

Age-related Shift in Adoption and Use of Information and Communications Technology

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Abstract— In previous studies the smartphone, considering the adaptation and use of modern technology, has not been detected. Based on a comparison of literature with newly collected data the question was answered whether the attitude of over 60 years' old people has changed towards technology in recent years. For a direct comparison of technology acceptance and use at the present time, a second group of young adults was interviewed. This group can be clearly assigned to the internet generation. The aim of these efforts is the study of intergenerational differences and similarities in the context of aging. Methodically this goal has been prepared by means of a semi-structured interview. A total of 30 subjects were divided into two age groups. Both groups were interviewed. The first age group includes 15 participants (7 men and 8 women) older than 60 years (mean = 68.00 years; SD = 5.11). The second age group includes 15 participants (9 men and 6 women) younger than 30 years (mean = 25.07 years; SD = 2.62). Across two age brackets a positive trend towards technical products could be found in all areas inquired. Older users are interested in advanced technical products and are willing to integrate them into their everyday lives, as long as the usability of these products meets their expectations and that the equipment can be used adapted to the individual needs,

Keywords—demographic change, adoption, technology, information and communication technology, socio-technological factors, individualization, quantified self

I. INTRODUCTION

Demographic change is no myth. For example, households consisting of people older than 75 years of age will double by 2050. Fifty percent of the population in Germany will then be over the age of 50, 33 percent over 60, and 12 percent over 80 [1]. In this context, aging is often associated with a decline in quality of life, due to factors such as limited mobility and autonomy and the appearance of various diseases. At the same time the birth rate is steadily decreasing in Germany. The number of births varies between 1.4-1.6 children per family for the year 2015. It is expected that even fewer children will be born in the next years [2].

The market will have to adjust to the attendant shift in consumer demand [1]. The needs of older consumers come to the fore. Rightly one has to ask: What aids to everyday life do the elderly desire? What media are they willing to use? Do they even desire aids of any kind? In this connection, the issue of technological aids or technological products is especially interesting, as they enable a high degree of autonomy. The devel-

opment of the Internet and of smartphones has risen comprehensive innovative advances, for example with the topic Industry 4.0 or the increasing penetration of everyday life by Apps. They could be used to enhance quality of life, focusing on greater independence and flexibility [3–5]. Smartphones are one of the most significant developments of recent years, and they are enduringly changing the structure of the market and the way individuals interact with one another [6]. The question is whether older people are also willing to integrate such communication technologies in their daily lives. For them, this means that they have to adapt to the new conditions. It can be said that the older respondents are “digital immigrants” [7,8].

The present study included a group of younger respondents in order to test the propositions it generated by means of a comparison with an additional sample. In addition to the results of Jakobs et al (2008), there has been a shift in recent years in youth culture with regard to fresh technological innovations. Younger users tend to come into contact with technology at an ever earlier age – an experience they view positively. In this context, the 2015 study by Lee and Coughlin concluded that younger and older users have different systems of relevance, and that they evaluate the use of technology accordingly to those systems [6].

This is the background to the 2008 study by Jakobs, Lehnen, and Ziefle on “Technology and Old Age,” which investigates the elderly’s needs and awareness for everyday technological equipment like cell phones and computers based on gender, life situation and use of technology [9]. The objective was to study how the acceptance of technological devices was correlated with personal characteristics like sex and family background.

Since the technology being assessed has rapidly changed, since 2008 as the smartphone or the tablet was invented. This modern information and communication technology can only be learned and used by active contact [10]. Therefore this study evaluated the acceptance of technological devices and willingness to use them and whether a shift has taken place in the over-65 generation since 2008. This study also intended to represent a preliminary study to develop a quantitative questionnaire for a long-term study about the acceptance of technological devices within the over-65 generation in Germany. The qualitative character of this study should be confirmed by representative quantitative evaluation with in the long-term study. About 5000 people will be questioned.

II. OBJECTIVE

The aim of this article as a pre-test is to clarify which devices are used to access data from the Internet and social communication. The data from Jakobs et al. was compared with current data and thus to trace the shift that has taken place in recent years with regard to the use and acceptance of technological devices. Special emphasis will be placed on the role of the development and widespread adoption of smartphones – a phenomenon that has taken place in the period between the investigation of Jakobs et al. and this one. Other priorities include the use of computer and Internet, as well as the use of modern medical technology products, within the meaning of the quantified self trends, in which users increasingly collect and analyze data as well as make them available.

Sometimes the devices are used only by the user, but increasingly also by doctors, health insurance companies and employers. Examples of this are the insurance group Generali, which gathers health data or a private university in Oklahoma, which involves fitness bracelets actively in university life [11,12]. In addition, there are various apps that offer support, such as reminders to take medication [13]. Younger people already use such media for example to get health data. For example Fitness bracelets, which are paid for by health insurance, are used to, record vital data.

In a globalized world, advances in new technologies are achieved ever more swiftly. Accordingly, users must adapt to them all the more quickly. This study will focus on how innovations affect willingness to accept new technologies. In order to shed more light on the situation, a comparison will also be made between older and younger users. The idea is to trace possible differences and similarities between the generations, and thus to determine whether and to what degree there is a difference in how technology is perceived by older and younger users. It is assumed that younger people engage more easily with such innovations [3].

III. METHODOLOGY

In order to grasp shifts in the use and acceptance of technology among older users, a questionnaire was developed that was based on the key questions asked by Jakobs et al. [14]. Reference was made in advance to the supplementary questionnaire in order to ensure, first, that the interviewees understood the questions and, second, that they consented to the additional survey. This section will provide an overview of the study's methodology, its interviewee data, and its execution.

A. Methodological Basis

A semi-structured interview was chosen as the methodological basis for the study. This manner of conducting interviews made it possible to use the questions formulated by Jakobs et al. and thus to construct a basis for direct comparison. It also gave interviewees a large degree of freedom when articulating their system of relevance, such that personal evaluations and assessment patterns could be taken into account as well as new, unforeseen matters. In addition, a semi-structured interview has the advantage that predetermined questions can be supplemented, changed, or omitted at the discretion of the interviewers [15,16]. In this way, the context of the survey was adapted to

each individual respondent without causing a strong deviation in thematic focus.

The questionnaire consisted of three core areas. The first section was devoted to questions regarding the acceptance of medical technology. The second section dealt with information and communication technology (cell phone and/or smartphone), and the third with the media of computers and the Internet. In addition to gathering descriptive data, all three sections asked about desires, attitudes, and positive and negative experiences with the devices in question (see Table 1 – 3.).

Section	Question
Section 1: Medical Technology	Do you use a medical device in everyday life (e.g. a blood pressure monitor, ...)? How do you feel about medical devices worn on the body (e.g. a hearing aid, ...)? Can you imagine wearing medical devices on your body whose purpose is to monitor and preserve your health (prevention)? Should a medical device be designed so as to be discreet?

Table 1 Medical Technology

Section	Question
Section 2: Information and Com- muni- cations Technology	Do you use a cell phone? Why do you refuse to use a cell phone? Why did you get a cell phone? Is your cell phone a smartphone? How comfortable are you operating your cell phone? Can you name any concrete problems related to using your cell phone? Why do you use your cell phone so much/little?

Table 2 Information and Communication Technology

Section	Question
Section 3: Computers and the Internet	Do you use a computer? Do you use the Internet? What was the essential factor that brought you to engage with computers and the Internet? What computer and Internet functions do you use? How great is your depth of use of both media? How comfortable are you using your computer? How comfortable are you using the Internet? Why did you get a computer, or why would you like to get one? Why don't you want to get a computer?

Table 3 Computers and the Internet

B. Description of Respondents

The interviews took place early in 2015. The respondents were divided into two groups. The first group was composed of people age 60 and older. It contained seven men and eight women. The average age was 68 (SD = 5.11).

The second group was composed of students and academics under the age of 30. There were nine men and six women in the group, with an average age of 25.07 (SD = 2.62).

The make-up of the groups was based on the study by Jakobs et al., in which the results were compared with those of a separate study of young people in order to identify generationally determined differences [9]. Jakobs et al. conducted 48 interviews on the basis of the questionnaire with respondents age 55 and older. This group was then subdivided into 55+, 65+, and 75+. The comparison group was taken from a 2005 study of young people by Jakobs, Schindler, and Straetmans [17]. In the present study, such a detailed subdivision of the subjects was carried out due to the number of subjects refrained.

This comparison provided the basis for deciding whether a convergence between the various age groups had occurred. On the one hand, the results of Jakobs et al. (2008) should be reassessed on the basis of new data; on the other, their research design should be taken up to generate cross-generational data.

IV. ANALYSIS

At the outset, notes of the interviews were transferred to Excel. The data set was divided into three thematic areas corresponding to the sections of the questionnaire: first, medical technology; second, information and communications technology; and third, computers and the Internet. Within each area, the various possible answers were coded and enumerated according to the frequency with which they were given. If certain questions elicited no answers, this was also noted. The coded data were then analysed in pivot tables, in which both individual questions and possible question combinations were considered.

First of all, the age groups were analysed separately, as it was conjectured that the range of possible answers might be related to age. Thereafter, the groups were compared to one another, and finally both groups were combined in order to make general observations about the respondents.

V. CONCLUSIONS

The following presents the conclusions of the study. Reference will be made to Jakobs et al., and socio-technological factors will also be considered. In addition, an age comparison will be undertaken. It will be examined whether social processes of individualization play an equally large role as descriptive attributes in the acceptance of technology.

Individualization, in the sociological sense, is the disintegration of industrial forms of life and their replacement by others. The distinguishing mark of these other forms of life is

that individuals must create and follow their own life path without the security previously offered by the fundamental indomitability of the stable, moral, and social milieu of industrial modernity [18–20]. The standard life-path familiar to older generations gives way to a path of one's own choosing. In this context, one's own body becomes a resource and thus also a tool of action [21–23]. Gestures and posture, even clothing and athletic activities, become a resource for displaying competence, self-assurance, and self-satisfaction [24–26]. In this way, individuals not only adapt to the growing expectations of society, but they increase both their attractiveness and their autonomy. In this connection, medical devices gain greater relevance (in the realm of prevention), as does securing quality of life.

This change penetrates different social classes in a great extent. This means that older people are increasingly individualized. Accordingly, they have the wish to live their lives autonomously on their own terms as long as possible. The way of data generation plays a special role. Corresponding data can be accessed through multimedia services in the shortest time. The possibilities to retrieve information and send them to other users grow continuously. The same personal data can be detected independently more easily - and need to be detected [27]. Users are increasingly operating within the meaning of the quantified self. It can be assumed that both groups are affected to a certain extent by this shift.

A. Medical Technology

As expected, medical devices were used by older respondents (n = 9 of 30). In contrast, only one of 15 younger respondents used such products. These results do not diverge from those of Jakobs et al. What did change was the attitude toward medical devices worn on the body. Only two respondents from the older group perceived such devices as negative (see Fig. 1).

The reason was a desire for optimization and the cumbersome nature of such devices, which implies that they were rejected merely because of their design. Accordingly, not all older interviewees were willing to use a medical device (n = 5 of 15). In Jakobs et al., seven out of 16 respondents from the 55+ group responded negatively. Furthermore, individuals who had no experience with medical devices tended to respond negatively. In Jakobs et al. an important reason for the rejection of such products was the stigmatization of old age.

In this comparative study, however, the respondents hardly mentioned this point. Instead, the focus was on the usefulness of devices with respect to potential early recognition of an illness and support (n = 8 of 30). The question whether the product should be designed discreetly garnered an unequivocal response: discreet is desirable. Nevertheless, it is interesting that young people with little experience with these devices were in favour of a conspicuous design in emergency situations. Thus two respondents were of the opinion that the way medical devices look should be immaterial to their design if those using them have acute problems. Another respondent remarked that the device should draw attention to itself in emergency situations by blinking and beeping in order "to prevent the worst" from happening. One respondent mentioned the fear of death as a reason for a conspicuous design.

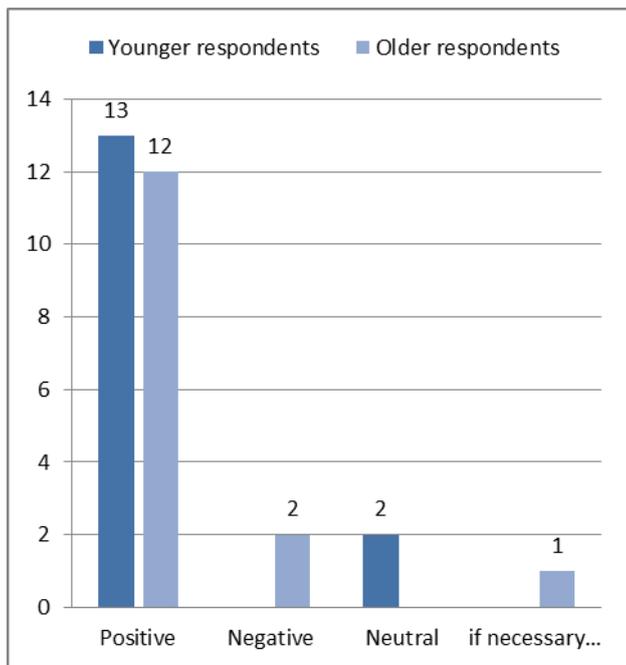


Fig. 1. Attitude toward medical devices worn on the body.

B. Information and Communication Technologies

All the respondents participating in this study had a cell phone ($n = 30$ of 30), whereas in Jakobs et al. only 33 out of 48 respondents had a cell phone. Reasons for acquiring one included, among others, general communication ($n = 6$ of 30), family ($n = 5$ of 30), work ($n = 4$ of 30), and emergencies ($n = 3$ of 30). There has thus been no significant change in these reasons in the last ten years.

It is interesting that two of the younger respondents got their first cell phone as a gift from their parents. This supports the theory that younger users come into contact with such technologies at an increasingly earlier age and thus learn to operate them more intuitively. Family also plays a significant role in the older group. For example, a smartphone may be bought at the request of the family ($n = 5$ of 15). In contrast to the 2008 study, most respondents claimed to feel comfortable using cell phones ($n = 12$ of 15) (see Fig. 2).

It is unclear, however, whether this is attributable to increased usability. For example, the criticism “small buttons,” which was often made in 2008, was no longer an issue, as the controls on a smartphone are larger. Nevertheless, the older group still had problems using cell phones: menu navigation, terms, symbols, and the intuitiveness of devices continued to be criticized as they had been in Jakobs et al. Thus, the acquisition of user expertise still seems to be considered hard work.

The younger group, on the other hand, mainly named battery life as the chief problem ($n = 7$ of 15). Finally, older users said they seldom used their devices ($n = 6$ of 15), whereas younger ones said they used them often ($n = 14$ of 15).

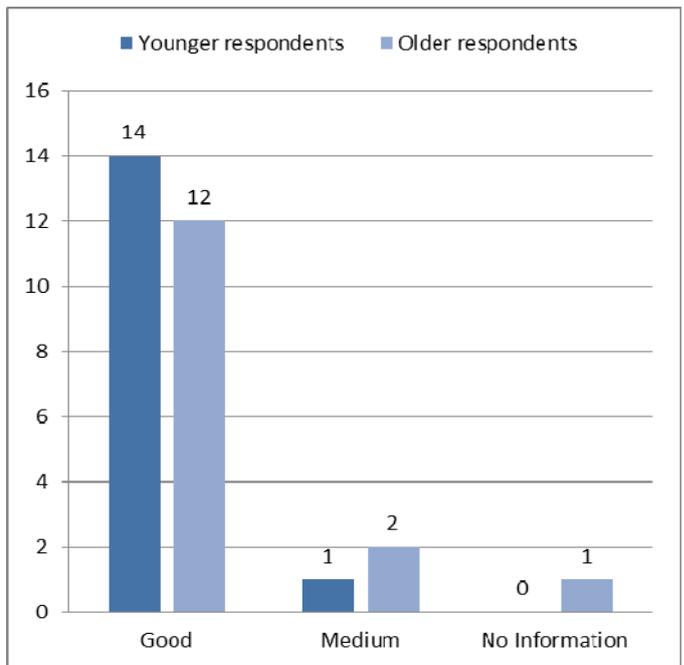


Fig. 2. Usage of Smartphones

C. Computers and the Internet

All except one older respondent use a computer ($n = 29$ of 30), and all interviewees use the Internet. Both in Jakobs et al. ($n = 19$ of 48 use computers, $n = 12$ of 48 use the Internet) and in this study, work is named as the chief reason for using computers and the Internet ($n = 9$ of 30).

Here it is interesting that young people also name work/studies/school as the chief reason for first coming into contact with a computer. Furthermore, although depth of use has increased, word processing programs and e-mail are still the most relevant functions for older people (see Fig. 3). Most respondents felt comfortable using the Internet and computers ($n = 25$ of 30), which represents no change with respect to Jakobs et al.

In the older group, work and curiosity were the only reasons given for acquiring a computer. The younger group also mentioned hobbies (such as playing computer games), using Skype, and social life.

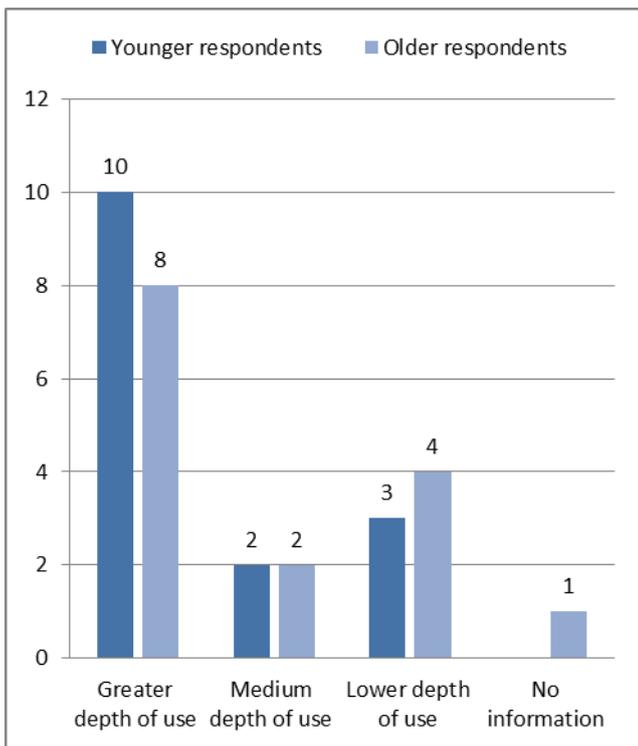


Fig. 3. Depth of computer and Internet use

VI. DISCUSSION

This study shows that no significant changes have taken place in user behaviour since 2008. The results of Jakobs et. al therefore can be confirmed. On the one hand, this may be because the temporal distance is too short. On the other hand, users may have adapted to the new media. In that case the focus would shift: users might have gotten used to old media, whereas new media might be judged according to old assessment patterns [3]. A third reason may be that young and old users address different things by speaking about technical devices.

In contrast, attitudes toward technological products have slightly improved, and a desire to integrate them into everyday life can be observed. In this sense, people will receive specific information about their health situation. Whether this is merely down to random sample bias or reflects a new trend should be examined in a long-term study. It should be investigated as well which intergenerational differences in the use of different services exist on the Internet and which data should be shared or accessed in platforms. It has become clear that design significantly determines whether and to what extent a device is perceived as attractive.

In general, it can be maintained that older people are interested in technology and are willing to familiarize themselves with it. It makes no difference whether that technology is a cell phone, a computer, or the Internet. It is particularly important that the equipment can be used adapted to the individual needs,

A. Medical Devices

In this context, it should be noted that both groups actively take their health into consideration. In order to remain active as long as possible in their environment, they would be willing to make use of medical devices. This means that they are willing to detect health-related data to a certain extent automatically and that they are willing to give the data to a third person.

The study of Rasche et. al (2016) shows, however, that there are also critical reflections in this perspective: diabetics are willing to collect data, but they don't want to send the data to the health insurance companies, because they expect a less favorable treatment [28].

Since younger interviewees have little to no experience with such products, it is likely that they regard them merely from the point of view of optimization. In terms of Ulrich Beck's theory, it can be conjectured that they want to successfully use their bodies as resources for as long as possible, and thus that the design aspect of a relevant medical device would be immaterial in the case of illness or an emergency.

The experiences of older people, on the other hand, show that disadvantages are taken into account (e.g. the disadvantages of a conspicuous device), although the yearning for an autonomous, independent life prevails here, too. The fear of being monitored exists with regard to such devices, but some of the respondents would nevertheless be willing to wear medical devices if they were manufactured better.

B. Information and Communication Technologies

It is likely that the younger respondents did not need to consciously familiarize themselves with the use of a cell phone, as some of them came into contact with one as children. Learning to use it was an implicit process, and its integration into the social environment happened automatically.

In contrast, the older group came into contact with this technology in a much later phase of life and thus had to actively learn to use it. As opposed to younger users, therefore, older users have taken a more conscious and more reserved stance toward such devices and, accordingly, could not incorporate them unquestioningly into their everyday life. It is unclear whether older users feel forced to adopt this technology on account of social change, and thus feel the social pressure of the adjustment, or if they do it for purely subjective reasons. It should be proofed in a long-term study whether the use of technical equipment is a result of practical reasons or of social imitation motives.

It became clear at the same time that elderly use such equipment in a non-binging manner. This kind of communication is no substitute for a face-to-face communication, but support a face-to-face communication in an additional way. The reason for this could be the problem of handling technical equipment. But it may also be possible that the group of older users has the opinion that such type of communication is non-binding. Older users integrate technical devices differently in their daily routine [27].

Younger users use these devices, however, much more in the private and professional spheres. They carelessly share their

data in social media and thus show a far less critical handling of it. This may be due to early contact with technological media, but also because of the use of depth of young user.

C. Computers and the Internet

Here, too, implicit learning plays a role with younger people. For the most part, they consider the use of computers and the Internet to be a matter of course, and they integrate both into their lives accordingly. In contrast, the older group must actively learn to use this medium. Thus the younger respondents would be named “digital natives,” whereas the older respondents would be “digital immigrants” [7]. Accordingly it is difficult for older users to become accustomed to new media. It can be conjectured that the younger group in particular tries to retroactively reconstruct explanations for use that correspond to their current stage of life (professional environment / university studies). It is very unlikely that a majority of young users only began to use computers and the Internet in school or on the job.

Furthermore, one may question whether both groups refer to the same thing when they speak of depth of computer and Internet use. It seems likely that both groups refer to different depths of use and competence, since they are familiar with different functional depths of these devices. This may be explained by differences in technical language, which the subgroups do not share. One way of avoiding such difficulties would be to concretely ask how individual operations work on computers and cell phones.

Whether this is really the reason will be investigated in the long-term study. Moreover, it is questionable whether the type of data usage is equivalent. Elderly subjects mainly use the mail function, from what can be concluded that the communication with fellows is far more important as other functions [29]. For example searching for information is less important. In comparison, younger subjects use the internet for information searches and as communication tool.

VII. LOOKING FORWARD

One result of this study is that since 2008 no significant change regarding the use and acceptance of technical devices has occurred. Thus, the results of Jakobs et. al can be confirmed. However, the question of the depth of use could not be clarified. It is unclear in which extent and what way older users use technical devices. Therefore the long-term study will be investigated this question. Additionally it should be clarified which data is of interest for elder users during the use of technical equipment in general, and how they handle it. It also will be investigated if known technologies are being replaced by new ones, for example the computer through the tablet. Fields of interest include everyday life activity like shopping and traveling as well as more private once as personal health and wellbeing.

The results of this study should be further analysed with a focus on quantitative methods to allow the largest possible number of respondents to be questioned. The list of questions is currently being extended. The respondents should be distributed more broadly. Therefore, effort will be made to speak to a more representative social spectrum in order to arrive at a more

comprehensive catalogue of views. The study will be a trend study due to the high possibility of penal mortality within the participants group. To derive a more concrete picture of the possible shifts the trend study will be carried out repeatedly in a three year time frame. The point is to gain more profound insights into the elderly’s understanding of technology and the adoption of technology regarding to age.

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