Autopilot versus hearing aid. Domain- and technology type-specific parameters of older people's technology acceptance

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In our society more and more people need technologies – such as medical and automobil technologies – to live an independent and autonomous life in old age. These technologies must meet older peoples' specific demands – otherwise they neither are useful nor usable. For the development of well-accepted future technologies, we have to find out, which factors are relevant for the evaluation and acceptance of different technologies. The present study examines conditions of older users' technology evaluation and acceptance taking different using contexts into account. Empirically, perceived advantages and barriers within the medical and the automobile technology domains were compared and examined with an interview and a following questionnaire study. Results show that acceptance and barriers vary according to the using context as well as to the type of technology.

BACKGROUND

One of the great upcoming challenges for modern societies is to master the fundamental demographic change with increasingly old and frail seniors, which imposes considerable organizational and structural demands. The increasing requirements for nursing and medical care is extremely sophisticated to accomplish due to the growing economic bottle neck, low fertility rates and the decreasing number of young people which could be caretakers of the seniors (Leonhardt, 2006). It is a fundamental problem how we can provide older adults a safe and livable life at home, and to keep up their mobility and independency. Recent technological developments, which focus on the older adult group, are promising in order to reach these goals.

Technical innovations in the medical sector provide novel or improved medical diagnosis, therapy, treatment and rehabilitation possibilities. Besides progress in biomedical sciences or genetics, electronic health technologies offer enormous potential to improve patients' medical care and to reduce the financial pressure on health care systems. eHealth technologies cover the interaction between patients and health-service providers, institution-to-institution transmission of data, or peer-to-peer communication between patients or health professionals (Jähn & Nagel, 2004; Tan, 2005). They can also include health information networks, electronic health records, telemedicine services, and personal wearable and portable communication systems for monitoring and supporting patients. eHealth technologies promise to deliver significant improvements in access to care, quality of care, and the efficiency and productivity of the health sector. Both, patients and healthy citizens, can benefit from eHealth technologies, because these systems can help to shorten or completely avoid the stay of patients in hospitals or rehabilitation centres, to enhance patients' safety after discharge from hospital and to maintain a prolonged independent lifestyle.

In addition, technological developments in the mobility sectors are also of crucial importance for the older people (Mollenkopf & Flaschenträger, 2001; Mollenkopf, et al., 2004). Even though public transport still is advancing in many cities, the automobile is an important means of conveyance to access services. This is specifically essential for older adults in order to participate actively and independently in social living. However, drivers aged 65 and older have the second highest accident rate and an increased crash risk (Ashley, 2001; Healthlink, 2005). In recent years, commercial advanced driver assistance systems have been increasingly implemented into cars. Beyond route information services, the devices also cover car functionalities and telecommunication services. The assistive technologies in the car are assumed to specifically address the needs of older drivers, compensating age-related decreases (e.g. Arning & Ziefle, 2007; 2008; in press; Ziefle and Bay, 2005; 2006; 2008; Ziefle, Schroeder, Strenk & Michel, 2007). This is of particular interest in cognitive demanding traffic situations, in which older drivers are especially penalized as they are known to have limited cognitive resources to process complex and large amounts of information, to time-critically react and to cope with multitasking demands (Dingus et al., 1997; Kocherscheidt & Rudinger, 2005; Latorella, 1999; Horrey & Wickens 2004; Wickens & Liu 1988).

Even though the rapid technical progress within age-specific technologies is indeed promising, still, there are serious obstacles in the final applicability. Recent research outcomes show that it is not predominately the technical barrier, which hampers a successful rollout and a broad responsiveness of users. Rather, older users' hesitant approach towards new technical devices in general (Arning & Ziefle 2007; 2008; Jakobs, Lehnen & Ziefle, 2008; Ziefle, 2008) and the low acceptance towards eHealth technology in particular (Jakobs et al., 2008; Ziefle 2008) might be serious obstacles for a broad proliferation of new technical developments. Even in the field of assistive automotive technologies older adults show to be reluctant

(Ziefle et al., 2008). Older adults emphasized that they would not accept automotive technologies, which increasingly replace the cognitive control of drivers. Rather, they claimed to keep the role as decision-making authority in the car as long as they are able to.

It is thus important to thoroughly understand the user acceptance and the reasons, which form the positive or negative evaluation of technical applications. They can only be successfully applied if two general conditions are fulfilled: Technology must be fully accepted by the group of older people and, what is still more important, technology must meet the specific demands of the older group. So far, studies on technology acceptance consider mainly acceptance issues in younger people. Also, technology acceptance is mainly examined within computers and information and communication technologies and is connected to two major factors: the ease of use and the perceived usefulness (Davis, 1989). It is though reasonable to assume that the extent of technology acceptance depends on many more factors, especially in the older group. Technology type, using context, age and the health status of older adults may also be relevant for the extent of acceptance and the willingness of older people to actually use technologies.

This study examines conditions of older users' technology acceptance taking different using contexts into account. Empirically, perceived advantages and barriers within two technology domains and contexts were assessed: Technology in the automobile and in the medical context. In order to fully exploit the benefits of different methodologies, we applied both, qualitative (interview) and quantitative (questionnaire) methods.

QUALITATIVE STUDY

First, a qualitative procedure was chosen to explore and uncover older peoples' individual cognitive concepts of and experiences with technologies, relevant features of technology that create or support use and acceptance as well as factors, that build up barriers of use and acceptance.

Method

48 older adults (55-91 years of age, 24 females and 24 males) were interviewed by a semi-standardized questionnaire. The interviewees were allocated to three age groups (55-64, 65-74, >75) each with 16 participants. The older participants were reached through the social network of older participants. They all volunteered to take part in the interviews. Most of the older adults lived independently at home; partly they lived in senior homes. All participants were mentally fit and showed a high interest to participate in a study, which aimed at uncovering their attitudes and interest in the design of modern technologies. The interviews took place in the participants' familiar surroundings to guarantee a quiet and relaxed atmosphere. The length of the interviews varied depending on the participants' willingness to provide information and restrictions due to limitation in concentration and attention span. The interviews lasted between 30 and 90 minutes.

Answers were recorded digitally, transcribed and analyzed by content as well as conversation analysis. Content analysis allows a systematic aggregation, reduction, and structuring of the extensive data to identify trends and the main issues. Conversation analysis may give valuable insights into using motivations, reasons and backgrounds of participants by their way of speaking (Lucius-Hoene & Deppermann, 2004).

The questionnaire consisted of 56 questions (50 open questions and 6 closed questions), which can be subdivided into seven batteries of questions: (1) demographic data (living arrangements, marital status, education, profession); (2) technology experience (3) general interest in technology (4) the reported ease of using technical products (5) purchase/using criteria (6) barriers and problems when using technology, and (7) requirements and wishes for the design of technologies.

The interviews focused on everyday life technologies at home as well as on technologies in the medical and in the automobile context.

Results

Automobile technologies. Mobility is one of the main issues desired by older people. Participants reported not to be willing to give up or restrict their mobility voluntarily – unless their state of health and not inalienable circumstances force them. Furthermore, the ability to drive and possessing a car increases life-satisfaction. Many older people associate the use of one's own car with freedom, autonomy, and independency.

The majority of participants report to be frequent car drivers, most of them are male. With increasing age, driving activities decrease. In the group of 55+ nearly all participants use a car (87,5%), whereas this applies only to 68,8% of the participants aged 65+ and 43,8% of the group older than 75. Showing a high self-confidence, nearly all respondents evaluate car driving as "(very) easy"; most of them have even fun driving a car. 20% report to drive a car only if required, and 16% do not like it anymore.

When focusing on purchase criteria, the prize is the most important one. Low energy consumption only seems to be important for male drivers; reliability and driving safety in contrast is more frequently named by females and older drivers. Less important criteria are the brand, technical finesse, engine power, appearance, and service quality. Interestingly, assistive technologies are of low impact (only one female participant mentioned the parking assistant as a crucial criterion).

Problems with driving or traffic were predominantly negated. Most of the respondents are very satisfied with their vehicle. Several criticize the multifunctionality of novel electronic devices in the car. Some are frustrated and angry that they cannot take a hand in the fully determined electronical processes and they cannot repair the car on their own anymore (because of the electronics). Problems with traffic situations are mainly reported by women. Primarily driving on motorways seems to be difficult – because of high traffic volume and overtaking maneuvers. Several participants comment on situations when they feel thronged by other traffic participants.

The usage of navigation systems is more positively evaluated. 9 participants (mostly in the 55+ group) already used one and several participants plan to buy navigation systems. The ease of using the navigation device is evaluated controversially. While some participants have good experience when using it, some criticize the miniaturization and the complexity of these devices as well as poorly designed interfaces. Though, overall, automotive technologies are basically positively connotated.

Participants show a high open-mindedness towards car technologies, describing it as "stunning", "fascinating", "excellent", and "amazing". Most of them see it as a relief. Overall navigation systems seem to be very well accepted.

When asked how to optimize navigation systems, a reduction of multifunctionality (only base functions), devices, which are integrated into the vehicle (no mobile navigation systems) and low price devices were demanded. Another car technology which is increasingly available in modern vehicles, are parking assistants (Färber, 2000). Only few participants have greater experience with parking assistants. The usage and usefulness of such systems are evaluated controversially. Some users describe parking systems as a "comfortable advantage" or "smasher". Critically it is objected that the acoustic signals of the systems need to be improved ("unpleasant", "irritating").

Not only systems using audio signals are criticized, the visual information design also needs improvement. Participants describe that displayed information is often hard to read. Moreover, over-complex and abstract usage of symbols, pictograms and objects are often hard to understand. A considerable number of participants basically reject the usage of parking assistants. According to their statements, drivers that need the help by a parking assistance should not drive a car (as parking belongs to the competency of a driver). Accordingly, parking assistants are evaluated as "nonsense", "awful", "abnormal" and "cruel".

Taken together, there was a clear trend that older adults like car technologies, and that car driving represents a very important means of keeping up mobility, flexibility and independency. The evaluation of any supplementary technology, which might be specifically reduce cognitive load (parking assistant, autopilots) is highly controversial. The most crucial objection against the usage of the technologies is the assumed loose of control, as it is the case of using an autopilot. According to statements of participants this competes with the "innate" advantages of car driving (fun, the ability to control the car, to steer). Furthermore participants doubt about the safety of such systems. They do not believe that an autopilot is realizable respectively they think the technology "is not mature yet". Others fear an overload or other failures of the system. Most of the respondents account humans to be more reliable than technical systems.

Medical technologies. Two thirds of respondents report to have basic experiences using conventional medical technologies (e.g. blood pressure meter). Interestingly, it is the oldest group (75+), which has the lowest experience with medical technologies. In addition, women tend to use a blood pressure meter slightly less often than men. Mostly a digital blood pressure meter is preferred over a mechanical device. Reasons for preferences are that digital devices are easy to handle and "probably more precise". Most of the participants have no difficulties using a blood pressure meter. They value handling it as "very easy" (67,7%) or "easy" (32,2%).

Hearing aids are another technology, which is used by a number of participants. Even though the basic usefulness of the hearing aids is conceded, all participants complain about the low usability level in these devices. Especially, the sound quality and the difficulties to discriminate between targeted sounds and noise are criticized as well as the handling of the miniaturized devices (especially for people with sensory and motoric restrictions). A 60-year-old male respondent: "Older people fumble with their shivering fingers. They can't adjust their hearing aid anymore. They turn the little knurls and fumble the little switches – older people are totally overstrained with it. I observed my father in doing so."

Hearing aids have an extremely negative connotation (not only by hearing aid users, but also by older adults which do not wear hearing aids). Obviously hearing aids are perceived as stigmatizing and as an age marker. The statement of a 59 years old man can visualize this: "Glasses are good. Some people even want them, although they don't need them. By contrast, hearing aids are associated with old age, aren't they? That's old age and with it you are old."

It was also questioned how the participants think about personal health care systems that have to be worn body near to control their state of health permanently. Again, reactions turned out to be very controversially: one quarter of our participants strictly rejects the usage of any body near medical technology (even though it could keep up independently living at home). Only one quarter reported to fully accept these medical technologies. The majority of participants reported to refused the usage of medical technologies as long as possible. Wearing medical technologies as a preventive measure, is rejected. "No, no prophylaxis. I would accept a pace maker if it is necessary, but nothing else" (women, 70 years). The most decisive characteristic of medical technology is their inconspicuousness. Medical technology, which is perceivable for others, is dismissed because participants fear of being stigmatizes as "helpless", "ill", "old" and "disabled". While the 55+ group mentions "shame" feelings when using medical technology, none of the 75 years olds mentions "shame" feelings in combination with the usage of medical technologies.

Summing up, medical technologies are less frequently used (compared to car technologies) and they are evaluated highly controversial. While participants would use them (when absolutely necessary) and basically concede a general usefulness, they have a negative attitude, which is characterized by fear of being stigmatized as old, disabled and/or ill.

QUANTITATIVE STUDY

Method

37 older adults, 20 male and 17 female participants volunteered to take part in the questionnaire study. The age of participants ranged from 55 to 80 years (M = 66.14; SD = 0.5). In order to have a representative profile of educational levels, the older adults had very different professions (before retiring). The older participants were reached through the social network of older participants. In order to match the procedure with the one in the qualitative study three age groups were formed: (1) the 70 + group (M = 73.5; SD = 3.1); (2) the 60+ group (M = 65.93; SD = 2.4) and (3) the 50+ group (M = 56.8; SD = 1.5). The questionnaire was designed to obtain information about (1) demographic data; (2) interest in technology in general and (3) interest in specific technological fields (home/household, entertainment, computer, mobile communication, automotive, medical, manufacturing, and gardening technologies), (4) purchase criteria for both, medical and automotive technologies (5) personal arguments for and against the usage of medical and automotive technologies. Overall, the sample revealed to have basic experience with automotive technologies. Nearly all par-

ticipants frequently use a car and rate the ease of driving as "quite easy". However, no experience was reported with assitive technologies (parking and navigation assistants). Regarding medical technologies, the blood pressure meter was highly known and rated as "quite easy". Beyond the blood pressure meter hearing aids or pulse-watches were used only by few participants.

The questionnaire consisted of closed multiple-choice and open-ended questions. Multiple-choice items had to be answered on scales (Likert) with different graduations (four to six point scales) and had to indicate the extent of approval/disapproval (do not agree at all to fully agree). The total time to fill in the questionnaire lasted approximately 40 minutes.

Results

Data was statistically analysed by MANOVA procedures and ANOVAs. Significance level was set at 5%. Outcomes within the less restrictive level of 10% are referred to as marginally significant. Outcomes are analyzed respecting age and gender effects.

Interest in technology. ANOVA analysis revealed no significant age effects (in all age groups, the reported interest was on average "medium"), but a marginally significant age effect ($F(1, 36) = 3.2$; $p<0.1$). In all age groups women reported a lower general interest in technology than did male participants (Figure 1). The interaction of age x gender did not reach significance.

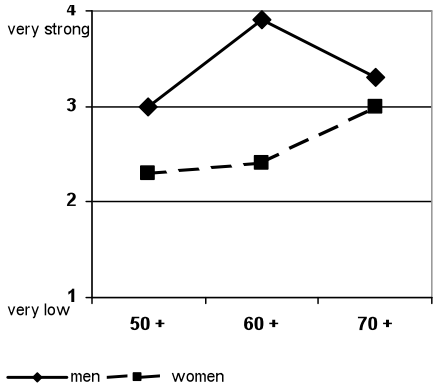

Figure 1: Gender differences in the general interest in technology

The interest in specific technologies differs considerably depending on different technology fields. It is high for technologies used in homes/household ("very high") and gardening ("high interest"). Though, it is comparably low for computer technologies. In figure 2, outcomes are visualised for age groups.

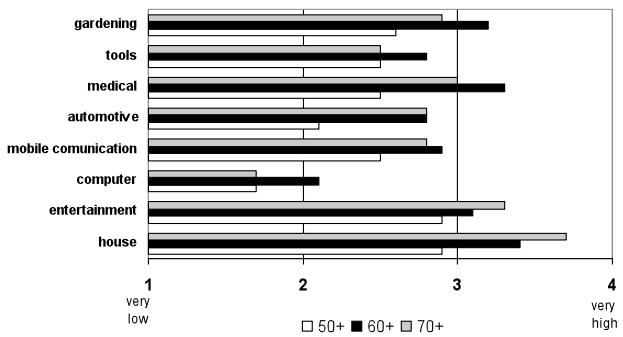

Figure 2: Age differences in the interest in specific technology fields

Age differences did not reach statistical significance, for none of the technical fields.

However, there were distinct gender effects (Figure 3). Women had a significantly higher interest in technologies applied in the house ($F(2, 36) = 11.8$; $p<0.05$), and the garden ($F(2, 36) = 7.6$; $p<0.05$). In contrast, male reported higher interest in manufacturing technologies/tools ($F(2, 36) = 19.3$; $p<0.05$), computer technologies ($F(2, 36) = 7.6$; $p<0.05$) and automotive technologies, confirming the stereotypes of technical interest in men and women. Beyond the gender differences it is interesting that there are fields of technologies, in which both gender show a comparably high interest, as e.g. mobile communication technologies, medical or entertainment technologies.

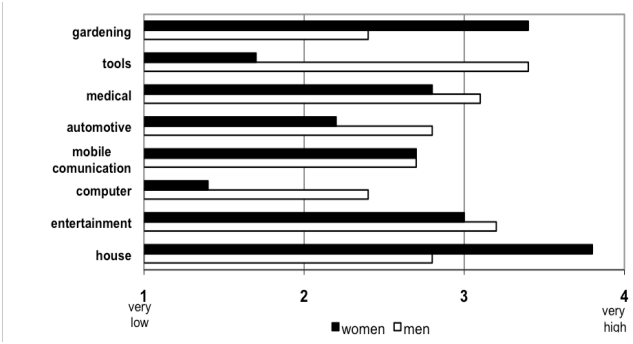

Figure 3: Gender differences in the interest in specific technology fields

Usage of automotive technologies. A detailed screening was undertaken regarding the usage of (assistive) automotive technologies. Participants had to state which arguments militate in favour of using these technologies (high values indicate a high acceptance) and which arguments are perceived as barriers (high values indicate a low acceptance). Descriptive outcomes are given in Table 1.

Table 1: Intention to use assistive automotive technologies (high values indivate high approval; max = 5)

I would use automotive technologies, because (of)	Mean	SD
Safety reasons	3.3	1
Ability to drive on my own	2.6	1.4
Possibility to keep up an independent life style	2.9	1.4
Coping with difficult traffic manoeuvres	2.6	1.2
Relief from cognitive complexity	2.6	1.3
General trust in electronic devices	2.6	1
Possibility to show my technical competence	1.6	0.7
Interest in innovative car technologies	2.2	1.1
Feeling of being young/modern	1.5	0.6
Enhancing mobility	2.7	1.3
Avoiding to become a burden for others	2.4	1.4
Design reasons	1.7	1
Fun reasons	2	1
Compensating age-related declines	2.6	1.3

Overall, the intention to use assistive automotive technologies is medium (values ranging between 1.5 and 3.3 points out of 5 points possible). The most important reason in favour of using automotive technologies are safety reasons, followed by the intention to keep up an independent life style. The reasons,

which are perceived as less important for the usage of assistive technologies are the possibility to show own technical competence, the feeling of being young and modern as well as design reasons. Statistical testing revealed neither significant effects of age nor effects of gender showing that the general intention to use automotive technologies is not depending on user characteristics but represents a universal more or less positive attitude towards automotive technologies.

When focussing on the arguments, which contradict using automotive technologies (descriptive outcomes can be found in Table 2), similar result patterns were found. Reasons contradicting the usage of automotive technologies are the fact that participants do not want to be bothered by a low usability, and do not want to be confronted with new technology. Moreover, participants reported to mostly not need these technologies, as they are good drivers (according to own evaluations). However there were also arguments, which did not play a major role for declining the usage of automotive technologies, e.g. the fear of being stigmatised as old or incompetent drivers. Again, neither age nor gender effects were found.

Table 2: Barriers against the use of assistive automotive technologies (high values indicate high approval; max = 5)

I would not use autom. technologies, because (of)	Mean	SD
I do not want to be controlled by technology	2.6	1.2
I do not want to be confronted with new technology	2.9	1.2
I do not want to get angry about low usability	2.9	1.2
I do not need them (as I am a good driver)	2.8	1.1
It is too complicated for me	2.6	1
The cost-benefit ratio is asymmetrical	2.4	1.1
Fear of a low reliability of devices	2.7	0.9
Fear of getting false information	2.4	1
Fear of being stigmatised as old	1.4	0.6
I generally do not trust automotive technology	2.1	1
I do not have interest in automotive technology	2.6	1.5
Fear of being stigmatised as an incompetent driver	1.5	0.5
I belief that seniors should not drive anymore	1.9	0.7
I rather quit driving when I am not able to drive anymore	2.1	1
General disliking of using these technologies	1.6	0.8

Usage of medical technologies. In order to learn if there are age- or gender-specific reasons, which militate in favor or against the usage of medical technologies, also a detailed screening of acceptance arguments was carried out. First, the extent of approval/disapproval respecting reasons *for* using medical technologies is reported. Descriptive outcomes can be found in Table 3.

As can be seen from Table 3, the overall ratings reach distinctly higher values in the evaluation of medical technologies compared to the automotive technologies. Values ranged from 1.5 to 3.4 at the most (out of 5 possible points). Obviously, the extent of approval was higher in the medical sector. Among the reasons which are perceived as most important in favor of using medical technologies, are “safety reasons”, “beware of long hospital stays” and the possibility to get better informed about the won health status”, followed by the increased mobility. In addition, the possibility to avoid becoming a burden for others is quite essential when using medical technologies (and had been rated as distinctly less important in the automotive field).

Table 3: Intention to use medical technologies (high values indivate high approval; max = 5)

I would use medical technologies, because (of)	Mean	SD
For safety reasons	3.4	1.2
Less frequent consultations	3.1	1.2
Independent living at home	3.1	1.2
Beware of long hospital stays	3.4	1.3
Better information about my health state	3.4	1.2
Relief from the responsibility to watch my health state	2.6	1.2
Relief from cognitive burdening	2.7	1.2
General trust in medical technology	3	1
Possibility to show my technical competence	1.7	1.1
I think medical technology has a great potential	3.2	1.2
Feeling of being young/modern	1.5	0.7
Enhancing mobility	3.3	1.3
Avoiding to become a burden for others	3.2	1.3
To keep mental fitness	3.2	1.2
Improvements of health condition	3.1	1.1

The reasons, which had been rated as less important when using medical technology were “feelings of being modern and young” and “the possibility of showing technical competence”. Neither age nor gender differences reached statistical significance, revealing a universal acceptance pattern regarding the usage of medical technologies.

Finally, the perceived barriers are looked at which had been evaluated by participants to use medical technologies (Table 4).

Table 4: Barriers against the use of medcial technologies (high values indicate high approval; max = 5)

I would not use med. technologies, because (of)	Mean	SD
I do not want to be controlled by technology	2.1	1
I do not want to be confronted with new technology	2.9	1.2
I do not want to get angry about low usability	2.7	1.1
I do not need them	2.4	1.3
It is too complicated for me	2.6	1.3
The cost-benefit ratio is asymmetrical	2.5	0.8
Fear of a low reliability of devices	2.2	0.8
Devices have often a limited peachiness	1.7	0.8
Fear of being stigmatised as old	1.8	1
As medical devices do not change my health state	2.4	1
Disliking of being constantly monitored	2.3	1
Fear of being stigmatised by others as ill	1.9	1
Disliking of being constantly reminded to be ill	2.2	1.1
Fear of loosing my dignity	1.9	1.3
Fear of getting false information	2.5	1.1
Fear of loosing data privacy	2.4	1.3
General disliking of using these technologies	1.8	1.0

Consistently with the evaluation of automotive technologies, the peachiness of devices is of minor impact. The same applies for the fear of being stigmatized as old and ill. The most prominent barriers, which are referred to as more serious arguments against using medical technology are low usability and the cognitive demand when being confronted with new technology.

While age group did not respond differentially, there were

two items, which revealed significant gender effects. Female users would more strongly deny medical technology because they do not want to be controlled by technology ($F(1,36) = 2.6$; $p < 0.05$) in comparison to male users. Also they reported higher negative values regarding the "general disliking of using medical technologies" compared to men ($F(1,36) = 2.7$; $p < 0.05$).

Purchase criteria. A final analysis was concerned with purchase criteria. Participants had to indicate which of a number of criteria are relevant for them when buying automotive technologies and also medical technologies. After the rating participants had to indicate which of the criteria – according to their view – represents the most decisive criterion for both technology types (automotive vs. medical).

First, automotive technologies are focuses at. It can be seen from Figure 5, that the most important criteria for purchasing or using automotive technologies are safety, followed by reliability, usability and price.

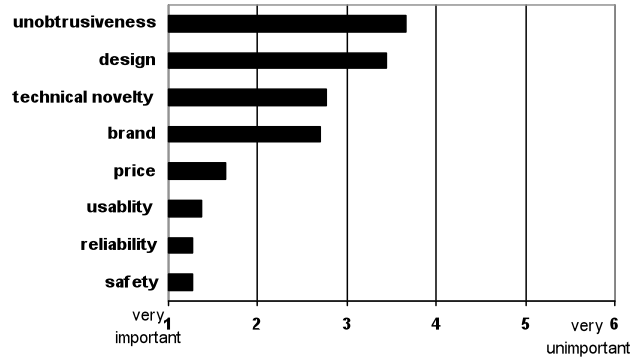

Figure 5: Purchase/usage criteria for automotive technologies (ranked according to their importance. Low values indicate a high importance, high values a low importance.)

The brand of a car its technical equipment and the design and outer appearance are of minor importance, independently of age and gender. When asked to indicate which of the criteria is most decisive, participants selected quite unequivocally reliability before safety.

In direct comparison, now the usage criteria for medical technologies are reported (Figure 6).

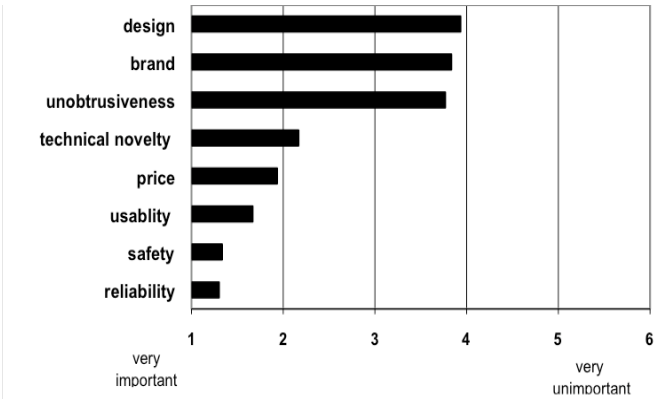

Figure 6: Purchase/usage criteria for medical technologies (ranked according to their importance. Low values indicate a high importance, high values a low importance.)

As can be seen there, the most important criteria are reliability and safety. Also usability is ranked to be of great impact. So far, these criteria are of nearly identical impact in medical technologies compared to automotive technologies. Also the criteria with the lowest impact are unobtrusiveness of devices, their brand and the design. These outcomes were independently of age and gender effects.

DISCUSSION

The present study focused on an investigation of the acceptance of different technologies in older adults. Different from earlier technology acceptance studies, in which mostly (mobile) communication and information technologies were in the research focus (e.g. Arning & Ziefle, 2007; Davis, 1989; Venkatesh & Davis, 2000; Venkatesh, Morris, Davis, & Davis, 2003; Ziefle & Bay, 2008) and in which mostly young and technology prone adults were under study, this research aimed at investigating acceptance factors in the older user group.

In order to gain insight into the technology- and context-specificity of technology acceptance, a comparative analysis of automotive and medical technologies was undertaken. Users between 50 and 80 years of age were examined, using a qualitative (narrative interview) techniques) and a quantitative (questionnaire methodologies) approach. It was of interest if determinants of technology acceptance vary in both technology types, also, if there are age- and gender-specific acceptance barriers as well as using motives. As technology acceptance was assumed to be a rather complex construct, we pursued an exploratory research procedure in order to collect many different perspectives on acceptance determinants. Overall, results show differences between technology domains, as well as gender and age-related acceptance components. On the other hand, however, the findings also reveal universal evaluation patterns, which are insensitive to age and gender factors.

According to the most popular model of technology acceptance (Davis 1989), two key components were assumed to form acceptance: the ease of using a device and its perceived usefulness. Even though both components show a very solid empirical base (e.g. Arning & Ziefle, 2007) further approaches propose amplifications of the model including more determinants. As such, cost-benefit evaluations (Melenhorst et al. 2001), the complexity of the task, which has to be accomplished with the respective technology as well as individual variables (skills and abilities), were assumed to form the technology acceptance in addition (Arning & Ziefle, 2007, Goodhue & Thompson, 1995; Venkatesh et al., 2003). In addition, social processes (subjective norms, system representations, perceived relevance and the quality of output) are discussed to be further components (Venkatesh 2000; Venkatesh & Davis, 2000).

However, still, technology acceptance might be not fully understood, as age and gender effects are not determined as well as technology domains are not yet considered satisfactorily.

When looking at the different technology domains, automotive technologies show to have a basically positive connotation. The more automotive technologies are acting automatically (autopilot) and independently of the driver control, the more they are rejected – independently of ageing.

Also, hedonic aspects (fun), the feeling of control over the car, and design issues are relevant for acceptance. In contrast,

technologies in the medical contexts are – tough basically acknowledged as potentially helpful – less positively evaluated. According to statements in the interview, participants dislike the feeling of being stigmatized as old, ill and disabled and these characteristics are associated with medical technologies. Attitudes towards personal health care systems are also ambiguously valued, especially in close distance to body. Participants claimed to only accept and actually use medical technologies if health status necessitates it and if there is no alternative to using these technologies (Ziefle, 2008). Furthermore, medical technology has to meet intimacy and privacy demands. Interestingly, the demand for respecting of intimacy and privacy demands were mainly stressed in the interviews and not that prominent in the quantitative study. On the basis of the represent data we cannot explain the different evaluations. One reason for these differences could lie in the fact that a considerable number of interview participants already live in senior homes in contrast to the participants of the questionnaire study, which are living at home. Possibly, the different living conditions may play a role for the need of privacy and intimacy when using medical technologies. This should be further examined in future studies.

Across technology domains, usability and ease of using the system are important components as well as safety and reliability of technology. Also, the impact of a specific brand in automotive and medical devices is rather unimportant for older adults, in contrast to younger adults, which attach great importance to appealing technical design.

The fact that only very few age differences showed up within the ratings is an astounding finding, which had not been expected. It shows that the acceptance and evaluation of automotive and medical technology is a quite universal phenomenon and not so much impacted by the probability to need these devices in the near future. Gender differences were revealed. The differences in the acceptance evaluation regard mainly the interest in different technology domains. Conforming classical stereotypes, older women – independently of age – preferred household and gardening technologies, while men showed higher interest in automotive, manufacturing and computer technologies. Remarkably though there were also technological domains, which were gender-, insensitive: mobile communication technologies were equally high evaluated by both gender groups. Regarding acceptance motives and using barriers no gender effects were revealed. Apparently, gender differences decrease with increasing age.

Concluding, our findings show that current acceptance models relying on communication and information technology are not sufficient to be applied to other technological domains. A conceptualization of medical acceptance as well as successful design activities will require a participatory approach, where users/patients' motives, needs and demands are adequately considered.

Future studies will have to investigate to what extent these outcomes may be generalized to chronically ill or handicapped people and if this target group reports same or different barriers. Also it will have to find out if the caveats reported by respondents do vanish if people get more familiar with the usage of these technologies.

CONCLUSION

Overall results show that technology acceptance is a rather complex construct whose components considerably depend on the age of participants, the technology domain and type and the using context. In each technology type, very different barriers and advantages come into force, which should be considered for an age-sensitive design.

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