlich	Äußerst

e) Kommunikation (E-Mail)

☐	☐	☐	☐	☐
1	2	3	4	5
Überhaupt nicht	Ein wenig	Mittelmäßig	Ziemlich	Äußerst

f) Kommunikation (Chat, Foren)

☐	☐	☐	☐	☐
1	2	3	4	5
Überhaupt nicht	Ein wenig	Mittelmäßig	Ziemlich	Äußerst

g) Gratis Software/Programme

☐	☐	☐	☐	☐
1	2	3	4	5
Überhaupt nicht	Ein wenig	Mittelmäßig	Ziemlich	Äußerst

h) Banktransaktionen				
☐	☐	☐	☐	☐
1	2	3	4	5
Überhaupt nicht	Ein wenig	Mittelmäßig	Ziemlich	Äußerst
i) Reisen Buchen				
☐	☐	☐	☐	☐
1	2	3	4	5
Überhaupt nicht	Ein wenig	Mittelmäßig	Ziemlich	Äußerst
j) Spiele				
☐	☐	☐	☐	☐
1	2	3	4	5
Überhaupt nicht	Ein wenig	Mittelmäßig	Ziemlich	Äußerst
☐	☐	☐	☐	☐

WHOQOL-Old

In den folgenden Fragen geht es darum, **wie stark** Sie während der vergangenen zwei Wochen bestimmte Dinge erlebt haben, zum Beispiel Entscheidungsfreiheit und Gefühle der Kontrolle in Ihrem Leben. Wenn Sie diese Dinge äußerst stark erlebt haben, dann kreuzen Sie die Zahl in dem Feld "Äußerst" an. Wenn Sie diese Dinge überhaupt nicht erlebt haben, dann kreuzen Sie die Zahl in dem Feld "Überhaupt nicht" an. Wenn Sie ausdrücken möchten, dass Ihre Antwort zwischen "Überhaupt nicht" und "Äußerst" liegt, dann kreuzen Sie die Zahl in einem Feld an, das zwischen diesen beiden Extrempunkten liegt. Die Fragen beziehen sich auf die vergangenen zwei Wochen.

F25.1 Wie sehr beeinflussen Beeinträchtigungen Ihrer Sinnesfunktionen (z.B. Hören, Sehen, Schmecken, Riechen, Tasten) Ihr tägliches Leben?

Überhaupt nicht 1	Ein wenig 2	Mittelmäßig 3	Ziemlich 4	Äußerst 5
----------------------	----------------	------------------	---------------	--------------

F25.3 Wie sehr beeinträchtigt das Nachlassen von z.B. Hören, Sehen, Schmecken, Riechen, Tasten Ihre Fähigkeit an Aktivitäten teilzunehmen?

Überhaupt nicht 1	Ein wenig 2	Mittelmäßig 3	Ziemlich 4	Äußerst 5
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F26.1 Wie viel Freiraum haben Sie, um Ihre eigenen Entscheidungen zu treffen?

Überhaupt keinen 1	Wenig 2	Mäßig viel 3	Ziemlich viel 4	Äußerst viel 5
-----------------------	------------	-----------------	--------------------	-------------------

F26.2 In welchem Umfang können Sie Ihre Zukunft beeinflussen?

Überhaupt nicht 1	Ein wenig 2	Mittelmäßig 3	Ziemlich 4	Äußerst 5
----------------------	----------------	------------------	---------------	--------------

F26.4 Glauben Sie, dass die Menschen in Ihrer Umgebung Ihre Unabhängigkeit respektieren?

Überhaupt nicht 1	Ein wenig 2	Mittelmäßig 3	Ziemlich 4	Äußerst 5
----------------------	----------------	------------------	---------------	--------------

F29.2 Wie sehr machen Sie sich darüber Sorgen, wie Sie sterben werden?

Überhaupt nicht 1	Ein wenig 2	Mittelmäßig 3	Ziemlich 4	Äußerst 5
----------------------	----------------	------------------	---------------	--------------

F29.3 Wie sehr fürchten Sie sich davor, keinen Einfluss darauf zu haben, wie Sie sterben werden?

Überhaupt nicht 1	Ein wenig 2	Mittelmäßig 3	Ziemlich 4	Äußerst 5
----------------------	----------------	------------------	---------------	--------------

F29.4 Haben Sie Angst vor dem Sterben?

Überhaupt nicht 1	Ein wenig 2	Mittelmäßig 3	Ziemlich 4	Äußerst 5
----------------------	----------------	------------------	---------------	--------------

F29.5 Wie sehr fürchten Sie sich davor, dass Ihr Tod von Schmerzen begleitet sein könnte?

Überhaupt nicht 1	Ein wenig 2	Mittelmäßig 3	Ziemlich 4	Äußerst 5
----------------------	----------------	------------------	---------------	--------------

In den folgenden Fragen geht es darum, **wie vollständig** Sie während der vergangenen zwei Wochen in der Lage waren, bestimmte Dinge zu tun, zum Beispiel so oft aus dem Haus gehen können, wie Sie wollen. Wenn Sie vollständig in der Lage waren, diese Dinge zu tun, kreuzen Sie die Zahl in dem Feld "Völlig" an. Wenn Sie überhaupt nicht in der Lage waren, diese Dinge zu tun, so kreuzen Sie die Zahl in dem Feld "Überhaupt nicht" an. Wenn Sie ausdrücken möchten, dass Ihre Antwort zwischen "Überhaupt nicht" und "Völlig" liegt, dann kreuzen Sie eine Zahl an, die zwischen diesen beiden Extrempunkten liegt. Die Fragen beziehen sich auf die vergangenen zwei Wochen.

F25.4 Inwieweit sind Ihre Möglichkeiten sich mit Anderen zu unterhalten durch Probleme mit Ihren Sinnesfunktionen (z.B. Hören, Sehen) eingeschränkt?

Überhaupt nicht 1	Eher nicht 2	Halbwegs 3	Überwiegend 4	Völlig 5
----------------------	-----------------	---------------	------------------	-------------

F26.3 In welchem Umfang sind Sie in der Lage die Dinge zu tun, die Sie gern tun wollen?

Überhaupt nicht 1	Eher nicht 2	Halbwegs 3	Überwiegend 4	Völlig 5
----------------------	-----------------	---------------	------------------	-------------

F27.3 Inwieweit sind Sie mit Ihren Möglichkeiten, weiterhin im Leben etwas zu erreichen, zufrieden?

Überhaupt nicht 1	Eher nicht 2	Halbwegs 3	Überwiegend 4	Völlig 5
----------------------	-----------------	---------------	------------------	-------------

F27.4 Haben Sie das Gefühl, dass Sie im Leben die Anerkennung bekamen, die Sie verdient haben?

Überhaupt nicht 1	Eher nicht 2	Halbwegs 3	Überwiegend 4	Völlig 5
----------------------	-----------------	---------------	------------------	-------------

F28.4 Haben Sie im Allgemeinen genug zu tun?

Überhaupt nicht 1	Eher nicht 2	Halbwegs 3	Überwiegend 4	Völlig 5
----------------------	-----------------	---------------	------------------	-------------

In den folgenden Fragen geht es darum, **wie zufrieden, glücklich oder gut** Sie sich während der vergangenen zwei Wochen hinsichtlich verschiedener Aspekte Ihres Lebens gefühlt haben. Zum Beispiel hinsichtlich Ihrer Teilnahme am Gemeindeleben oder hinsichtlich dessen, was Sie im Verlauf Ihres Lebens erreicht haben. Entscheiden Sie, wie zufrieden oder unzufrieden Sie mit jedem dieser Aspekte Ihres Lebens sind und kreuzen Sie die Zahl an, die am besten mit Ihrem Gefühl übereinstimmt. Die Fragen beziehen sich auf die vergangenen zwei Wochen.

F27.5 Wie zufrieden sind Sie mit dem, was Sie im Leben erreicht haben?

Sehr unzufrieden 1	Unzufrieden 2	Weder zufrieden noch unzufrieden 3	Zufrieden 4	Sehr zufrieden 5
-----------------------	------------------	--	----------------	---------------------

F28.1 Wie zufrieden sind Sie mit der Art und Weise, wie Sie Ihre Zeit nutzen?

Sehr unzufrieden 1	Unzufrieden 2	Weder zufrieden noch unzufrieden 3	Zufrieden 4	Sehr zufrieden 5
-----------------------	------------------	--	----------------	---------------------

F28.2 Wie zufrieden sind Sie mit Ihrem Maß an Aktivität?

Sehr unzufrieden 1	Unzufrieden 2	Weder zufrieden noch unzufrieden 3	Zufrieden 4	Sehr zufrieden 5
-----------------------	------------------	--	----------------	---------------------

F28.7 Wie zufrieden sind Sie mit Ihren Möglichkeiten, an öffentlichen Aktivitäten teilnehmen zu können?

Sehr unzufrieden 1	Unzufrieden 2	Weder zufrieden noch unzufrieden 3	Zufrieden 4	Sehr zufrieden 5
-----------------------	------------------	--	----------------	---------------------

F27.1 Wie glücklich sind Sie bei dem Gedanken an Dinge, die Sie noch erwarten können?

Sehr unglücklich 1	Relativ unglücklich 2	Weder glücklich noch unglücklich 3	Relativ glücklich 4	Sehr glücklich 5
-----------------------	-----------------------------	--	---------------------------	---------------------

F25.2 Wie beurteilen Sie Ihre Sinnesfunktionen (z.B. Hören, Sehen, Schmecken, Riechen, Tasten)?

Sehr schlecht 1	Schlecht 2	Mittelmäßig 3	Gut 4	Sehr gut 5
--------------------	---------------	------------------	----------	---------------

Die folgenden Fragen beziehen sich auf alle innigen Beziehungen, die Sie haben. Bitte beantworten Sie diese Fragen in Bezug auf eine/n Ihnen nahestehende/n Partner/in oder eine andere Ihnen nahestehende Person, mit der Sie mehr als mit jeder anderen Person in Ihrem Leben Vertrautheit teilen.

F30.2 Inwieweit erfahren Sie in Ihrem Leben ein Gefühl von Gemeinschaft?

Überhaupt nicht 1	Ein wenig 2	Mittelmäßig 3	Ziemlich 4	Äußerst 5
----------------------	----------------	------------------	---------------	--------------

F30.3 Inwieweit erfahren Sie Liebe in Ihrem Leben?

Überhaupt nicht 1	Ein wenig 2	Mittelmäßig 3	Ziemlich 4	Äußerst 5
----------------------	----------------	------------------	---------------	--------------

F30.4 Inwieweit haben Sie die Möglichkeit, anderen Menschen Ihre Liebe zu geben?

Überhaupt nicht 1	Eher nicht 2	Halbwegs 3	Überwiegend 4	Völlig 5
----------------------	-----------------	---------------	------------------	-------------

F30.7 Inwieweit haben Sie die Möglichkeit, die Liebe anderer Menschen zu erfahren?

Überhaupt nicht 1	Eher nicht 2	Halbwegs 3	Überwiegend 4	Völlig 5
----------------------	-----------------	---------------	------------------	-------------

Basic Psychological Needs Scale

Im nächsten Abschnitt geht es um verschiedene Bereiche Ihres Lebens. Bitte lesen Sie die folgenden Aussagen gut durch, und denken Sie darüber nach inwieweit Sie diesen zustimmen. Kreuzen Sie dann das Kästchen mit der Antwort an, das am ehesten für Sie zutrifft.

1. Ich fühle mich frei zu entscheiden, wie ich mein Leben leben möchte.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

2. Ich mag die Menschen, mit denen ich in Kontakt bin.

☐	☐	☐	☐	☐	☐	☐
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Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

3. Ich fühle mich selten kompetent.

☐	☐	☐	☐	☐	☐	☐
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Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

4. Ich stehe unter Druck in meinem Leben.

☐	☐	☐	☐	☐	☐	☐
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Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

5. Menschen, die ich kenne, sagen mir, dass ich gut in dem bin, das ich tue.

☐	☐	☐	☐	☐	☐	☐
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Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

6. Ich verstehe mich gut mit den Menschen, mit denen ich in Kontakt bin.

☐	☐	☐	☐	☐	☐	☐
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Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

7. Ich bin eher ein Einzelgänger und habe nicht viele soziale Kontakte.

☐	☐	☐	☐	☐	☐	☐
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Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

8. Im Allgemeinen fühle ich mich frei, meine Ideen und Meinungen zu äußern.

☐	☐	☐	☐	☐	☐	☐
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Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

9. Die Menschen, mit denen ich regelmäßig Kontakt habe, bezeichne ich als Freunde.

☐	☐	☐	☐	☐	☐	☐
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Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

10. Erst kürzlich konnte ich neue interessante Fertigkeiten lernen.

☐	☐	☐	☐	☐	☐	☐
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Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

11. In meinem täglichen Leben muss ich oft das tun, was mir gesagt wird.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

12. Die Menschen in meinem Leben interessieren sich für mich.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

13. An den meisten Tagen fühle ich mich erfüllt mit den Dingen, die ich tue.

☐	☐	☐	☐	☐	☐	☐
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Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

14. Menschen, mit denen ich im Alltag Kontakt habe, nehmen auf meine Gefühle Rücksicht.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

15. In meinem Leben habe ich nicht oft Gelegenheit zu zeigen, wie kompetent ich bin.

☐	☐	☐	☐	☐	☐	☐
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Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

16. Es gibt nicht viele Menschen, die mir nahe stehen.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

17. Ich habe das Gefühl, dass ich in alltäglichen Situationen so sein kann, wie ich bin.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

18. Die Menschen, mit denen ich regelmäßig Kontakt habe, scheinen mich nicht sehr zu mögen.

☐	☐	☐	☐	☐	☐	☐
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Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

19. Ich fühle mich oft nicht sehr kompetent.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

20. Es gibt nicht viele Gelegenheiten in meinem täglichen Leben eigenständige Entscheidungen zu treffen.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

21. Die meisten Menschen sind sehr freundlich zu mir.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

Beziehen Sie die folgenden Aussagen auf Ihre Einstellung, wenn Sie das Internet verwenden. Bitte lesen Sie die folgenden Aussagen gut durch, und denken Sie darüber nach inwieweit Sie diesen zustimmen. Kreuzen Sie dann das Kästchen mit der Antwort an, das am ehesten für Sie zutrifft.

Wenn ich das Internet verwende...

1. Fühle ich mich als kompetente Person.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

2. Durch die Verwendung des Internets habe ich neue Fähigkeiten gelernt.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

3. Ich bin stolz darauf, mit dem Internet umgehen zu können.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

4. Fühle ich mich selbstbestimmt.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

5. Habe ich das Gefühl, dass ich sein kann, wie ich wirklich bin.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

6. Habe ich das Gefühl eigenständige Entscheidungen treffen zu können.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

7. Fühle ich mich den Menschen, mit denen ich per E-Mail oder in Foren kommuniziere sehr nahe.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

8. Fühle ich mich nicht einsam.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

9. Es gibt enge Kontakte, die ich über das Internet pflege.

☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7
Stimme überhaupt nicht zu	Stimme weitgehend nicht zu	Stimme eher nicht zu	Neutral	Stimme eher zu	Stimme weitgehend zu	Stimme völlig zu

Selection Optimisation Compensation (SOC) Questionnaire

In dem folgenden Teil des Fragebogens geht es um ganz allgemeine Aspekte Ihrer persönlichen **Lebensgestaltung**. Konkret ist von Interesse, wie Sie vorgehen, um Ihr eigenes Leben so zu gestalten, dass es Ihren Vorstellungen von einem guten Leben entspricht. Versuchen Sie bei den folgenden Aussagen sich vorzustellen, dass sich zwei Personen unterhalten. Kreuzen Sie dann die Aussage an, die Ihrer persönlichen Einstellung über das Leben nachzudenken am ehesten entspricht, d.h. wie Sie sich selbst am ehesten verhalten, wenn es um Ihre Lebensgestaltung geht. Lesen Sie sich die gegenübergestellten Aussagen gut durch, und überlegen Sie dabei, was Sie selbst am ehesten tun würden, sprich ob Sie sich eher wie Person A oder Person B verhalten und kreuzen Sie das entsprechende Kästchen an.

PERSON A		PERSON B	
☐	Ich verfolge immer nur einen Plan nach dem anderen.	☐	Ich verfolge immer viele Pläne auf einmal.
☐	Wenn ich mir überlege, was ich will, lege ich mich auf ein oder zwei wichtige Ziele fest.	☐	Auch wenn ich mir überlege, was ich eigentlich will, lege ich mich nicht endgültig fest.
☐	Ich überlege mir ganz genau, was für mich wichtig ist.	☐	Ich lasse die Dinge erst einmal auf mich zukommen und sehe dann weiter.
☐	Wenn ich nicht mehr weitermachen kann wie gewohnt, richte ich meine Aufmerksamkeit auf mein wichtigstes Ziel.	☐	Auch wenn ich nicht mehr weitermachen kann wie gewohnt, richte ich meine Aufmerksamkeit nach wie vor auf alle meine Ziele.
☐	Wenn die Dinge nicht mehr so gut gelingen wie bisher, verfolge ich zunächst nur mein wichtigstes Ziel.	☐	Wenn die Dinge nicht mehr so gut gelingen, lasse ich es dabei bewenden.
☐	Wenn etwas zusehens schwieriger für mich wird, stecke ich meine Ziele genauer ab.	☐	Wenn etwas zusehens schwieriger für mich wird, versuche ich, mich abzulenken.
☐	Ich setze alles daran, meine Pläne zu verwirklichen.	☐	Ich warte lieber ab, ob sich meine Pläne nicht vielleicht von selbst verwirklichen.

PERSON A		PERSON B	
☐	Wenn ich weiterkommen möchte, schaue ich mir auch an, wie andere es gemacht haben.	☐	Wenn ich weiterkommen möchte, schaue ich mich selten um, wie andere es gemacht haben.
☐	Ich überlege mir genau, wie ich meine Vorstellungen am besten umsetzen kann.	☐	Ich denke nicht erst lange darüber nach, wie ich meine Vorstellungen umsetzen kann, sondern probiere es einfach.
☐	Wenn mir etwas auf gewohnte Weise nicht mehr gelingt, suche ich nach anderen Wegen.	☐	Wenn mir etwas auf gewohnte Weise nicht mehr gelingt, begnüge ich mich mit den Dingen, wie sie sind.
☐	Wenn mir etwas nicht mehr so gut gelingt wie früher, kann ich andere bitten, es für mich zu erledigen.	☐	Wenn mir etwas nicht mehr so gut gelingt wie früher, nehme ich Verluste in Kauf.
☐	Wenn etwas nicht mehr so gut klappt wie gewohnt, schaue ich, wie andere es machen.	☐	Wenn etwas nicht mehr so gut klappt wie gewohnt, mache ich mir nicht viele Gedanken darüber.

Curriculum Vitae

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Personal Data

Date of Birth: 07.03.1981

Address: Florianiweg 7/1, 3100 St. Pölten, Austria

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E-Mail: claudia.oppenauer@gmx.at

Education

Since 10/2006	PhD Student at the Institute for Applied Psychology: Health, Development and Education, Faculty of Psychology, University Vienna
05/2007	Registration in the list of Clinical and Health Psychologists by the Federal Ministry of Health, Family and Adolescence
02/2006	Finished education Crisis Intervention Österreichisches Rotes Kreuz
10/2005	Finished Graduate Study in Psychology at the University of Vienna
06/1999	Abitur at the Schiller Gymnasium in St. Pölten

Academic Experience

Since 02/2010	Human Computer Interaction Researcher at the Center for Usability Research and Engineering (CURE), Vienna
03/2009-01/2010	Training staff in the EU-Project CARERS
Since 01/2008	Assistant Editor of the peer reviewed Journal <i>Gerontechnology</i>
10/2007-03/2009	Collaboration in the research project „Safety Assistant for the Elderly“ (S.A.F.E.), ARC Seibersdorf GmbH
10/2006–04/2007	Interviewer in the EU-Project <i>POMONA II</i>
10/2006–02/2007	Researcher, Interviewer and Trainer in the <i>Posttraumatic Stress Disorder and Decision Making</i> Project funded by the Jubiläumsfonds of the ÖNB
07/2006-01/2010	Scientific Assistant at the Institute of Clinical, Biological and Differential Psychology, Faculty of Psychology, University Vienna
09/2006-01/2010	Team member in the Lehr- und Forschungspraxis, Faculty of Psychology, University Vienna with focus on clinical counselling
10/2004–06/2006	Student Researcher at the Institute of Clinical, Biological and Differential Psychology, Faculty of Psychology, University Vienna

Grants, Nominations

10/2008-01/2010	Nomination for the Mentoring Program for Young Researchers, University Vienna
11/2009	Winner of the Wilhelm-Exner Grant for Psychology 2009
09/2009	Nomination for the workshop for Phd students within the 6 th conference of the Media Psychology division, Duisburg, Germany
11/2007 & 11/2008	Nomination for Masterclass “Gerontechnology” organized by the ISG in Eindhoven, Netherlands
09/2006	DGP Grant for the Fall Academy “Neuropsychiatry and Psychology of Aging” in Berlin, Germany

Professional Memberships

ÖGP, Austria: Österreichische Gesellschaft für Psychologie

DGP; Germany: Deutsche Gesellschaft für Psychologie

ISG, Netherlands: International Society of Gerontechnology

Main Research Themes

Technology acceptance in old age, User experience

Teaching Record

Winterterm 2008 and 2009	Exercise Course Basic Skills in Clinical Psychology
Summerterm 2007 and 2008	Proseminar Clinical Psychological Diagnosis and Differential Diagnosis: Gerontopsychology

Publications

Journal Articles

Kaiser, I., Oppenauer-Meerskraut, C., Kryspin-Exner, I., Czech, T. & Alesch, F. (2010). Aging and technology in medical care: using the example of patient controllers in deep brain stimulation. *Expert Review Medical Devices*, 7 (6), 759-766.

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Oppenauer-Meerskraut, C. (2013). Would a virtual butler do a good job for old people? Psychological consideration about benefits and risks of technological assistance. In R. Trappl (Ed.), *Your Virtual Butler. Making-of* (S.11-15), *Lecture Notes in Computer Science*, 7407. Berlin: Springer.

Published Abstracts in Journals

Oppenauer, C. (2009). How do psychological models fit into gerontechnological research? *The Journal of Nutrition, Health & Aging*, 13 (S1), pp.105.

Oppenauer, C. (2009). Usability of assistive technologies in ageing and disabilities. *International Journal of Integrated Care*, 9, 22 June.

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Publications in Conference Proceedings

Facal, D., González, MF., Navarro, A., Oppenauer, C., Geven, A., Prost, S., Tscheligi, M., Petsatodis, T., Pnevmatikakis, a., Theodoreli, V., Urdaneta, E., Yanguas, J. (2010). Qualitative assessment of computerized-

cognitive games for elderly people. In R. Mateos, K. Engedal, M. Franco (Eds.), *Abstracts of the IPA international meeting*, (pp 294-295).

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Scientific Presentations

Oppenauer, C. (2009). Usability of assistive technologies in ageing and disabilities. Oral presentation at the 1st International Conference on Bridging Knowledge in Long Term Care and Support. Crossing Boundaries between Ageing and Disability, Barcelona, Spain, March 5-7, 2009.

Oppenauer-Meerskraut, C. (2010). User involvement from the very beginning: Challenges and Benefits. Presentation at the 2nd AAL Forum, Odense, Denmark, September 15-17, 2010.

Oppenauer, C., Brehmer, B., Zeilinger, E. & Weber, G. (2009). How to train family caregivers of people with intellectual disability – The CARERS EU-Project. Oral presentation at the 7th European Congress of Mental Health in Intellectual Disability, Amsterdam, Netherlands, September 3-5, 2009.

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Oppenauer, C., Jagsch, R., Six, N., Wölfl, H., Kryspin-Exner, I. & Pötter, R. (2006). *Comparison of two instruments measuring psychosocial distress of cancer patients*. Poster presented at the 20th Annual Conference of the European Health Psychology Society, Warsaw, Poland, August 30 – September 2, 2006.

Oppenauer, C., Jagsch, R., Six, N., Wölfl, H., Kryspin-Exner, I. & Pötter, R. (2006). *Comparison of two instruments measuring psychosocial distress of cancer patients*. Poster presented at the 8th World Congress of Psycho-Oncology, Venice, Italy, October 16–21, 2006.

Oppenauer, C., Jagsch, R., Six, N., Wölfl, H. & Pötter, R. & Kryspin-Exner, I. (2007). *Evaluation of a psychooncological outpatient clinic in Austria*. Oral presentation at the 10th European Congress of Psychology, Prague, Czech Republic, July 3-6, 2007.

Oppenauer, C. & Kryspin-Exner, I. (2007). *Technology-based caregiving in old age: future directions and psychological considerations under an ethical point of view*. Poster presented at the 10th European Congress of Psychology, Prague, Czech Republic, July 3-6, 2007.

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- Oppenauer, C. & Kryspin-Exner, I. (2008). A psychological approach to technology acceptance in old age. Poster presented at the 3rd Masterclass Gerontechnology, Eindhoven, The Netherlands, November 11-12 2008.
- Oppenauer, C. & Kryspin-Exner, I. (2008). *User-Needs in Hinblick auf gerontotechnische Unterstützung*. Oral presentation at the Forum für Geriatrie, Bad Hofgastein, Austria, March 3–6 2008.
- Oppenauer, C. & Kryspin-Exner, I. (2008). *Technik und Alter? Ein psychologischer Diskurs über mögliche Erklärungsmodelle zu Technikakzeptanz im Alter*. Oral presentation at the 8th Conference of the Austrian Society for Psychology (ÖGP), Linz, Austria, April 3–6 2008.
- Oppenauer, C., Kryspin-Exner, I. & Zagler, W. (2006). *Can assistive technologies delay institutionalization in old age?* Poster presented at the Fall Academy of the Graduate Programm, Berlin, Germany, September 27–29, 2006.
- Oppenauer, C., Prazak-Aram, B., Hochgatterer, A. & Kryspin-Exner, I. (2007). *Psychological Evaluation of the Safety Assistant for the Elderly*. Poster presented at the 2nd ISG Masterclass Gerontechnology, Eindhoven, Netherlands, November 13-14, 2007.
- Oppenauer, C., Prazak-Aram, B., Hochgatterer, A. & Kryspin-Exner, I. (2008). *Psychologische Evaluation des „Safety Assistant for the Elderly“*. Oral presentation at the uDay VI, Dornbirn, Austria, on 16th May 2008.
- Oppenauer, C., Preschl, B., Kalteis, K. & Kryspin-Exner, I. (2007). Technology in old age from a psychological point of view. Oral presentation at the 3rd Symposium of the WG HCI&UE of the Austrian Computer Society, Graz, Austria, November 22, 2007.
- Oppenauer, C. & Weber, G. (2007). *Facial emotional recognition in persons with intellectual disability and its relation to mental health: implications for future research*. Oral presentation at the 6th European Congress of Mental Health in Intellectual Disability. Zagreb, Croatia, October 11-13, 2007.

Invited Presentations

- Oppenauer, C. (2007). *Psychologische Aspekte des Alterns*. Invited oral presentation at the ÖGDKA Symposium 50 plus, Vienna, Austria, November 9, 2007.
- Oppenauer, C. (2008). Technikakzeptanz im Alter – Die psychologische Perspektive. Invited oral presentation at the Workshop Technologie und Akzeptanz im Rahmen des benefit Programms, Vienna, Austria, 30.09.2008.
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- Oppenauer, C. (2009). Der wohlverdiente Ruhestand. Invited oral presentation at the Fachforum „Lebensübergänge“, Haus der Barmherzigkeit, April 27, 2009.