# Use and acceptance of new technology by older people. Findings of the international MOBILATE survey: 'Enhancing mobility in later life'

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*M.Tacken, F.Marcellini, H.Mollenkopf, I.Ruoppila, Z.Széman. Use and acceptance of new technology by older people. Findings of the International MOBILATE survey: 'Enhancing mobility in later life'. Gerontechnology 2005;3(3):126-137.* Technology has become part of today's life. It constitutes a fundamental aspect of the environment also for older people who are not familiar with most of the new technologies. Is their use of technology based on certain abilities and is this related with such factors as income, lack of alternatives, past performance, or availability of equipment? **Methods** The MOBILATE 2000 database of a survey conducted in 5 European countries was aimed at the enhancement of out-of-home mobility of older people. The project offers data describing the use and acceptance of new technologies. Insight can be gained into the characteristics of users and non-users of more or less common technologies like ATM, ticket dispensers, and PIN payments. **Results** Findings show that in the present generation of people aged 55 years and older, the share of users for most technologies (PC, internet, electronic banking) is low, but these users are rather satisfied with these. Commonly available technologies like ATM or PIN-payment are used by many older persons. Their experiences are mostly positive. Ticket dispensers are most used by public transport users, but these machines are rather complicated even for the users. Apparently, elderly people feel barriers to start using new technologies. A high educational level, a high income, and a good health offer good conditions for overcoming these barriers.

**Keywords: technology, older people, ATM, ticket machine, PIN payment**

New technology and older people seem to be an inappropriate combination. The PC was not part of the daily work for many people aged over 55. In old age, the motivation to learn more of new technologies is rather weak. However, their introduction has become part of daily life. Bank offices reduce local branch offices often to

automatic teller machines (ATM); public transport installs automatic ticket machines for distributing tickets. Introduction of the chip card is imminent in parking automats and as a general solution for the variety in tickets and fares in different public transport modes. Cruise control and navigation systems are being introduced in the car. The introductions of such new technologies can be perceived as challenges. At the same time, several new developments may make some functions easier to use, also for older people. The chip card for payment in shops or public transport is easier than looking for change or for making the right choice in transport tickets. Electronic payment makes shopping easier and safer. New technology in cars and in traffic infrastructure makes car driving easier. Mobile phones offer more freedom and provide feelings of security, especially for older people with a frail health. Personal alarms enable people to live longer independently.

The European research project MOBILATE has focused on the enhancement of out-of-home mobility of older adults. Information has been gathered for the description and explanation of out-of-home mobility and the hindrances and opportunities perceived by the target group. Besides understanding out-of-home mobility, the project aimed at the development of new alternatives and at the improvement of external conditions. It also offers the opportunity to analyze the use of new technologies by older people. The objective of this paper is (i) to give a description of how older adults in five European countries actually use different kinds of technologies in daily life; (ii) to distinguish different types of users within the group of older adults; (iii) to investigate if new technologies have been used as alternatives for out-of-home mobility or how these can improve accessibility of daily facilities.

## OLDER PEOPLE AND DIFFICULTIES WITH NEW TECHNOLOGY: A STATE OF THE ART

### The role of technology in the daily life of older people

Technology may play a problematic role in older people's life[1]. In 2001, the Dutch Office of Social and Cultural Planning[2] summarized some of the threats of new technology, but also some opportunities. Many older people use the opportunities, but the number of users is lower than in the younger age group. In 1998, mobile phones were owned by 37% in age group 35-44 and by 10% in age group 75+; a PIN-card by 97% and 75%; PC by 74% and 5%, respectively. The presence of a PC is higher among men, the better educated, higher income and more-person households. Age has a major impact on PC availability. Over 50% of the older people experience problems in using a PC, a VCR, and a mobile phone. People, who are familiar with computers in their work, stay on as users after retirement. Eventually, most older people will find the way to the digital world. However, the introduction of ticket machines, automatic teller machines, etc. comes too fast for some of them.

In 1995, in the project entitled 'Keeping the Older People Mobile' [3], the conclusion was that older people made little use of new technologies such as ATM, ticket machines, and telephone cards. Age was the most important predictor of usage, followed by education and gender. In the more recent study "MOBILATE", age appeared again to be a relevant factor followed by residential location, education, and cognitive abilities[4]. The follow-up showed that the same people used more technologies 5 years later. Old age as such was not preventing the use of technology.

The American Association of Retired People (AARP) stated that the fear for an encompassing 'grey divide' proved to be

unfounded. A study showed a 300% increase in the reported online access among its members from 1997 to 2001. The 2004 report of the Pew Internet and American Life project[5] mentioned that just 22% go online, and that their enthusiasm for e-mail and search may inspire their peers to take the leap. On the other hand the report concludes that most seniors live far removed from the Internet, and that starting with new technology is a great step.

**The acceptance of new technology (unwillingly) by older people**

*Technology a new hindrance*

Older adults complain about having difficulties with user interfaces[6]. Dutch research reported in 2002 showed that half of older people did not use modern technology that could make life easier[7]. In the age group of people younger than 50 years, 72% of men were able to handle a computer versus 60% of women, but in the age group of 64 to 70 percentages were 28% of men versus 8% of women[8]. Information and Communication Technology (ICT) development put older people under pressure[9]. As the ability and the motivation to use new technology are strongly determined by work experience and education, this can lead to a new kind of social exclusion.

On the basis of the history of user interfaces, Docampo Rama[6,10] distinguished several 'technology generations', people who use and perceive new technologies differently. She emphasized the development from the directly controlled user interface (pressing buttons or turning a wheel) to the modern multi-layered menu-controlled devices. The difficulties experienced by people are related to generation and past performance rather than to age. Docampo Rama [10:p39] concluded, "…hidden interface layers put a considerable load on working memory… This is true for all age groups. In our experiments all age groups gradually overcame the difficulties."

Mollenkopf[11] described factors affecting acceptance and rejection of technical aids that hold for technological devices in general: (i) The fear of the new; (ii) Motivation for use; often a demand is lacking for this specific function or people are willing to try out; (iii) Ease of use lowers the difficulties people often feel; (iv) Advice, training, and encouragement are supportive. According to a German study: 'Everyday Technologies for Senior Households' (Sentha)[12], access of older people to modern technologies appears strongly dependent on income, education, experiences, and attitudes[13].

*Technology as a new opportunity*

Richonnier has summarized in the European MARTELL forum some ways technology can be helpful by supplying extra information needed for older people in the domains of transport, teleshopping, etc. Telematics also enables new approaches to care[14]. New technology will be useful to older people, both in road infrastructure (electronic information signs, route information, etc.) and in public transport systems (trip planning services, automated information kiosks, etc.), provided that the interface is appropriate[15]. ICT can also reduce the need for some everyday traveling. However, the first evidence suggests that changes in overall travel (kilometers traveled) will be minimal. Technology may also facilitate some conditions for integration: social communication, care, information and relaxation, participation in leisure activities, teleshopping, and outdoor mobility[11].

Knook[7] stated that no place is left for people who do not want to use new technology. Much equipment is not being developed as user-friendly as should be done. Many older persons are not motivated to learn new techniques. This is not

a problem of lacking learning abilities, but people don't see the need for them. But older people have no choice; one has to come along with the technology. A recent report[16] showed that the use of internet increased from 3% in 1998 to 34% in 2003 for people aged 65 to74 years. Other data show, however, that this increase seems to have slowed down recently[17].

### Understanding more of technology use by older people

We have insight in the actual situation on older people's use and acceptance of technology, but locally and segmented, and more descriptive than explanatory. Most attention goes to the role of technology in the home. Cullen and Moran[18] emphasized the role of technology in prolonging the independence of older people in the community care context. They focused their report most on assistive devices for in-home technology. They concluded that the quality of life could be improved by more widespread use of technological innovations and that the capacity of some of these innovations offers great promise for the future. In the MOBILATE study we focused on the relationship between technology and out-of-home mobility. Several technologies require mobility or they can play a role as substitute or facilitator of out-of-home mobility.

## METHODS

### Mobilate data as a source for analysis

The European project MOBILATE[19] interviewed 3950 people aged 55 years and older in urban and rural areas of five countries: Finland, (East and West) Germany, Hungary, Italy, and the Netherlands, in 2000. The national samples were randomly drawn from the respective municipality population registers. They were stratified by gender and age (persons aged 55 to 74 years and 75 years or older), with enough men and women of high age to enable an explanatory analysis. To correct for oversampling towards older persons and males, all descriptive and comparative analyses were weighted by the share of the respective age and gender groups in the selected regions. The selection for urban and rural areas was related to the countries, respectively: real countryside in Finland and Hungary and a non-urban area in the Netherlands; middle-sized cities ranging from an extensive Finnish town to compact German and Italian cities.

About 55% of the eligible sample was interviewed. In most countries (exception: East Germany), the response rate was higher in the rural (58%) than in the urban areas (about 52%). The main reasons for dropping out were: refusing without giving detailed reasons (23%), having no time (6%), or being not reachable (5%), and only a minor percentage (5%) of the possible participants mentioned health reasons. Age ranged from 55 to 98 years. Standardized questionnaires were used to

*Table 1. The use of new technologies by country (% using technology); source: MOBILATE survey 2000, N=3950, weighted; a = total realized sample in country; b = number of people using at least one technology; c = % of users of total sample: users*

| | Finland | East Germany | West Germany | Hungary | Italy | Netherlands | Total |
|---|---|---|---|---|---|---|---|
| Automatic teller machine | 65 | 89 | 79 | 3 | 22 | 77 | 66 |
| Electronic cash (PIN) | 35 | 37 | 32 | 61 | 19 | 79 | 41 |
| Ticket automat | 78 | 33 | 38 | 17 | 7 | 27 | 37 |
| Automatic admission | 37 | 10 | 32 | 0 | 93 | 16 | 35 |
| Mobile telephones | 63 | 16 | 12 | 32 | 32 | 40 | 32 |
| Card-operated phone | 16 | 23 | 39 | 28 | 37 | 36 | 30 |
| Internet | 18 | 2 | 3 | 1 | 6 | 13 | 8 |
| Telebanking | 6 | 3 | 3 | 5 | 2 | 6 | 4 |
| % Of total sample [c] | 83 | 73 | 77 | 16 | 75 | 75 | 67 |
| Total of users [b] | 508 | 562 | 574 | 95 | 451 | 465 | 2655 |
| N = total sample [a] | 610 | 768 | 750 | 605 | 600 | 617 | 3950 |

assess essential features of the (local) community and various kinds of activities and mobility. Demographic and health aspects, social networks, and personality were assessed as well. If available, internationally acknowledged measures were employed. We used the Digit Symbol Test as a measurement of working memory (indicating fluid intelligence); subjects had to replace a list of figures or digits by the appropriate symbols given in a basic model list (Nuremberg Age Inventory)[20]. Moreover, all people had to respond to a list of statements about the level of control they perceived (Locus-of-Control Scale)[21-22]. The project further made use of a trip diary, presenting the out-of-home activities of people of the day before the interview and the day after the interview; every weekday was covered in the data gathering.

People responded also to questions about the use of new technology. The first question asked people if they were using one of the listed technologies (*Table 1*). Much attention has been given to a translation in the local terminology. These technologies or services were not further explained except for "automatic admission systems (e.g. in swimming pools)" and "electronic cash (with PIN code)". A second question concerned the ease of using the respective devices. Another question assessed several technology-related leisure activities such as computer games, chatting, or internet use. We used these data for describing the present situation of technology use by people with different socio-structural background.

## RESULTS

### The use of a new technology by older people

Table 1 shows the order in which older people in several European countries use new technologies. In the row ' % of total sample ' the share of users of at least one technology is presented. In Hungary the use of new technology is lagging behind most: only 16% of the sample is using at least one of the new technologies.

The Automatic Teller Machine (ATM) is used to get cash money and the PIN-payment is an alternative for cash payment. The bankcard with Personal Identification Number is used for payments in shops, for instance. Paying with PIN-code (or electronic cash) is very common in Hungary, with 61% of the users. Finland has the highest use of technology with 83% of the sample. Ticket automat, ATM, and mobile phones are very common. The other countries have about the same share of users, but the technologies are different. In general, the ATM is the most common technology, except for Hungary and Italy. In Italy, automatic admission systems are most common. Internet browsing and telebanking (not defined: by telephone or by computer) are less common. The largest

*Table 2. Users (%) of new technologies by strata of the sample; source: MOBILATE survey 2000, N=3950, not weighted*

| | Urban | | | | Rural | | | | total |
|---|---|---|---|---|---|---|---|---|---|
| | 55 - 74 | | 75+ | | 55 - 74 | | 75+ | | |
| | Male | Female | Male | Female | Male | Female | Male | Female | |
| Automatic teller machine | 72 | 67 | 50 | 40 | 70 | 72 | 54 | 52 | 63 |
| Electronic cash (PIN) | 48 | 39 | 23 | 22 | 44 | 41 | 27 | 30 | 37 |
| Ticket automat | 42 | 47 | 39 | 39 | 25 | 30 | 31 | 34 | 36 |
| Automatic admission | 38 | 41 | 40 | 36 | 29 | 26 | 24 | 15 | 33 |
| Mobile telephones | 42 | 29 | 26 | 16 | 33 | 27 | 18 | 15 | 28 |
| Card-operated phone | 31 | 33 | 18 | 15 | 30 | 36 | 13 | 16 | 27 |
| Internet | 14 | 8 | 4 | 2 | 6 | 4 | 2 | 1 | 6 |
| Telebanking | 5 | 3 | 3 | 4 | 6 | 1 | 2 | 0 | 3 |
| % of total sample | 84 | 80 | 60 | 50 | 71 | 66 | 47 | 34 | 63 |
| Total users | 458 | 424 | 265 | 229 | 390 | 365 | 206 | 149 | 2486 |
| Total sample | 545 | 532 | 440 | 456 | 547 | 551 | 440 | 439 | 3950 |

percentage of internet users can be found in Finland and in the Netherlands with, respectively, 13 and 16%. Telebanking is the least common technology. The use of it can be rather complicated for people who are not used to computers or to internet or to computer controlled telephones. However, with disappearing bank offices, this facility can become very useful for people.

When differentiating by age and gender, the percentages show that older people (75+) use less of all these technologies than younger elders (55 - 74) and that women use them less than men (*Table 2*). Ticket automats are used more by women, the more frequent users of public transport, and the same relationship can be seen for card-operated phones. These data show clearly that gender and age are important predictors for the use of new technology. We have to be aware of the typical composition of the older age group: mostly women, declining health, living alone, lower income, lower education, less cars and less driving licenses. This mixture of characteristics is a determinant for the role age will play.

The most common technologies used are ATM, PIN-payment, and ticket machines.

*Table 3. Logistic regression (by SPSS23) for the use of ATM, ticket dispenser and PIN-payment (1=use of technology); Significance based on Wald statistic and exp (B)= odds ratio of the row independent with the dependent; source MOBILATE 2000, N=3950, weighted*

| | ATM | | PIN payment | | Ticket automat (selection of users of public transport) | |
|---|---|---|---|---|---|---|
| | Sig. | Exp(B) | Sig. | Exp(B) | Sig. | Exp(B) |
| **Gender**, 0= male and 1= female | 0.46 | 1.07 | 0.12 | 1.15 | 0.63 | 0.95 |
| **Age**, number of years | 0.00 | 0.97 | 0.00 | 0.97 | 0.00 | 0.98 |
| **Education**, years of education | 0.00 | 1.11 | 0.00 | 1.08 | 0.01 | 1.04 |
| **Household size**, 0= alone, 1= more than 1 | 0.10 | 0.84 | 0.00 | 0.72 | 0.78 | 1.03 |
| **ADL-scale**, number of problems with Activities of Daily Living (sum-score 0= no problems, 20= many problems) | 0.00 | 0.94 | 0.00 | 0.95 | 0.00 | 0.95 |
| **Urban (0) or rural (1) location** | 0.00 | 0.66 | 0.08 | 0.85 | 0.73 | 1.04 |
| **Working memory**, Digit Symbol Test: a method for measuring the cognitive functioning (number of correct substitutions (0 to maximum 67) | 0.00 | 1.03 | 0.00 | 1.03 | 0.00 | 1.02 |
| **Income**, 0= low or middle and 1= high (income groups in each country divided in 3 more or less equal parts of one third of the sample) | 0.00 | 0.23 | 0.00 | 0.53 | 0.00 | 0.40 |
| **Physical mobility**, 0= not or moderately active and 1= (very) active (the sum-score of 10 statements concerning Activities of Daily Living, for instance: climbing stairs 0=without difficulty, 1= with difficulty, 2= can not) | 0.01 | 1.43 | 0.85 | 0.98 | 0.68 | 1.07 |
| **Self rated physical mobility**, 0= very poor and moderate 1= (very) good | 0.85 | 1.02 | 0.00 | 0.68 | 0.01 | 1.36 |
| **Security feeling during day**, 0= (very) insecure or moderately secure and 1= very secure | 0.00 | 0.69 | 0.14 | 0.84 | 0.47 | 1.10 |
| **Security feeling during night**, 0=(very) insecure or moderately secure and 1= very secure | 0.16 | 1.18 | 0.04 | 0.79 | 0.92 | 1.01 |
| **Constant** | 0.00 | 6.25 | 0.53 | 1.35 | 0.21 | 2.03 |
| **Improved prediction** | from 51% to 73% | | from 71% to 73% | | from 61% to 67% | |

For each of these we used a logistic regression to analyze the characteristics that contribute most to differences in the use (*Table 3*). With this we show how much the prediction of the use of a specific technology will be improved by knowledge about several background variables. It depends on the odds ratio >1 or <1, if the odds of the dependent respectively will increase or decrease. This analysis gives more insight in the characteristics of the users of new technology.

Income plays a major role. The odds, by SPSS expressed in Exp(B), for using ATM decrease with 77% (1-exp(B) = 0.23), when the high-income level goes to medium or low. The impact of the educational level is also significant: an increase of the educational level with one year means an increase of odds of 11% for using ATM. This finding is rather similar with the conclusion of Mollenkopf and Kaspar[13] based on the Sentha study, in which income and education appeared to be very important for explaining equipment and use of technology. De Klerk[2] also found that education and income are relevant variables for the use of technology. A high income makes most technologies better affordable. A high level of education can mean that people had better opportunities or cognitive abilities to get familiar with comparable techniques. The higher the score for cognitive functioning as measured by the Digit Symbol Test, the more the odds for using ATM increased. On the other hand also physical functioning (ADL-scale) played a role. The odds of using an ATM increase with a higher ADL-score and a higher activity level. Age had a relevant effect on using such machines: a change of one year leads to an increase of odds of 3%. Age could also play an intermediary role. The odds for using an ATM decreased with each year people got older. The present older generation often has less income and less education. At the same time the physical abilities and cognitive abilities decrease with age.

Further, the type of residential area influenced the use of ATMs. A switch from urban to rural location decreased the odds on using an ATM with 34% - possibly because ATMs are less available in the countryside. The feelings of security during the day played also a role in the choice for using ATMs. Income level and self-rated physical mobility influenced the odds for the use of the PIN-payment. Again age played a major role. The change in odds was rather small but with a great difference in years this is important. The same can be said for the cognitive functioning: with an increase the odds of using PIN-payments grew.

The use of ticket dispensers is typical for public transport. This can also be seen in the fact that 83% of the users were also users of public transport, compared to 53% of the non-users. Therefore, the same analysis was made for public transport users. In this subgroup the role of self-rated physical mobility was very relevant. One needs a good physical condition to participate in public transport. Income also influenced the odds for using ticket dispensers. People with a high income used these devices less often due to their lower usage of public transport.

**Individual use of specific technologies**

The number of techniques used per person (*Table 4*) offers a more comprehensive view on the individual variety in the use of technologies.

*Table 4. Mean number of technologies used per person in five European countries; Source: MOBILATE survey 2000, N=3950, weighted; See Table 1 of the list of technologies*

| | Finland | Germany East | Germany West | Hungary | Italy | The Netherlands |
|---|---|---|---|---|---|---|
| Technologies used | 2.7 | 2.1 | 2.4 | 0.2 | 1.6 | 2.2 |

The difference between Table 1 and Table 4 is that in Table 1 all people who have used at least one of the technologies are included, while in Table 4 also the variety in the use of the several technologies is taken into account. This shows clearly the low use in Italy and the minimal use in Hungary. An ANOVA analysis with Bonferroni test (comparison of means in all pairs, level of significance divided by number of comparisons[23], table not added) shows that most countries differ significantly ($p<0.01$) from the others except East and West Germany, both parts of Germany with the Netherlands, and West Germany and Finland. This means that the northern countries are most similar.

The data presented in Table 5 confirm the findings displayed in Table 2: urban people used more technologies than their rural contemporaries. Furthermore, young-old people used more different technologies than older people and men used a greater variety of technologies than women. The significances added in Table 6 show the differences between subgroups. Most differences in the younger age groups are significant. Among the older age groups some differences are not significant.

As could be seen for the individual technologies, the level of using these devices is higher with higher education, often going together with higher income, which is needed for some new technologies such as internet: the purchase of a computer and the costs of telephone or cable connection. Table 7 makes clear indeed that both variables have effects on the use of technologies. The higher the income or education, the more different technologies are used. The effect for education stays when controlled for income. The relationship with income is slightly higher; especially, low income has the most negative effect: apparently one needs enough money to get access to several new technologies as computers, mobile phones, internet, etc. People with a low educational level and low-income use 0.5 technologies on average and people with a high level on both use 3.2 technologies (not shown in a table). This relationship with education

*Table 5. Mean number of technologies used per person by different strata of the sample; Source: MOBILATE survey 2000, N=3950, weighted*

| | Urban | | | | Rural | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | 55 - 74 | | 75+ | | 55 - 74 | | 75+ | | |
| | Male | Female | Male | Female | Male | Female | Male | Female | |
| Technologies used | 2.5 | 2.2 | 1.4 | 1.0 | 1.9 | 1.8 | 1.0 | 0.7 | 1.7 |

*Table 6. ANOVA Bonferroni test of the number of technologies used per person; * matrix of significances at a level of 0.05*

| | young urban male | young urban female | old urban male | old urban female | young non-urban male | young non-urban female | old non-urban male | old non-urban female |
|---|---|---|---|---|---|---|---|---|
| young urban male | X | * | * | * | * | * | * | * |
| young urban female | * | X | * | * | .23 | * | * | * |
| old urban male | * | * | X | 1.00 | * | .88 | .38 | * |
| old urban female | * | * | 1.00 | X | * | * | 1.00 | .15 |
| young non-urban male | * | .23 | * | * | X | .09 | * | * |
| young non-urban female | * | * | .88 | * | .09 | X | | * |
| old non-urban male | * | * | .38 | 1.00 | * | * | X | 1.00 |
| old non-urban female | * | * | * | .15 | * | | 1.00 | X |

*Table 7. Average number of new technologies used per person by level of education and income; source: MOBILATE survey 2000, N=3950, weighted*

| | Education | Income |
|---|---|---|
| Low | 1.0 | 0.6 |
| Medium | 1.8 | 1.9 |
| High | 2.6 | 2.7 |

suggests that intellectual capacity plays a part in acceptance and implementation of new technology. A similar tendency can be found in the relationship between the results of the Digit Symbol Test and the use of technology. The quite high correlation of 0.44 between both shows that this cognitive functioning offers a good condition for using technology.

A regression analysis with some background variables summarizes the conclusions on the use of the separate techniques. Income level, self-rated physical condition, and age play a major role for the use of different technologies. Cognitive abilities are also a significant factor: a basic level is needed to memorize PIN and to understand the instructions. Gender is not a significant explanatory factor.

With SPSS Answer tree we formed several subgroups, which have a maximal contrast on the variety of technology use as dependent variable. The explanatory variables concerned are: age in 4 categories; gender, urban or rural; income in 3 categories; health (summarized in four categories composed from self-rated physical mobility, ADL-scale and activity level). The subgroup with the highest use of technology (n= 198; mean of 3.8 different technologies) was defined by high income, young age (55 - 64), and high education. The group with the lowest use of technology (n=146; mean of 0.1 technology used) consisted of people with poor health, older than 74, and a low income. The largest subgroup (n=241; mean 2.2 different technologies) consisted of people with high income, younger than 74 years, and with moderate health condition. The total decision tree showed that income is the most important variable, followed by age and education. Health and gender play a role in the lowest level. These findings fit very well with the conclusions of other researches[2,13], in which also education and income played a major role, and gender and age a minor role.

**Technology as substitute for deficiencies of older people**

New technologies can be used as alternatives for existing activities or as additional possibilities to access spatial functions. People could use ICT to compensate for physical deficiencies. They can use the Internet or mobile phones in order to stay or get in contact with other people. They can use them as alternative alarms in out-of-home activities etc. Teleshopping could be used as an alternative for difficult access to shops. Research has offered evidence that mobility-restricted people are main users of teleshopping, mainly by using the telephone as communication medium[24]. However, a first general analysis of the relationship between health and the variety of the use of technology showed no indication for this substitution effect, even when controlled for age. In fact, people in poor health used mobile phones and Internet even less than people in good health. In general, the use of technology per person decreased with declining health conditions (persons with poor health used 0.7 technologies and those with very good health used 2.9).

So, in the present generation of older people we do not find any indication for substitution of physical action or contact by digital means. This can be a specific generation effect: people with poor health have on average a high age and they are not familiar with the newer technologies. We saw the contrary relationship: the more active people are, the more they use these technologies. People who were active with the Internet or with chatting and computer games used more different technologies (4.9) than people who did neither one of these activities (1.9). At present, the use of technology seems to be more influenced by income, age, and education than by compensation of physical shortcomings. Furthermore, correlation analysis showed that a higher variety of technology use

goes significantly more together with an internal locus of control (Pearson correlation of 0.12) and less with an external locus of control (Pearson correlation of -.20)[21,25]. These correlations are not very high considered the sample size, but they show a slight tendency that technology users have stronger feelings to control their own life and that they feel less controlled by external circumstances, both by powerful others or by fate or chance. This tendency remains when controlling for education.

**Experiences with the use of new technologies**

The use of a technology is often evoked by external developments: branch offices of banks and post offices are closed and the cash dispenser (ATM) is the only alternative. Machines replace ticket booths. Parking fees can only be paid by chip card in ever more localities. Paying by PIN-code has created more public safety by reducing the need for cash money. How do older people perceive this development? In the MOBILATE survey the users of specific new technologies were asked whether this technology makes life easier or more difficult for them.

*Table 8. The perception of new technology by users of these techniques (% of users of each technology); source: MOBILATE survey 2000, N=3950, weighted. Question asked: Do you enjoy using automated machines because they make your life easier or do you think that they make life more difficult for you? Or do they make no difference in your life whatsoever?*

| | Enjoy, easier | Use, but difficult | No difference | Total number of users |
|---|---|---|---|---|
| Automatic teller machine | 83 | 6 | 11 | 1715 |
| Electronic cash (PIN) | 87 | 4 | 9 | 1065 |
| Ticket automat | 70 | 13 | 17 | 954 |
| Automatic admission | 71 | 8 | 22 | 921 |
| Mobile telephones | 85 | 4 | 11 | 830 |
| Card-operated phone | 69 | 9 | 22 | 782 |
| Internet | 81 | 6 | 14 | 199 |
| Telebanking | 84 | 5 | 10 | 99 |

Table 8 shows in descending order the use of these technologies and how people perceived these new techniques. Most users (69-87%) enjoyed them and they perceived these as making life easier. In particular, users experienced PIN-payments, mobile phones, telebanking, and ATM as making life easier. Card-phones, ticket machines, and automatic admission got the lowest scores. Ticket automats for public transport were perceived as most hard to use. One has to choose a destination, number of trips, fare, etc., which has to be done by pushing many buttons in the right order or by using several screens in different levels. In general, the findings confirm similar experiences of previous studies[2,6]. The Pew report[5] stresses also that once seniors get online, they are just as enthusiastic as younger users.

## DISCUSSION AND CONCLUSION

Most of the assumptions on the use of technologies by older adults, as stated in the introduction, have been confirmed by the MOBILATE data. The usage of some of the new technologies by older people is really low; especially people with low income and a low education level use new technologies less than people with a high income or a high education. Furthermore, access to some of the new technologies is rather expensive for a number of older people. The costs of a PC or the costs of using a mobile phone are relatively high.

Another important precondition for using new technologies is the cognitive abilities of older adults, which may decrease at high age. In a logistic regression of the usage of some new technologies the role of these variables could be traced. On the one hand cognitive abilities, education, and income are relevant factors; on the other hand the physical access of these equipments also plays a role. Age seems to be a kind of intervening variable in which is reflected a reduction of abilities by old age. Also we

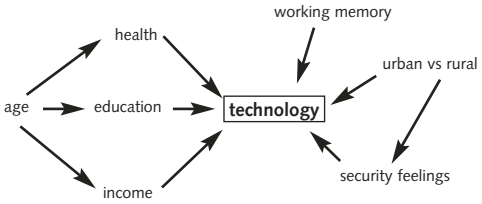


*Figure 1. Model of the relation between variables relevant for the use of technology*

observed that a generally introduced technique like Automatic Teller Machines is widely accepted by older people in some countries. The other techniques are - up to now - less common and in some countries rarely used: for instance automatic admission in Hungary or Internet and telebanking in most countries.

The analysis gives indications for a model of the use of technology (*Figure 1*). The levels of health, education, and income filter the role of age. Poor health, low income, and a low educational level can typify the oldest age group. Working memory plays also a role. The location of residence (urban or rural) offers better or worse conditions for the use of technology, partly filtered by the security feelings people have.

We did not find any support for the hypothesis that older people use new techniques as a substitute for physical deficiencies. Very unhealthy people used fewer technologies than people of good health. Some relation with physical problems, which people experience in using technologies, may be a part of the explanation: the accessibility of ATMs is often difficult for impaired people, the size of buttons may create problems, or the speed of the process is too fast for some people. Public transport can constitute high barriers for impaired or disabled people.

One may expect that the experience with the use of new technologies and an adequate motivation - based on experienced advantages - are good conditions for the continuation of this use. Older people can learn to handle new techniques. They have difficulties, are less familiar by former work experience with these techniques, but once overcome, they can be enthusiastic users as shown by the increase of internet use.

The most promising finding for the future was that users are mostly happy with the new technology once they have started using it. They experience the devices as 'making life easier'. This may justify that new technologies be introduced, even when at the start objected to by older people. However, introduction should be careful and tailor-made[2]. Based on the available knowledge and on our findings we agree with Knook[7] that technology is part of life and in general no invincible impediments exist for older people in using new technologies. In the present generation income, education, and health constitute real impediments, but one may expect that a coming generation will have more income, better education, and a better health condition at the same age, as shown in a recent Dutch report[2].

More general points of discussion could be the representativeness of the list of technical applications. We have composed a list of technologies that we expected to be available in the participating countries. We are aware of the differences between countries in access and availability of these applications. But, we expect that this has more effect on the regional use than on the explanation of the use.

The findings are certainly context-bound. Environmental pressures to use these technologies and environmental possibilities learning the use of these applications are different between countries. We found, however, that the structural preconditions were similar in all regions.

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**References**

1. Delaunay P, Toucas V. Gérontologie et nouvelles technologies. In: Guerci A, Consigliere S, editors. Living Old Age: Western World and Modernization. Genova: Erga edizioni; 2002; pp145-149
2. Klerk M de. Rapportage ouderen 2001, veranderingen in de leefsituatie (Report of older people 2001, Changes in life situation). The Hague: SCP; 2001
3. Marcellini F, Mollenkopf H, Spazzafumo L, Ruoppila I. Acceptance and use of technological solutions by the older people in the outdoor environment: findings from a European survey. Zeitschrift für Gerontologie und Geriatrie 2000; 33(3):169-177
4. Marcellini F, Marcucci A, Freddi A. Older people's acceptance and use of technological devices in everyday life. In: Guerci A, Consigliere S, editors. Living Old Age: Western World and Modernization. Genova: Erga edizioni; 2002; pp150-163
5. Fox S. Older Americans and the Internet, Pew Internet & American Life Project: Washington D.C. 2004; www.pewinternet.org/reports/pdfs/PIP_Seniors_Online_2004.pdf
6. Docampo Rama M. Technology generations handling complex user interfaces, PhD Thesis University of Eindhoven; 2001
7. Kuiper I. Je moet wel met je tijd meegaan (One has to cope with the present). Special of Nestor, Journal of KBO; 2002;50/6:24-27
8. Brouns M. Leeftijd en sekse in een digitale wereld (Age and gender in a digital world). FACTA 1998; 6: 6-8
9. Rijsselt R van, Weijers T. Uitsluiting van ouderen - de dreiging verkend - (Exclusion of older people, the thread explored). The Hague: Rathenau Institute; 1995
10. Docampo Rama M, Ridder H de, Bouma H. Technology generation and age in using layered user interfaces. Gerontechnology 2001;1(1):25-40
11. Mollenkopf H. Assistive Technology: Potential and Preconditions of Useful Applications. In: Charness N, Schaie KW, editors. Impact of Technology on Successful Aging. New York: Springer; 2003; pp 203-214
12. Mollenkopf H, Meyer S, Schulze E, Wurm S, Friesdorf W. Technik im Haushalt zur Unterstützung einer selbstbestimmten Lebensführung im Alter - Das Forschungsprojekt "Sentha" und erste Ergebnisse des Sozialwissenschaftlichen Teilprojekts (Technology to help older people maintain an independent household). Zeitschrift für Gerontologie und Geriatrie 2000; 33(3):…-….
13. Mollenkopf H, Kaspar R. Attitudes to technology in old age preconditions for acceptance or rejection. In: Guerci A, Consigliere S, editors. Living Old Age: Western World and Modernization. Genova: Erga edizioni; 2002; pp134-144
14. Richonnier M. Telematics and the older citizen, MARTELL forum Technology for the older citizen, 7 November 1995, Brussels (grey paper);
15. OECD. Ageing and Transport; Mobility needs and safety issues, Paris: OECD, 2001
16. Haan J de, Klumper O, Steyaert J, editors. Surfende Senioren; kansen en bedreigingen van ICT voor ouderen, (Surfing seniors, opportunities and threats of ICT for older people). Den Haag: Academic Service; 2004
17. Doh M. Trotz hoher Zuwächse bei 50plus bleibt ‚digitale Kluft' zwischen alt und jung bestehen. URL: http://www.digitale-chancen.de/content/stories/; Accessed April 26, 2004
18. Cullen K, Moran R. Technology and the older people, the role technology in prolonging the independence of the older people in the community care context. Brussels: Commission of the European Communities, DG Science, Research and Development, FAST research report; 1992
19. Mollenkopf H, Marcellini F, Ruoppila I, Széman Z, Tacken M, Oswald F, Wahl H-W. The MOBILATE Project - Enhancing Outdoor Mobility in Later Life. Final Report. Heidelberg: German Centre for Research on Aging (DZFA), 2003
20. Oswald W, Fleischmann U. Nürnberger-Alters-Inventar (NAI)( Nuremberg Age Inventory), Zahlen-Symbol_Test G. Nuremberg: Universität Erlangen; 1986
21. Smith J, Marsiske M, Maier H. Differences in control beliefs from age 70 to 105. Unpublished manuscript. Berlin: Max-Planck-Institute for Human Development, 1996
22. Kunzmann U. Being and feeling in control. Two sources of older people's emotional well-being. Berlin: Max-Planck-Institut für Bildungsforschung, 1999
23. Vocht Ade. Basis handboek SPSS 10 voor Windows (Basic manual SPSS 10 for Windows), Utrecht: Bijleveld; 2000
24. Tacken M. Effects of Teleshopping on the Use of Time and Space. Transportation Research Record #1285, Washington: Transportation Research Board, 1990
25. Kunzmann U. Being and feeling in control. Two sources of older people's emotional well-being. Berlin: Max-Planck-Institut für Bildungsforschung, 1999