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Attitudes of Elderly Austrians towards New Technologies - Communication and Entertainment versus Health and Support Use

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Attitudes of Elderly Austrians towards New Technologies - Communication and Entertainment versus Health and Support Use.

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We use a representative survey from Austria to investigate attitudes towards new technologies in information and communication technology (ICT). The technologies can significantly facilitate the daily lives of an aging population. Our main results indicate that strong gender differences in attitudes towards new technologies exist: men value communication and entertainment devices more, whereas women's attitudes are more positive towards devices that include a specific health or support value. Furthermore, while older cohorts value entertainment devices less than younger ones, no such pattern exists for health and support systems.

Johannes Kepler University of Linz, Austria. The study uses data from SHARE, The Survey of Health, Ageing and Retirement in Europe (for methodological details see Börsch-Supan et al., 2013) that is funded by the European Commission and various national funding sources (see www.share-project.org). The authors thank the Federal Ministry of Science, Research and Economy and the Federal Ministry of Labour, Social Affairs and Consumer Protection for funding the SHARE research infrastructure in Austria as well as the Austrian Christian-Doppler Society. Rudolf Winter-Ebmer is affiliated with IHS, Vienna.

A Introduction

Information and communication technology (ICT) can potentially facilitate the daily lives of an aging population. Several technological innovations were proposed and tested in prototypical situations in the domain of communication and entertainment as well as in situations in which individuals require help in health-threatening situations. There is a paucity of systematic studies on the attitudes of elderly individuals above 50 years of age towards such technologies, and thus we investigate the same by using a representative survey on individuals 50+ in Austria (SHARE, The Survey on Health, Ageing and Retirement in Europe).

The statement of technological possibilities, such as robots working and serving in nursing homes or artificial intelligence providing automatic language translation between nurses and patients (to name just two recent examples), is not sufficient to initiate the broad implementation of such technologies[1]. Specifically, with respect to individuals in older age groups, technological scepticism prevails, and the usability of new technologies is an important issue.[2] One of the biggest obstacles to the introduction of the aforementioned types of technological innovations is undoubtedly the personal attitude of aging individuals and their willingness to confront new technological devices. Our study examines differences in attitudes between communication and entertainment uses as well as in health and support use. It is expected that aspects related to increased age and health limitations as intervening factors will be important.

In an environment with a growing old-age dependency-ratio, not all individuals are able to request or afford personal assistance whenever required. New technology potentially offers solutions in cases of still highly autonomous individuals or couples, who nevertheless require a certain amount of assistance or supervision in their daily living activities. The objective of resorting to new technologies primarily corresponds to enabling these individuals to continue their daily activities and lives for as long as possible independently, while ensuring that they are offered the necessary technological assistance to cope with their (personal) needs. Technology potentially offers a solution for increasing the quality of life of elderly persons while relieving social systems from (some of) demographic pressure. Our main results indicate that gender differences exist in attitudes towards new technologies: men value communication and entertainment devices more, whereas women's attitudes are more positive towards devices that include a specific health or support value. Furthermore, although older cohorts value entertainment devices less than younger ones, no such pattern exists for health and support systems.

B Previous research

The existing literature typically either focuses on the use of communication and entertainment technology in the context of elderly workers or on the usability of mobile health (mHealth) systems, which are "handheld (or wearable) transmitting devices with multi-

[1] See e.g., Joe and Demiris (2013) for a review of feasibility studies of the use of mobile phones for health: most of the studies use samples involving 10–20 individuals.

[2] See e.g., Grindrod et al. (2018) for an example of usability problems in authentication options for mobile phones for older adults.

functional capabilities used to store, transmit, and receive health information" (Richardson and Reid, 2013). The mHealth systems were experimentally tested in the general population albeit less for individuals in the older age group.

Gell et al. (2013) analyzed data from the U.S. 2011 National Health and Aging Trends Study (NHATS) with approximately 8000 observations 65+. The main purpose was to determine patterns fostering the use of communication technology such as email, internet, and text messaging. Based on their results, the use of technology is related to age, gender, race, educational level, and marriage status. Young age, male gender, white race, higher education, and being married are correlated with increased use of technology. The use of technology decreases significantly with physical and mental limitations.

Another survey termed as GASEL (Gamified Services for Elderly) was implemented in northern Finland during the winter of 2014/15. The authors Keränen et al. (2017) examined the use of information and communication technologies (ICT) in the context of frailty, which is an indicator for health and independence. They examined disparities in internet usage between individuals with different frailty levels. Their results indicate that frail individuals are less likely to possess access to internet (80% non-frail, 70% pre-frail, and 46% frail individuals enjoy internet connections at home). Frail individuals are also less likely to use tablets or smartphones. The individuals that continue to use the same experience more difficulties when compared with non-frail individuals. Age is significantly negatively related with internet usage and use of tablets and smartphones. Higher education positively affects the use of information and communication technologies. Significant gender differences were not observed in the aforementioned Finnish study.

Vorrink et al. (2017) established that technology use (for e.g., broad variety of 33 technological items: computer, fax, smartphone, mobile phone, tablet, email, navigation system, video phone, e-reader, and fitness device.) is negatively associated with age, lower education, lower social status (income), and lower physical functioning. With respect to gender and employment status, significant effects were not observed. Their sample is based on Dutch respondents over the age of 65 years. Ma et al. (2016) investigated personal factors affecting the acceptance of smartphone technology by older Chinese adults. Unfortunately, the sample was constrained to individuals below the age of 65 years.

Keränen et al. (2017) also analyzed attitudes towards mobile information and communication technologies (ICTs). They established that frail nonusers of mobile ICT exhibit a more adverse attitude towards the aforementioned technologies than nonusers with good health. Czaja and Lee (2007) conversely indicated that older individuals are generally ready to use the advantages of new technologies. However, this is not observed in reality and is mainly due to usability issues and availability of support. Cognitive functioning plays a crucial role. Generally, older individuals encounter more difficulties in learning new issues.

Mostaghel and Oghazi (2017) highlighted the importance of usefulness and ease of use of new technologies in terms of the acceptance by elderly individuals. They analyzed 800 individuals 60+ in Sweden and observed that the ease of use of technological devices is significantly related to - mainly - age-related factors although unease towards the usage

of new technologies, cognitive ability, and the ability to follow instructions appear as the strongest drivers in both directions. Comfort and cognitive ability increase the ease of use and this also applies to the ability to follow instructions that also increases the perceived usefulness of a technology.

Chopik (2016) used data from the Health and Retirement Study (HRS) in the United States in 2012 to investigate technology use for social connection, such as email, social networks, video or phone calls or smartphones, and health relations. In the HRS, older adults exhibit generally a positive attitude towards new social technologies. The study indicated that social technology use is associated with better health and well-being. They indicated loneliness as a mediating factor and argued that the elderly benefit from technology use because it decreases loneliness by simplifying communication. The findings are in line with those of another study on a smaller sample: Morton et al. (2018) investigated whether Internet connectivity and training in its use for social purposes support the well-being of older adults receiving care. The results indicate that Internet access and training support the self and social connectedness of vulnerable older adults and contribute positively to well-being.

Studies in mHealth are generally concerned with feasibility issues and initial effectiveness of the applications. Flores Mateo et al. (2015) provide a meta-analysis of 12 studies on mobile phone apps to promote weight loss. These studies are typically clinical studies, are relatively small in size, and concentrate on the adult (non-elderly) population. A majority of the studies indicated that such mobile phone apps contribute to weight loss. Similarly, Hall et al. (2015) examined 15 studies – or even meta-studies – on the impact of mobile text messaging for health and obtained typically positive effects. The study mainly concentrates on prime-age individuals, and thus is not informative with respect to the aging issue. Kuerbis et al. (2017) provide a recent review of relevant issues of mobile technology and older adults in terms of mHealth; the study concentrates on feasibility issues, and thus age gradients are not involved.

In a more recent study, Castro Sweet et al. (2017) report the outcomes of a digital health program combined with human coaching for reducing risk for diabetes. In a sample of 501 medicare participants, digital health training was combined with human coaching for promoting weight loss. In the study, participants achieved high levels of interaction with digital program features. The level of weight loss achieved among those interested in and willing to use the digital program features clearly exceeded the benchmark set by the CDCs National Diabetes Prevention Program. Although their sample potentially suffered from a certain bias, the outcome suggests that the program successfully modified the targeted health behaviors as intended.

There is a paucity of specific or large scale quantitative analysis on the attitude towards or acceptance of technological security devices. However, numerous qualitative and small application studies indicate that the acceptance of the systems is considerably high (see e.g. Feldwieser et al., 2016; Claes et al., 2015). Tracking systems are often used as a back-up to determine an individual with dementia in the case of wandering. The system is specifically important to care givers as a back-up. White et al. (2010) indicated that it is often not elderly individuals themselves who decide to use the advantage of a GPS-

tracking system.[3]

C Data and Sample

Data for the study stem primarily from the SHARE Wave 6 survey in Austria. The Survey of Health, Ageing and Retirement in Europe (SHARE) is a multidisciplinary and cross-national panel database of micro data on health, socio-economic status, and social and family networks of more than 120,000 individuals aged 50 years or older (more than 297,000 interviews). SHARE currently covers 27 European countries and Israel. The 6th wave of SHARE was implemented from January to September 2015. In Austria, 3.402 individuals were re-interviewed in the longitudinal wave. Additionally, a country-specific paper-and-pencil questionnaire was implemented and covered several questions including two questions that focus on respondents' attitudes towards and use of new technologies.

The paper-questionnaire was created by the authors with a partial focus on questions with respect to technology usage of an aging population.[4] It was designed and implemented exclusively in Austria. The 3.103 respondents aged 50 years or older returned the national paper-questionnaire after the main interview was completed, and this resulted in a response rate of over 90%, and the probability weights are also available for a total of 3085 respondents. This results in a sample size of 3085 that is used for the analysis. The average age is 69 years, and 59% of respondents are women.

SHARE is a panel survey. Sampling errors, non-response, and panel attrition therefore bias the representativity of the panel. In order to avoid the aforementioned problems, data was weighted with calibrated individual probability weights from the 6th wave of SHARE (Börsch-Supan and Malter, 2017). According to the principles laid out by Solon et al. (2015), analysis beyond descriptive statistics is generally implemented both in a weighted and unweighted manner to control the model-misspecification and possible heteroskedasticity of the independent variables due to unobserved group-level factors.

D Methods

D.1 Variables

The main data for the study originates from questions of the paper-and-pencil-questionnaire from the SHARE wave 6 survey in Austria. We asked respondents if they were aware about a few new technological devices or innovations and asked questions on the respondents' attitudes towards the same. With respect to the question on attitudes towards new technologies, respondents were asked to rate 11 different new technologies by selecting 8 given different statements. The different technologies are as follows: Tablets, Smartphones, Social Networks, Voice-Controlled PCs, Emergency Tracking Systems, Auto Fall Alert devices, Personal Alarms, and Auto Cooker Control systems. Each new technology was

[3] See also Landau et al. (2009)

[4] The paper-questionnaire can be accessed here: `www.share-project.org/fileadmin/pdf_questionnaire_wave_6/AT_EN_drop-off_w6.pdf`. All other data originate from SHARE waves 1 to 6, release 6.0.0.

evaluated with the following statements: 'I do not know this', 'I am already using this', 'I am open to this', 'This is/would be a great help for me', 'I find this daunting', 'I doubt that I would find this helpful', 'I am not interested in this', and 'I do not feel comfortable around this' (see Table 3). Multiple answers were possible.

The case of Emergency Tracking Systems offers a good example for a technological innovation assisting elderly and dependent individuals in their lives at home while relieving social institutions from demographic pressure. Assisted individuals wear a wristband with an emergency button, that connects them directly to a 24-hour call center. If individuals press the emergency button on their wrist band, they are contacted on a hands-free speakerphone. An ambulance (with keys) is dispatched in the case of confirmed medical emergencies or if the emergency contact for the assisted person is currently out of reach. Beyond their primary objectives as pure emergency devices, such tools are also promising for trimming down secondary aging effects, such as fear of falling (FOF), that can clearly reduce the quality of life for elderly individuals (Litwin et al., 2017). [5]

The data were successively enriched with demographic and other information collected during the standard SHARE interview. Our main focus was on demographic variables, such as age, gender, education (higher education entrance qualification), employment status (not employed/white-collar/blue-collar), living circumstances (living in urban/rural area, in a house/flat), and family context (living with a partner, having children), and also health related variables such as self-rated health and limitations in activities of daily living.[6] Table 5 in the appendix provides an overview of all the variables that are used.

D.2 Attitude-score

From the second question in the national paper-questionnaire that focuses on respondents' attitudes towards new technology devices, we built an attitude-score in the form of a dichotomous variable that assumes the value of 1 in case of a positive statement and 0 for negative statements. With respect to positive statements on the attitude towards new technologies, we count 'I am already using this', 'I am open to this', and 'This is/would be a great help for me'. Negative statements include 'I find this daunting', 'I doubt that I would find this helpful', 'I am not interested in this', and 'I do not feel comfortable around this'. The statement 'I do not know this' is kept neutral, and thus it is set to a missing value and excluded from our analysis. Furthermore, with respect to the cases in which respondents selected multiple responses, in our definition contradictory statements for the same item, the attitude-score was set as missing and such occurrences were excluded from our successive analysis.[7][8]

[5] In 2016, the Austrian Red Cross as the country's biggest operator solely operated more than 40,000 emergency response systems for assisted individuals. In comparison, the total number of beds in old-age and nursing homes in the country was slightly below 70,000.

[6] IADLs: Instrumental Activities of Daily Living (IADLs) include activities such as cooking, shopping, and driving.

[7] The number of excluded cases ranges between 10 and 52 for each technological device with an average of 28. Auto Cooker Control exhibits the lowest number of invalid answers, and Tablets correspond to the maximum number of invalid answers. In the first column of Table 3 details on 'do not know' answers are included.

[8] All analysis were performed by using statistical software Stata/SE 13.0 for Windows, 64-bit version. We analyze positive or negative attitudes towards new technologies (all of which are dichotomous outcome

Table 1: Rate of positive attitude by gender.

	Men	N	Women	N	All	N
Social Networks	0.31	1129	0.27	1552	0.29	2681
Voice-Controlled PC	0.34	1073	0.26	1464	0.30	2537
Tablet	0.55	1113	0.47	1506	0.51	2619
Auto Cooker Control	0.45	1047	0.58	1501	0.52	2548
Smartphone	0.63	1159	0.53	1588	0.58	2747
Tracking System	0.59	1093	0.61	1518	0.60	2611
Auto Fall Alert	0.58	1091	0.65	1568	0.62	2659
Personal Alarm	0.66	1109	0.72	1600	0.69	2709

The results indicate that Personal Alarm systems enjoy the highest sympathy by respondents over 50 years (69% positive score) and is followed by Auto Fall Alerts with 62% positive attitudes. Tracking Systems and Smartphones also enjoy significantly positive rankings with 60 and 58% positive attitudes, respectively. Auto Cooker Control and Tablets are slightly in the middle with 52 and 51% shares of positive attitudes, respectively, while Social Networks and Voice-Controlled PCs exhibit the least positive attitudes with 30 and 29%, respectively. Table 1 lists the results by gender.

Additionally, Figure 1 shows the attitude terms by gender. The results indicate a slightly more positive attitude towards entertainment applications by men and a more positive attitude towards health applications by women exist. See the next section for details about grouping of the tools.

Based on Figure 2, a very interesting age pattern exists. The results are derived from simple probit regressions where we only control for age and gender to predict aggregate age patterns. We observe falling positive attitudes for *communication and entertainment* devices. However, a falling pattern for devices that are more *support and health* oriented is absent (almost). Specifically, a decrease with age is absent for the use of Auto Fall Alert and Personal Alarm. Conversely, attitudes towards Tablets or Smartphones decline significantly.

With respect to age effects in cross-sectional data, it is evidently not possible to accurately distinguish between age and cohort effects. The use of a device must be learned and trained, and thus it appears highly unlikely that the attitude towards this type of a device should decrease when individuals age. It is potentially more likely that older cohorts of respondents are generally less technology-prone than younger cohorts who already possess more contact with modern technology during their lifetime. Such an interpretation also leads to different predictions with respect to aging individuals, and we forecast similarly high positive attitudes for individuals in the age group of 80+ years in 30 years as we currently measure for individuals in the age group of 50–59 years. Specifically, the forecast

variables) by using a probit estimation and reported the marginal effects at means and corresponding standard errors. Significance levels are indicated by asterisks (+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$).

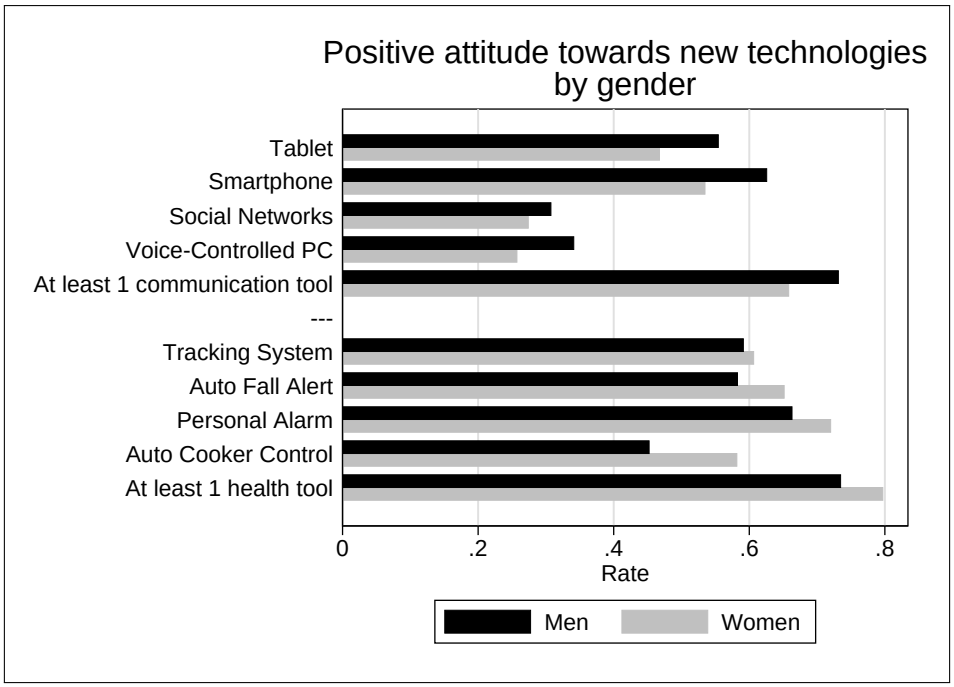

Figure 1: Share of positive attitudes by gender

potentially increases given additional exposure and better usage possibilities.

D.2.1 Grouped attitude score

For the purposes of simplicity and additionally for the binary variables created above, we grouped all devices into the following two categories: *Communication and entertainment* and *support and health* devices. *Tablet*, *Smartphone*, *Social Networks* and *Voice-Controlled PC* fall in the category *communication and entertainment*, and *Tracking System*, *Auto Fall Alert*, *Personal Alarm* and *Auto Cooker Control* are categorized as devices in the *support and health* group. For the two groups of devices, we define a binary variable that assumes the value of 1 whenever at least one of the devices in that group is rated positively.

The results indicate that 77% of all respondents exhibit a positive attitude towards at least one new technology in the *health and support* group. Approximately 69% display positive attitudes towards *communication and entertainment* technologies (see Figure 1). Approximately 57% of all respondents are interested in both groups of technological devices, and 12% of the overall sample is not interested at all in new technologies.

The simple probit prediction model from Figure 3 reveals statistically highly significant gender differences for both groups of technological devices. Women are more interested in *support and health* devices while men are generally more interested in *communication and entertainment* devices. In both cases, the gender difference amounts to slightly over 5 percentage points at age means. We also observe a strong age effect for *communication and entertainment* devices while barely any age effect is observed for *support and health* devices. This may indicate a growing demand for *support and health* devices with increasing age (and therefore also deteriorating health) that eventually compensates, or

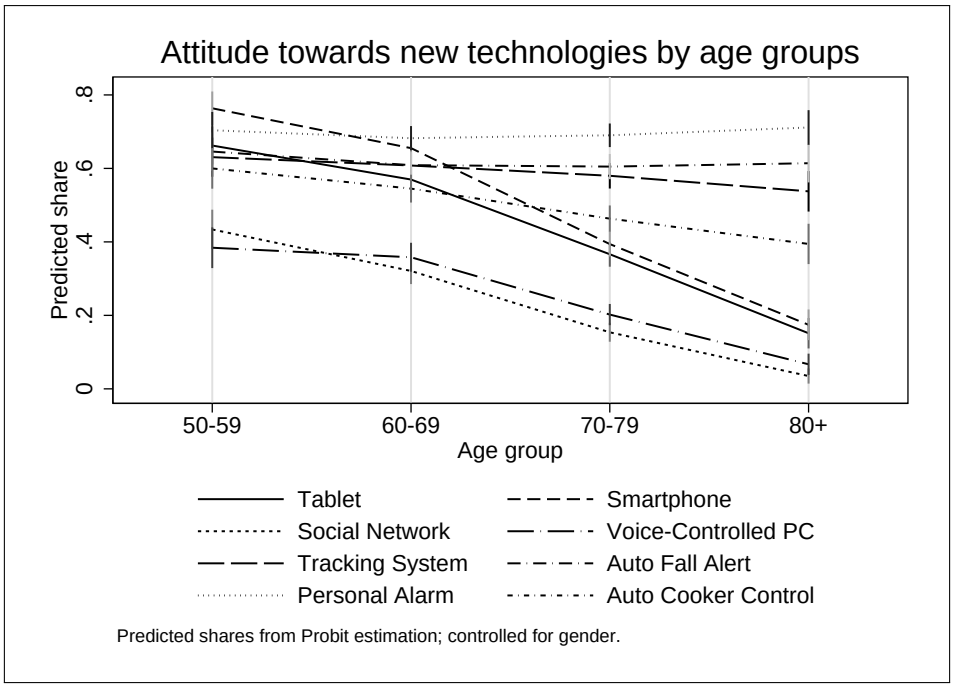

Figure 2: Share of positive attitudes by age groups

even over-compensates for the reasons for the age-effect initially.

E Multivariate Analysis

We perform a multivariate analysis in Table 2 to regress positive attitudes on our age dummies, education, basic employment indicators, and a few demographic factors. We also include two health indicators. The dependent variable is dichotomous, and thus we use probit models separately for men and women.

The results confirm the above outlined age or cohort effects with respect to *communication and entertainment* devices. Specifically, individuals aged 70 to 79 years old are between 25 and 29 percentage points (male/female at means) and individuals aged 80+ years are from 46 to 49 percentage points less likely to value *communication and entertainment* devices compared to the youngest cohort. Education increases the odds of positive attitudes to new technologies by 12 to 18 percentage points, and this also holds for white-collar employment (+13 / +17 percentage points). A single exception applies for women with respect to *support and health* devices in which neither education, nor white-collar employment exhibit any statistically significant effect. The result potentially points towards the overall importance (and need) of these types of devices for women irrespective of the educational level or the technological abilities acquired during employment.

Other statistically significant factors that are significant correspond to men living in a house as follows: the group of respondents is by 9 percentage points more inclined to value *support and health* devices positively. Fair or poor subjective health also increases the positive stances towards support and health devices by 16 (male) and 6 (female) percentage points, respectively. Finally, physical limitation (IADL) decreases the positive

Table 2: Estimation results: Positive attitude towards different technologies

	Communication & entertainment		Support & health	
	Men	Women	Men	Women
Base age: 50-59				
60-69	-0.06	-0.05	0.07	-0.07
	(0.04)	(0.05)	(0.06)	(0.04)
70-79	-0.25***	-0.29***	0.06	-0.06
	(0.05)	(0.06)	(0.06)	(0.04)
80+	-0.46***	-0.49***	0.01	-0.05
	(0.07)	(0.07)	(0.07)	(0.05)
High school grad.	0.18***	0.18***	0.12**	0.06+
	(0.04)	(0.05)	(0.04)	(0.03)
Base employment: Retired/not employed				
White-collar	0.13*	0.17**	0.16**	-0.04
	(0.06)	(0.06)	(0.05)	(0.06)
Blue-collar	0.01	0.03	0.18**	0.06
	(0.09)	(0.12)	(0.06)	(0.07)
Living in a house	0.01	0.03	0.09*	0.04
	(0.04)	(0.04)	(0.04)	(0.03)
Urban area	0.09*	0.04	0.02	0.02
	(0.04)	(0.04)	(0.04)	(0.03)
Partner in household	0.01	-0.03	0.04	-0.02
	(0.04)	(0.03)	(0.04)	(0.03)
Has children	0.07	0.02	0.04	0.01
	(0.05)	(0.05)	(0.05)	(0.04)
Poor/fair health	-0.05	-0.03	0.16***	0.06*
	(0.04)	(0.03)	(0.04)	(0.03)
# IADL limitations	-0.01	-0.05***	0.01	0.00
	(0.01)	(0.02)	(0.01)	(0.01)
Observations	1034	1372	1050	1461

Standard errors in parentheses. Marginal effects at means from probit estimation.
+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

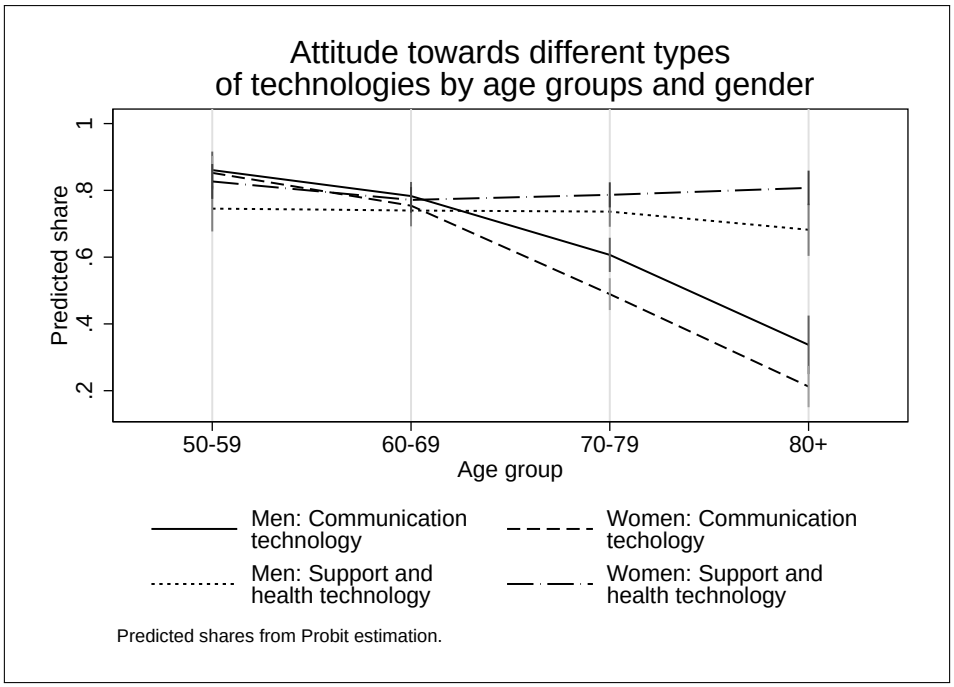

Figure 3: Share of positive attitudes by age groups and gender

stances towards *communication and entertainment* devices for women by 5 percentage points as always while holding all other variables constant at their mean values.

With respect to the level of individual devices or applications as indicated in Table 4, our main results for cohort effects are completely identical; and the findings indicate that the largest negative cohort effects for the use of Smartphones and then Tablets and Social Networks. With respect to the additional control variables, education positively affects almost all devices. With respect to a white-collar worker; effects for females are smaller and more fragile. Men in urban areas are also more open-minded towards *communication and entertainment* devices.

With respect to health, specifically men exhibit large values in technological devices for *health and support* use: if they display poor or fair health, their attitude increases significantly. Effects are only half as large for women.[9]

F Conclusions

The analysis in the present study indicates a positive attitude of a majority of respondents in Austria towards most technological innovations with the potential to cover specific needs of an aging population. This is specifically true for devices and applications in the *support and health* group, such as Personal Alarms, Auto Fall Alerts, and Tracking Systems. A more heterogeneous picture emerges for devices and applications in the

[9]We performed all estimations with and without health variables. Results are not reported since the inclusion of health indicators did not considerably change the size and significance levels of coefficients of other variables.

communication and entertainment group. With the exception of Smartphones and Tablet computers, the overall attitude towards innovations such as Voice-Controlled Computers or Social Networks is rather negative. The concrete purposes and functions of devices and applications appear to drive respondents' attitudes as follows: the more precise the functions, the higher the acceptance rate, in general.

Specifically, a significant gender gap emerges between the two groups of applications and devices defined in the study as follows: women appreciate devices in the *support and health* group more. Conversely, men value *communication and entertainment* innovations more. This finding appears to indicate a general pattern in the appreciation for new technologies: Women value technologies with considerably concrete purposes and functions more when compared with men. However, the extent of the gender gap is limited, and in most cases does not change the overall picture where *support and health* technologies are generally more appreciated than their counterparts.

Our analysis also indicates a pronounced age-effect for *communication and entertainment* devices. However, at the present stage, we are unable to distinguish whether we are confronted with genuine age effects, in which older individuals are generally less interested in *communication and entertainment* devices, or if it is more a matter of cohort effects. A plausible explication for less interest in technological devices at older ages might also be rooted in less acquaintance and experience of those generations (during their lifetime) with technological devices in general, and *communication and entertainment* devices in particular. If so, the presumed cohort effects are expected to fade in the forthcoming years.

Most importantly, age or cohort effects are not applicable to *support and health* devices. An alternative argument is that with increases in age, possible age effects are offset by a higher need of (technological) assistance due to deteriorating health and other conditions. However, our results also hold if we control the state of health and limitations in instrumental activities of daily living. The control variables are assumed to capture any effect originating from deteriorating health and other limitations that increase with old age although they do not significantly alter the age effect. We are therefore inclined to conclude that in contrast to *communication and entertainment* devices, *support and health* devices generally do not exhibit age effects.

We conclude that, in particular, technological innovations that are categorized as *supportive tools*, or with *specific health purposes*, are the ones with the highest potential of being positively appreciated and received by elderly members of society.

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Appendix

Table 3: Attitudes towards new technologies: Detailed selection. Weighted; Multiple answers possible; Concurrent positive and negative attitudes included.

	I don't know this	I am already using this	I am open to this	This is/would be great help	I find this daunting	I doubt that I would find this helpful	I am not interested in this	I do not feel comfortable around this
Tablet	0.12	0.20	0.24	0.03	0.01	0.04	0.34	0.09
Smartphone	0.08	0.35	0.18	0.02	0.01	0.04	0.31	0.08
Social Networks	0.09	0.19	0.08	0.01	0.03	0.06	0.54	0.05
Voice-Controlled PC	0.16	0.04	0.19	0.02	0.01	0.07	0.49	0.05
Tracking System	0.13	0.03	0.44	0.07	0.01	0.05	0.26	0.02
Auto Fall Alert	0.10	0.01	0.48	0.09	0.01	0.04	0.28	0.02
Personal Alarm	0.08	0.03	0.53	0.09	0.01	0.04	0.22	0.01
Auto Cooker Control	0.17	0.02	0.37	0.06	0.01	0.05	0.33	0.02
N	3085	3085	3085	3085	3085	3085	3085	3085

Table 4: Estimations with binary on positive attitude for each technological device by gender.

	Tablet	Smartphone	Social Networks	Voice-Controlled PC	Tracking System	Auto Fall Alert	Personal Alarm	Auto Cooker Control
MEN								
Base age: 50-59								
60-69	-0.09	-0.11*	-0.07	0.04	0.07	0.06	0.07	0.11
70-79	-0.25***	-0.31***	-0.23***	-0.11	0.06	0.03	0.05	0.02
80+	-0.39***	-0.51***	-0.35***	-0.27***	-0.03	-0.02	0.04	-0.06
High school grad	0.20***	0.21***	0.07	0.20***	0.16***	0.09*	0.07+	0.03
Not employed/retired	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
White-collar	0.21**	0.20**	0.08	0.20**	0.21**	0.19**	0.17**	0.27***
Blue-collar	-0.05	-0.06	0.01	0.06	0.09	0.16+	0.19*	0.10
Living in a house	0.07	0.01	-0.02	-0.06	0.04	0.03	0.04	-0.05
Urban area	0.10*	0.10*	0.09+	0.00	-0.05	-0.02	0.01	-0.02
Partner in household	0.03	-0.02	-0.08	-0.01	0.10+	0.03	0.03	0.11*
Has children	0.04	0.01	0.08	0.05	0.03	0.03	0.03	0.05
Poor/fair health	-0.06	-0.06	-0.06	-0.00	0.10*	0.14**	0.15***	0.09+
# of IADL limitations	-0.02	-0.04**	-0.04	-0.00	-0.00	0.02	0.02	-0.02
Observations	1022	1065	1038	981	1007	1000	1017	955
WOMEN								
Base age: 50-59								
60-69	-0.04	-0.05	-0.13*	-0.01	-0.03	-0.06	-0.01	-0.15**
70-79	-0.25***	-0.34***	-0.29***	-0.17**	-0.06	-0.04	-0.00	-0.20***
80+	-0.42***	-0.48***	-0.37***	-0.24***	-0.04	-0.03	0.01	-0.21**
Matura	0.20***	0.21***	0.10**	0.15***	0.08+	0.05	0.02	0.06
Not employed/retired	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
White-collar	0.09	0.25***	0.07	0.08	0.04	-0.01	0.02	0.01
Blue-collar	0.01	0.02	-0.03	-0.10+	0.08	-0.02	0.06	0.04
Living in a house	0.04	0.05	-0.02	-0.05	0.04	0.03	0.04	0.02
Urban area	0.04	0.05	0.06	-0.01	0.00	-0.03	-0.00	-0.02
Partner in household	0.05	-0.03	-0.03	-0.01	-0.04	-0.01	-0.03	0.08*
Has children	0.03	0.05	0.02	0.00	0.02	0.00	-0.02	0.03
Poor of fair health	0.02	-0.05	-0.00	-0.04	0.03	0.08*	0.08*	0.07+
Number of IADL limitations	-0.08**	-0.04**	-0.04+	-0.03	-0.01	-0.01	0.00	-0.00
Observations	1364	1435	1402	1321	1369	1413	1443	1351

Marginal effects at means from probit estimation. + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: Summary statistics, not weighted

Variable	Description	N	Median	Mean	SD	Min	Max
Demographics:							
Year of birth		3085	1946	1946	9.353	1912	1964
Age	Age in 2015	3085	69	69.44	9.353	51	103
Gender	1 = Female	3085		0.586	0.493	0	1
Age group 50-59		3085		0.160	0.367	0	1
Age group 60-69		3085		0.362	0.481	0	1
Age group 70-79		3085		0.330	0.470	0	1
Age group 80+		3085		0.147	0.354	0	1
Family and living situation:							
High school grad	1 = Obtained higher education entrance qualification	3020		0.237	0.425	0	1
Partner in household	1 = Partner is living in household	3085		0.643	0.479	0	1
Has children	1 = has children	3084		0.887	0.317	0	1
House	1 = Living in a house	2936		0.603	0.489	0	1
Urban area	1 = Urban area	2925		0.550	0.498	0	1
Employment:							
Retired	1 = Retired	3048		0.742	0.438	0	1
Unemployed	1 = Unemployed	3048		0.0138	0.117	0	1
Homemaker	1 = Homemaker	3048		0.0876	0.283	0	1
Employed	1 = Employed or selfemployed	3048		0.143	0.350	0	1
White-collar	1 = Blue-collar worker	3026		0.102	0.302	0	1
Blue-collar	1 = White-collar worker	3026		0.035	0.184	0	1
Health:							
Poor/fair health	1 = Poor or fair self-assessed health	3085		0.338	0.473	0	1
IADL	Number of limitations in instrumented activities of daily living	3084	0	0.616	1.640	0	9
Technology:							
Tablet[a]	1 = Positive attitude	2619		0.460	0.499	0	1
Smartphone[a]	1 = Positive attitude	2747		0.514	0.500	0	1
Social Networks[a]	1 = Positive attitude	2681		0.249	0.433	0	1
Voice Controlled PC[a]	1 = Positive attitude	2537		0.260	0.439	0	1
Tracking System[a]	1 = Positive attitude	2611		0.581	0.493	0	1

Auto Fall Alert[a]	1 = Positive attitude	2659		0.601	0.490	0	1
Personal Alarm[a]	1 = Positive attitude	2709		0.682	0.466	0	1
Auto Cooker Control[a]	1 = Positive attitude	2548		0.502	0.500	0	1
Communication and entertainment technology	1 = Positive attitude towards Tablet, Smartphone, Social Networks or Voice Controlled PC	2639		0.642	0.479	0	1
Support and health technology	1 = Positive attitude towards Tracking System, Auto Fall Alert, Personal Alarm or Auto Cooker Control	2766		0.758	0.429	0	1
Weight:							
Weight	Calibrated cross-sectional individual weight - wave 6	3085	786.7	968.2	764.5	74.09	8284

All obsverations 50+ of wave 6 that returned the drop off questionnaire and where weights are available.

[a] *For detailed and not cleaned answers see Table 3.*