Attitudes and adoption related to technology and active and healthy ageing - A national survey with a generational perspective

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Abstract

Research is needed to understand attitudes and adoption of the broad range of technologies currently available to support active and healthy ageing, in different generations. Previous and current research tends to neglect the diversity of products and services, as well as typically focuses on current older people rather than those representing future generations. Research-based knowledge is warranted to support development of future technologies that successfully promote active and healthy ageing. The present study aims to give an overview of the (Blinded) survey and sample, followed by a description of attitudes and acceptance related to technology in general and as a means to support active and healthy ageing. A national cross-sectional survey was conducted with a randomised sample (N = 2,121) including men and women from three age cohorts (30–39, 50–59 and 70–79 year-old persons) in Sweden, including questions on attitudes and acceptance related to a broad perspective of technology. The results show that perspectives were shared across generations rather than just within, especially in the younger and middle-aged generations. However, there were significant generational differences regarding what kind of technologies are preferred to support active and healthy ageing as well as reasons for using certain technologies. Our study described generational perspectives rarely displayed in research and shows that attitudes toward and acceptance of technologies for active and healthy ageing are shared across generations. Notable differences were displayed concerning choosing and adopting new technology, which deserve attention when developing new products and services. The study shows that research applying a comparative generational perspective has potential to nurture the understanding of acceptance and adoption throughout the ageing process, and guide development and implementation of technologies for active and healthy ageing.

Introduction

The rapid technological development seen today promises new ways and means to support active and healthy ageing (Schomakers, Offermann-van Heek, & Ziefle, 2018; Schulz et al., 2015), but the actual capability of technologies to offer such support is underexplored (Kim, Kelly, Lafortune, & Brayne, 2020). Although a broad spectrum of technologies is well integrated in people's everyday lives and routines, research tends to neglect the existing diversity of products and services. According to a literature review, multiple studies describe attitudes towards and adoption of information and communication technology (ICT), e-health, wearable or home-based health monitoring systems and smart home technology (Dahler, Rasmussen, & Andersen, 2016), but other products used in everyday life such as kitchen appliances, other household equipment, cars, etc. are scarcely considered. While the positive effects of using technologies for monitoring physical, cognitive and mental health are well known, research on how technology can support active and healthy ageing is scarce. The results that do exist are conflicting (Liu, Stroulia, Nikolaidis, Miguel-Cruz, & Rios Rincon, 2016) and better quality evidence is needed (Buyl et al., 2020). Similarly, there is a need for larger quantitative studies to better understand relationships between factors that influence said acceptance (Mostaghel, 2016; Peek et al., 2014).

Moreover, studies are urgently needed to explore adoption of technology not only among current older populations, but also throughout the course of ageing. In fact, few studies have a longitudinal design or have been designed to identify generation/cohort effects (N. Hauk, Huffmeier, & Krumm, 2018; Yusif, Soar, &

Hafeez-Baig, 2016). Studies contemplating the differences among (Zhao, Ni, & Zhou, 2018), within or across different age groups are especially lacking. Belonging to a different technology generation may explain why groups of older adults experience problems with current ICT products (Lim, 2009; Zhao et al., 2018). However, the relationship between older people's technological needs and their prior knowledge and experience is largely unexplored (Lee & Coughlin, 2015; Lim, 2009). Early use of technology is a strong predictor for later use of technology, and use during childhood and adolescence lays the foundation for an individual's experience with technology (Mitzner et al., 2019).

Previous research has mainly focused on adoption of technology by older adults and their difficulties with technology, presenting them as technophobic and having lower levels of computer literacy (McDonough, 2016). Findings from a meta-analysis challenged such stereotypes as technology acceptance in older adults showed a negative relationship with chronological age only for technologies that had no clear functionality (i.e., social media) in the lives of older adults. Moreover, perceived usefulness and perceived ease of use (N. Hauk et al., 2018) facilitated acceptance and demonstrated a significant positive correlation with older adults' attitudes towards technology, and older adults attach importance to the benefits expected from the use of technology products (Zhou, Zhang, Tan, Tseng, & Zhang, 2020). Further, challenging ageistic stereotypes, a recent qualitative study (Ref Blinded, 2021) found that attitudes to technology were individually minded rather than generational as people from three generations shared perspectives across rather than within generations. However, more generalisable knowledge is certainly called for, and the current quantitative study is a first contribution. These two studies are both part of the (Blinded), designed to address urgent knowledge gaps considering the complex interaction between generations of the ageing population and their adoption of a wide range of technologies, and how this plays a role for active and healthy ageing.

The purpose of this study was to give an overview of the (Blinded) survey and sample, followed by a description of attitudes and adoption related to technology in general and as a means to support active and healthy ageing from the perspective of three generations. Observing age cohort as well as gender similarities and differences the following research questions guided the analyses:

- What were the attitudes to different types of technology in the three generations targeted?
- What products were perceived to be most important for an active and healthy ageing process?
- What characteristics did adults in the three generations consider important when adopting / accepting new technology?

Method

Design

This study was based on a quantitative, cross-sectional survey, (Sentence blinded). The Swedish Ethical Review Authority (Dnr: (Blinded)) approved the study. Kantar Sifo (KS), a company with documented experience from large-scale data collection, performed the sampling, recruitment, and data collection for the present study on behalf of and in collaboration with the research team.

Respondents, sampling and recruitment

A random sample was drawn from the Swedish State Personal Address Register (SPAR), representing men and women stratified in three age cohorts (30-39, 50-59 and 70-79 years-old). Based on 2016 population statistics (Statistics Sweden), the 30-39 year-old national cohort was approximately 1.25 million (48.7% women), the 50-59 year old cohort was approximately 1.25 million (49.3% women), and the 70-79 year old cohort was approximately 900 thousand (51.8% women). We calculated a total sample size of 3,598 to generate estimates with a confidence level of 95% and a margin of error of 4 (Cochran 1977). To generate this sample, KS acquired 10,000 addresses from SPAR in August 2019. The SPAR includes all persons registered as residents in Sweden and is updated each day with data from the Swedish Population Register. Different numbers of addresses were included for the different age cohorts to compensate for the fact that younger persons have a lower response rate according to KS's current data collection experiences (Table 1). We planned to continue recruitment until 600 men and 600 women from each age cohort, that is, each stratum, had responded to the survey.

KS first contacted potential respondents through postal letters, including information for informed consent in line with research ethical principles, a survey web-link, and unique individual login-information. Non-responders were sent a postal reminder after one week including the same content as the first letter. Trained staff from KS made up to eight attempts by phone to reach persons who had not responded after two weeks, to remind about the online survey. During the same call, respondents could respond to the survey via a telephone interview, upon verbal informed consent, or get a postal version of the survey sent by mail to their home address. Potential respondents, who said they would respond but did not within two-three weeks, received an additional reminder replicating the original information once more. A synchronised system was used by KS to safeguard that no responders received a reminder. These combined efforts resulted in a final sample of 2121 respondents including 1081 (51 %) men (response rate 22 %) and 1040 (49 %) women (response rate 21 %), divided into three generation cohorts 30 - 39, 50 – 59 and 70 – 79. The youngest generation included 639 respondents 49 % men and 51 % women. The middle aged generation included 703 respondents, with 49 % were men and 51 % women. The oldest generation included 779 respondents with 54 % men and 46 % women (Table 1).

Table 1. Sampling frame, number of respondents, response rate and response mode across the three age cohorts, N=2121.

Age cohort	Sampling frame	No. of respondents (response rate in %)	Total no. of responses (response rate in % online/phone/postal[1])
	Men/women	Men/women	
30-39 year-olds	2300/2300	316 (14)/323 (14)	639 (97/3/1)
50-59 year-olds	1500/1500	345 (23)/358 (24)	703 (97/3/1)
70-79 year-olds	1200/1200	420 (35)/359 (30)	779 (93/5/2)
Total	5000/5000	1081 (22)/1040 (21)	2121 (95/4/1)

[1]Mode of response

Data collection

Data was collected through a questionnaire developed for (Blinded) based on qualitative findings (Ref blinded, 2021) involving the same age cohorts as the present study from the same project and relevant scientific literature. The survey included 24 questions on attitudes to, and acceptance of a broad range of technology, including products as well as services used in everyday life activities (e.g., household devices, kitchenware, cars, new lightbulbs, TVs) ICT (e.g., smartphones, surf tablets, computers), welfare technology provided by society (e.g., safety alarms, video surveillance, e-Health) and medical technology (e.g., assistive technology such as wheeled walkers, wheelchairs and communication aids as well as medical products such as pacemakers or insulin pumps). The questionnaire also included seven questions regarding respondent's characteristics such as education, occupation, housing, civil state, country of birth, as well as self-rated general health, life satisfaction, and economy to cover technology needs. The estimated time required to complete the survey was 10-15 minutes.

A pilot study was conducted with 21 men and women representing the three age cohorts recruited via the KS web panel. The KS web panel includes a representative sample of the internet-using general population in Sweden and was considered relevant for the pilot study. The pilot results demanded only a few changes to the survey (e.g. one response alternative removed as the pilot respondents did not find it relevant, and the "other" response alternative at the end of most questions was re-phrasing).

During the data collection, KS performed regular quality control of data, focusing on correct, complete and logical recording in the database, and communicated with the (Blinded) research team when needed. Researchers monitored the data collection to identify potential systematic errors when 10 percent of the data was collected and listened to five percent of the phone interviews to secure quality. The researchers and KS also engaged in active dialogue during the process to ensure that processes were followed as intended.

Data analyses

Descriptive statistics were used to analyse the basic demographics from each stratum. Differences based on gender and age cohort were analysed descriptively as well. Kruskal-Wallis analyses were implemented to investigate differences between age cohorts and Mann-Whitney U analyses were used to investigate gender differences. The alpha level was set to $p < 0.05$, and thereafter corrected with the Bonferroni method. IBM SPSS Statistics 27 was used for the data analyses.

Results

The (Blinded) survey sample in terms of birthplace, education, occupation, self-rated economy, subjective/self-rated health status, birth country, and current place of residence is presented in Table 2. Although the internal response rate was generally complete, 138 of the respondents refrained from reporting their birthplace.

Table 2. Characteristics of the (Blinded) survey sample (N=2,121).

	Age 30 – 39 n=639		Age 50 - 59 n=703		Age 70 – 79 n=779		Group comparison	
	Men	Women	Men	Women	Men	Women	By gender	By generation
	% (n)		% (n)		% (n)		p-value	p-value
Country of birth								
Sweden	42 (269)	41 (264)	41 (287)	40 (282)	47 (369)	40 (315)	0.30	0.05*
Europe	3 (18)	3 (18)	4 (26)	4 (27)	4 (28)	2 (18)		
Other	3 (21)	2 (15)	2 (12)	1 (7)	<1 (3)	<1 (4)		
Education								
Compulsory school	1 (8)	1 (6)	3 (20)	2 (10)	13 (104)	15 (113)	<0.001*	<0.001*
High school	16 (100)	8 (53)	19 (136)	15 (108)	11 (69)	5 (42)		
Polytechnic	8 (49)	6 (36)	6 (39)	6 (44)	11 (88)	5 (42)		
University	25 (158)	35 (225)	21 (147)	28 (194)	20 (156)	20 (158)		
Main occupation								
Studying	2 (11)	3 (18)	<1 (1)	<1 (5)	<1 (1)	<1 (1)	0.47	<0.001*
Working	43 (276)	39 (251)	45 (315)	45 (315)	1 (9)	<1 (4)		
Maternity/Paternity leave	2 (10)	5 (33)	0 (0)	0 (0)	0 (0)	0 (0)		
Retired	<1 (1)	0 (0)	<1 (4)	1 (9)	51 (399)	43 (336)		
Unemployed	2 (10)	1 (6)	1 (10)	1 (9)	0 (0)	0 (0)		
Other	1 (6)	2 (12)	2 (11)	2 (17)	1 (10)	2 (13)		
Size of municipality (no. inhabitants)								
> 200 000	22 (142)	21 (131)	17 (119)	19 (124)	17 (135)	14 (109)	0.24	<0.001*

> 40 000	16 (103)	20 (130)	21 (146)	20 (126)	21 (161)	18 (141)		
> 15 000	8 54	8 (52)	10 (61)	13 (83)	10 (81)	10 (79)		
Rural municipality	2 (15)	2 (10)	2 (14)	4 (24)	5 (39)	4 (29)		
Subjective economy for technology needs								
Well	27 (172)	25 (161)	26 (180)	29 (202)	22 (169)	17 (136)	0.29	<0.001*
Fairly well	17 (110)	18 (118)	18 (129)	16 (110)	25 (196)	18 (142)		
Fairly bad	4 (27)	4 (28)	3 (19)	5 (32)	4 (34)	5 (42)		
Bad	1 (6)	2 (15)	2 (15)	1 (10)	2 (18)	4 (34)		
Self-rated General Health								
Excellent	11 (69)	10 (61)	8 (55)	9 (65)	5 (39)	3 (25)	0.28	<0.001*
Very Good	21 (131)	21 (133)	19 (132)	20 (143)	18 (142)	13 (100)		
Good	13 (85)	15 (97)	17 (121)	13 (92)	20 (152)	19 (150)		
Fair	4 (28)	4 (24)	4 (27)	6 (42)	10 (75)	9 (68)		
Poor	<1 (2)	1 (7)	1 (7)	2 (14)	1 (9)	1 (8)		
Self-rated Life Satisfaction								
Excellent	7 (45)	8 (51)	7 (48)	10 (67)	8 (66)	7 (54)	0.5	0.2
Very Good	23 (144)	23 (146)	21 (146)	23 (161)	22 (172)	17 (129)		
Good	14 (90)	15 (93)	15 (108)	12 (85)	17 (134)	16 (124)		
Fair	4 (24)	5 (29)	5 (36)	4 (30)	5 (38)	5 (42)		
Poor	1 (9)	<1 (3)	<1 (4)	1 (9)	<1 (3)	<1 (3)		

Note: Numbers expressed as percentage of each age cohort and rounded to nearest integer. * Significant difference between gender or generations ($p<0.05$). All p-values have been corrected with bonferroni method.

Attitudes toward technology for active and healthy ageing

To support active and healthy ageing, the respondents would prefer using household devices, home entertainment, exercise devices and assistive devices. Compared to the other generations, the oldest (70-79) generation was significantly ($p<0.001$) less interested in using activity sensors, personal health sensors, medical technologies, smart homes, welfare technologies, home and social robots, internet shopping and internet services to support active and healthy ageing. The youngest (30-39) generation was significantly ($p<0.001$) less interested in using motorised vehicles and social media for active and healthy ageing than the other generations (Fig 1).

The primary reasons reported for wanting to use technologies were to be independent, remain in contact with friends and family, be physically active, and notify someone in case of a fall or illness. The oldest generation was significantly ($p<0.001$) less interested in using technologies to save time, feel safe, monitor health, control home entertainment, access services, for pleasure and entertainment, or shopping than the other generations (Fig 2).

Overall, respondents considered household devices to be practical and necessary to meet their needs. However, the oldest generation was significantly ($p<0.001$) less likely than the other generations to perceive household devices as useful, user friendly and time saving. The youngest generation was significantly less likely than the older generations to acknowledge that household devices brought independence ($p<0.001$) (Fig 3).

Most of the respondents perceived ICTs to be useful, practical, time saving and meet their necessary needs. However, significantly ($p<0.001$) fewer respondents in the oldest generation, compared to the other generations, perceived ICT products as useful, practical and time saving. The 30–39-year-olds were significantly more likely than the older generations to consider ICT products as user friendly ($p<0.001$) (Fig 4).

Important factors when choosing and adopting technology

The responses show that price, technology allowing flexible use and standard rather than extra functions matter when choosing new products (Fig 5). Overall, the respondents, reported that they learnt new products easily and had no problems to keep up with technology development. Especially, the oldest generation considered environmental sustainability important when adopting new technologies, (Fig 6).

Results

The (Blinded) survey sample in terms of birthplace, education, occupation, self-rated economy, subjective/self-rated health status, birth country, and current place of residence is presented in Table 2.

Although the internal response rate was generally complete, 138 of the respondents refrained from reporting their birthplace.

Table 2
Characteristics of the (Blinded) survey sample (N = 2,121).

	Age 30–39		**Age 50–59**		**Age 70–79**		**Group comparison**	
	n = 639		**n = 703**		**n = 779**			
	Men	Women	Men	Women	Men	Women	By gender	By generation
	% (n)		% (n)		% (n)		p-value	p-value
Country of birth								
Sweden	42 (269)	41 (264)	41 (287)	40 (282)	47 (369)	40 (315)	0.30	0.05*
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Working	43 (276)	39 (251)	45 (315)	45 (315)	1 (9)	<1 (4)		
Maternity/Paternity leave	2 (10)	5 (33)	0 (0)	0 (0)	0 (0)	0 (0)		
Retired	< 1 (1)	0 (0)	< 1 (4)	1 (9)	51 (399)	43 (336)		
Unemployed	2 (10)	1 (6)	1 (10)	1 (9)	0 (0)	0 (0)		
Other	1 (6)	2 (12)	2 (11)	2 (17)	1 (10)	2 (13)		

Note: Numbers expressed as percentage of each age cohort and rounded to nearest integer. * Significant difference between gender or generations ($p < 0.05$). All p-values have been corrected with bonferroni method.

	Age 30–39 n = 639		Age 50–59 n = 703		Age 70–79 n = 779		Group comparison	
Size of municipality (no. inhabitants)								
> 200 000	22 (142)	21 (131)	17 (119)	19 (124)	17 (135)	14 (109)	0.24	< 0.001*
> 40 000	16 (103)	20 (130)	21 (146)	20 (126)	21 (161)	18 (141)		
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Bad	1 (6)	2 (15)	2 (15)	1 (10)	2 (18)	4 (34)		
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Very Good	21 (131)	21 (133)	19 (132)	20 (143)	18 (142)	13 (100)		
Good	13 (85)	15 (97)	17 (121)	13 (92)	20 (152)	19 (150)		

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	Age 30–39 n = 639		Age 50–59 n = 703		Age 70–79 n = 779		Group comparison	
Fair	4 (28)	4 (24)	4 (27)	6 (42)	10 (75)	9 (68)		
Poor	< 1 (2)	1 (7)	1 (7)	2 (14)	1 (9)	1 (8)		
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Very Good	23 (144)	23 (146)	21 (146)	23 (161)	22 (172)	17 (129)		
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Fair	4 (24)	5 (29)	5 (36)	4 (30)	5 (38)	5 (42)		
Poor	1 (9)	< 1 (3)	< 1 (4)	1 (9)	< 1 (3)	< 1 (3)		

Note: Numbers expressed as percentage of each age cohort and rounded to nearest integer. * Significant difference between gender or generations ($p < 0.05$). All p-values have been corrected with bonferroni method.

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Note

Percentages rounded to the nearest integer. [1]Personal emergency response system.

* Generation differs significantly from the other generations ($p < 0.05$).

Figure 1. Technologies that respondents would like to use for active and healthy ageing (N = 2,121).

The primary reasons reported for wanting to use technologies were to be independent, remain in contact with friends and family, be physically active, and notify someone in case of a fall or illness. The oldest generation

was significantly ($p < 0.001$) less interested in using technologies to save time, feel safe, monitor health, control home entertainment, access services, for pleasure and entertainment, or shopping than the other generations (Fig. 2).

Note

Percentages rounded to the nearest integer. *Generation differs significantly from the other generations ($p < 0.05$).

Figure 2. Respondents' reasons to use technologies to promote active and health ageing (N = 2,121).

Overall, respondents considered household devices to be practical and necessary to meet their needs. However, the oldest generation was significantly ($p < 0.001$) less likely than the other generations to perceive household devices as useful, user friendly and time saving. The youngest generation was significantly less likely than the older generations to acknowledge that household devices brought independence ($p < 0.001$) (Fig. 3).

Note

Percentages rounded to the nearest integer.

* Generation differs significantly from the other generations ($p < 0.05$).

Figure 3. Respondent attitudes towards household devices (N = 2,121)

Most of the respondents perceived ICTs to be useful, practical, time saving and meet their necessary needs. However, significantly ($p < 0.001$) fewer respondents in the oldest generation, compared to the other generations, perceived ICT products as useful, practical and time saving. The 30–39-year-olds were significantly more likely than the older generations to consider ICT products as user friendly ($p < 0.001$) (Fig. 4).

Note

Percentages rounded to the nearest integer.

* Generation differs significantly from the other generations ($p < 0.05$).

Figure 4. Respondent attitudes towards ICT (N = 2,121).

Important factors when choosing and adopting technology

The responses show that price, technology allowing flexible use and standard rather than extra functions matter when choosing new products (Fig. 5). Overall, the respondents, reported that they learnt new products easily and had no problems to keep up with technology development. Especially, the oldest generation considered environmental sustainability important when adopting new technologies, (Fig. 6).

Note

Percentages rounded to the nearest integer.

* Generation differs significantly from the other generations ($p < 0.05$).

Note

Percentages rounded to the nearest integer.

* Generation differs significantly from the other generations ($p < 0.05$).

Figure 6. The respondents' preferences, within each generation, when adopting new technology (N = 2,121).

Discussion

Going beyond reporting responses from single age groups in later life, based on a large sample from Sweden the present study reports similarities and differences across generations rarely reported in research on ageing and technology. Across the three targeted generations, the respondents preferred traditional technologies (i.e., household devices, assistive devices), rather than more recently introduced technologies (smart homes and welfare technologies) to support their active and healthy ageing. Moreover, we found variations in attitudes toward technology and reasons for using technology. Additionally, across generations most of the respondents feel they can keep up with technology.

While preferences for novel technologies may be limited due to few persons having experience from using them, it is surprising that none of the generations participating in our study acknowledged the advantages of established welfare technologies and smart homes. In fact, welfare technologies (e.g. personal emergency response systems) have been available and used in the health care and social services for older adults since the 1970´s, and smart home solutions have been available and described at least since the 1980's (De Meyer, 1988). The preferences for traditional technologies revealed by the present study reflect age stereotypic attitudes in line with previous findings suggesting that older adults are less interested in technology development and less likely to adopt novel technologies (Joyce, Peine, Neven, & Kohlbacher, 2017). However, other facets of the results show that attitudes toward technology are shared among respondents from all generations. This is in line with a recent systematic review, which identified that neither age nor gender were significantly associated with attitudes toward, for example, social robots (Naneva, Sarda Gou, Webb, & Prescott, 2020). This more nuanced and complex picture not least identified from the present study should be shared with audiences such as policymakers, public authority officials and the general population to counteract ageistic views.

Like the qualitative study (Ref blinded, 2021) preceding the present survey study in the (Blinded) some attitudes towards technologies differed within the generations, and perspectives were sometimes shared across generations rather than within. Regardless of generation, respondents considered household devices as practical and necessary to meet their needs, while not always useful or user friendly. Coherent with recent research (Siegel & Dorner, 2017) and a Swedish national report (Swedish Internet Foundation, 2021),

respondents largely wanted to use technologies to remain independent and stay in contact with friends and family. Likewise, all generations shared opinions on home entertainment as well as exercise and assistive devices as means to support active and healthy ageing.

Contrasting the unanimous facets of the results, the present study displays generational variation in attitudes toward technology and reasons for using technology. For example, the oldest rather than the younger generations reflected on environmental sustainability prior to adopting new technologies. While this is a finding in line with our qualitative study from the same project (Ref blinded, 2021), other studies describe climate anxiety to be more prevalent in younger generations (Clayton, 2020). Further, the oldest generation was least willing to use digital technologies or AI, and the youngest generation was least likely (and the middle generation most likely) to define social media as a means for active and healthy ageing. Particularly the younger and middle generations shared opinions concerning ICT and household devices as being useful and saving them time. Different generations of people belong to different technology generations because they experienced different technologies and technology developments during their life time, which is a period effect that might explain such findings (Lim, 2009; Zhao et al., 2018).

According to the domestication theory (Haddon, 2011) adaptation to technology is an ongoing process. That is, technology is first integrated into everyday life, which leads to individual adjustment and adaptation to the technology, and in turn helps the industry innovate new ways for the forthcoming generations. All generations have experiences of technology but in slightly different ways (Haddon, 2011; Lim, 2009), which may unite or divide across generations. Further research with a domestication approach could help explain adoption and acceptance in a broader perspective in all generations.

Technology period effect may also explain why the oldest generation perceived technology as less useful and user friendly, and why their reasons for using technology overall differed from those reported by the younger generations in our study. The perceived usefulness, ease of use, and meaningfulness of technology explains attitudes and acceptance of technology among older adults (Zhou et al., 2020). If ICT products, for example, for shopping and controlling the home entertainment, do not save time or are designed to target older adults' needs, they are likely to be found less relevant and meaningful to use. In addition, stigmatization describing older adults as less willing to use technology may spur technology developments that rather target younger user groups (McDonough, 2016) and limit user friendliness across generations. Overall, as the oldest generation was willing to adopt new technologies our findings support that this is a technology problem rather than an age problem, which speaks to the need for more and earlier user involvement in the technology development processes. That is, generational preferences such as the oldest generation's wish for standard rather than complex and extra functions in digital devices should be taken seriously for the development of new user-friendly technologies.

In contrast to existing research, we found that across all three generations represented in our study, but more pronounced in the youngest generation, respondents found themselves able to keep up with technology. That is, previous studies often focused merely on the current generation of older adults and displayed their difficulties to keep up with technology (Mitzner et al., 2019). Supported by our findings, older people are interested in and want to use technology (Hunsaker et al., 2020), and they are familiar with technology and technology development. However, it is important to keep in mind that our study was conducted in Sweden,

where Internet access among older people has never been higher (Swedish Internet Foundation, 2019). There are likely cross-national differences in this respect, and more research is warranted to shed light on such developments.

All three generations identified safety as an important reason to use technologies for active and healthy ageing, but in contrast to what could be expected, the oldest generation was least likely to do so. This is interesting as many technologies (e.g. PERS and night cameras) are designed and implemented to support safety in later life, and other studies display that older people use smart phone technology to make them feel safe, for example, during out-of-home walks (Peek et al., 2016).

Moreover, the oldest generation was least likely to prefer monitoring of health and activity or using internet-based shopping and internet services to support active and healthy ageing. However, the data collection was done prior to the COVID-19 pandemic and with the increased use of digital shopping etc. during the pandemic (Swedish Internet Foundation, 2021), preferences may have changed and even caused increased digital inequalities (Beaunoyer, Dupere, & Guitton, 2020). Up-to-date Swedish data on people born in the 1940s (equivalent to the oldest generation in the present study) show that 38% of them need help with digital technologies, 7% have no knowledge about the Internet and 17% do not use it (Swedish Internet Foundation, 2021). However, as socio-economic factors such as finances, education, experience and previous exposure to technology in working life, play an important role for digital literacy and the possibility to invest in technology (Peek et al., 2016), it should be kept in mind that in all generations digital and social exclusion is prevalent.

Strengths and limitations

While we utilized a large sampling frame and made several reminders, the response rate remained low, especially in the younger generations. Unfortunately, this limits the generalizability of the results. It is a strength, however, that the sample resembles the Swedish population. For example, 78% of the respondents had at least a high school degree, compared to 85% in the Swedish general population. While 49% of our respondents had a university degree, 42% of Swedish citizens hold such a degree. Like the Swedish general population overall, most respondents were born in Sweden (90%) and lived in a larger or major city (≈ 75%). The respondents represented different socio-economic classes and nationalities, making the survey sample diverse. Accordingly, the results are of general relevance but should be interpreted with this picture and the risk for bias in mind. Another possible bias is induced by the eventuality that those who respond to a web-survey have more interest in technology than those who do not respond, impeding the validity of the results regarding the overall perception of technology in our study. That is, although alternative administration modes were offered almost all (95%) responded online. The fact that 98% of the Swedish households had access to the Internet at the time of the data collection (Swedish Internet Foundation, 2019) likely means that this had a minor influence on the results.

Conclusion

Unlike previous studies on ageing and technology that only focus on older adults, our study captured generational perspectives rarely displayed in research. Through this design we were able to identify generational differences and similarities that without generational comparison would have been interpreted

as attributed to a single age group. This is important as the results show that attitudes toward and acceptance of technologies for active and healthy ageing are similar across generations in many ways. Notable differences were nevertheless displayed and deserve attention when developing new technology. Research applying a generational perspective to understand acceptance and adoption of different types of technology throughout the ageing process is a largely unexplored avenue to guide the development and implementation of technologies for active and healthy ageing.

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Figures

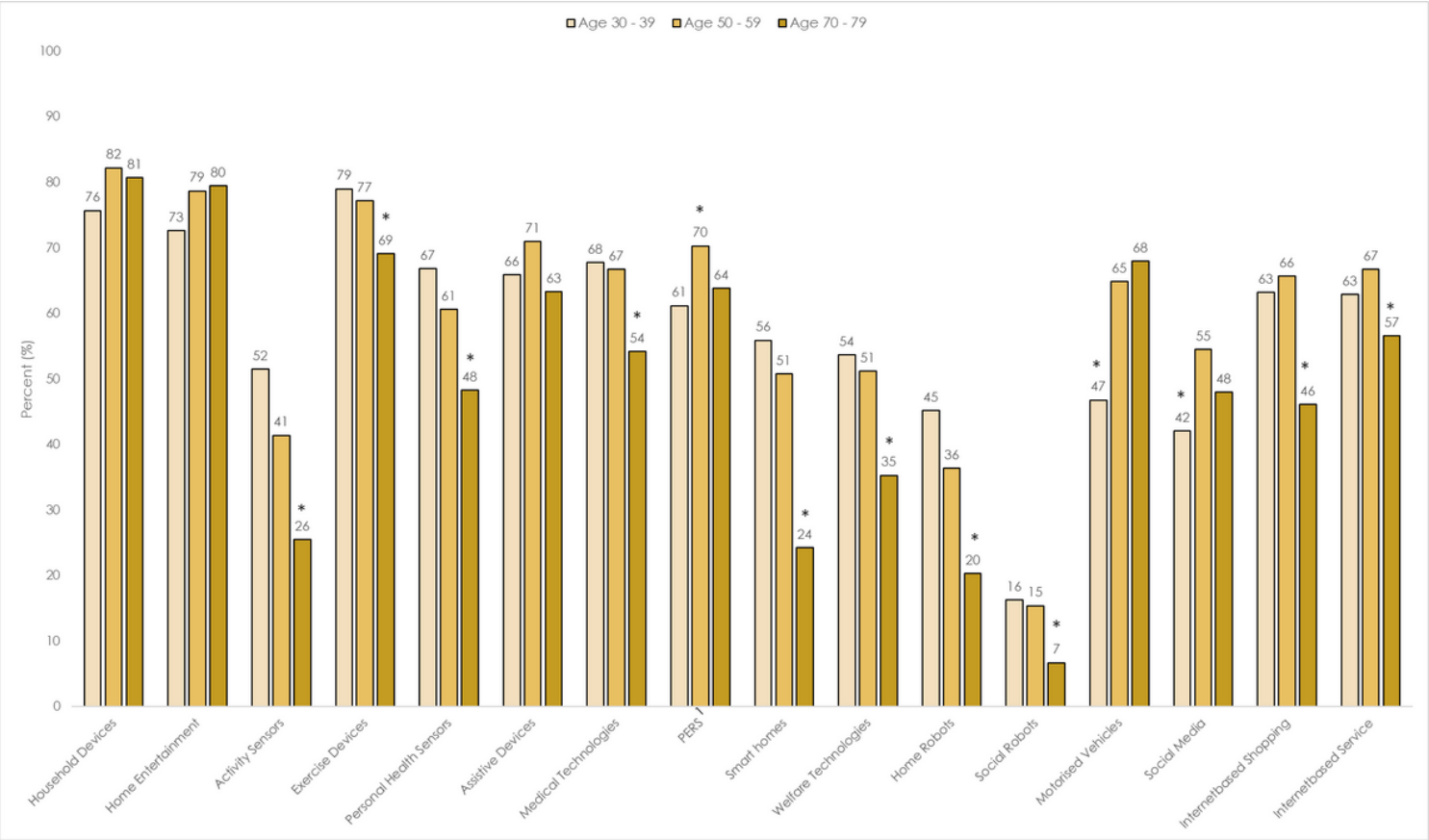

Figure 1

Note: Percentages rounded to the nearest integer. [1]Personal emergency response system.

* Generation differs significantly from the other generations ($p<0.05$).

Figure 1. Technologies that respondents would like to use for active and healthy ageing (N=2,121).

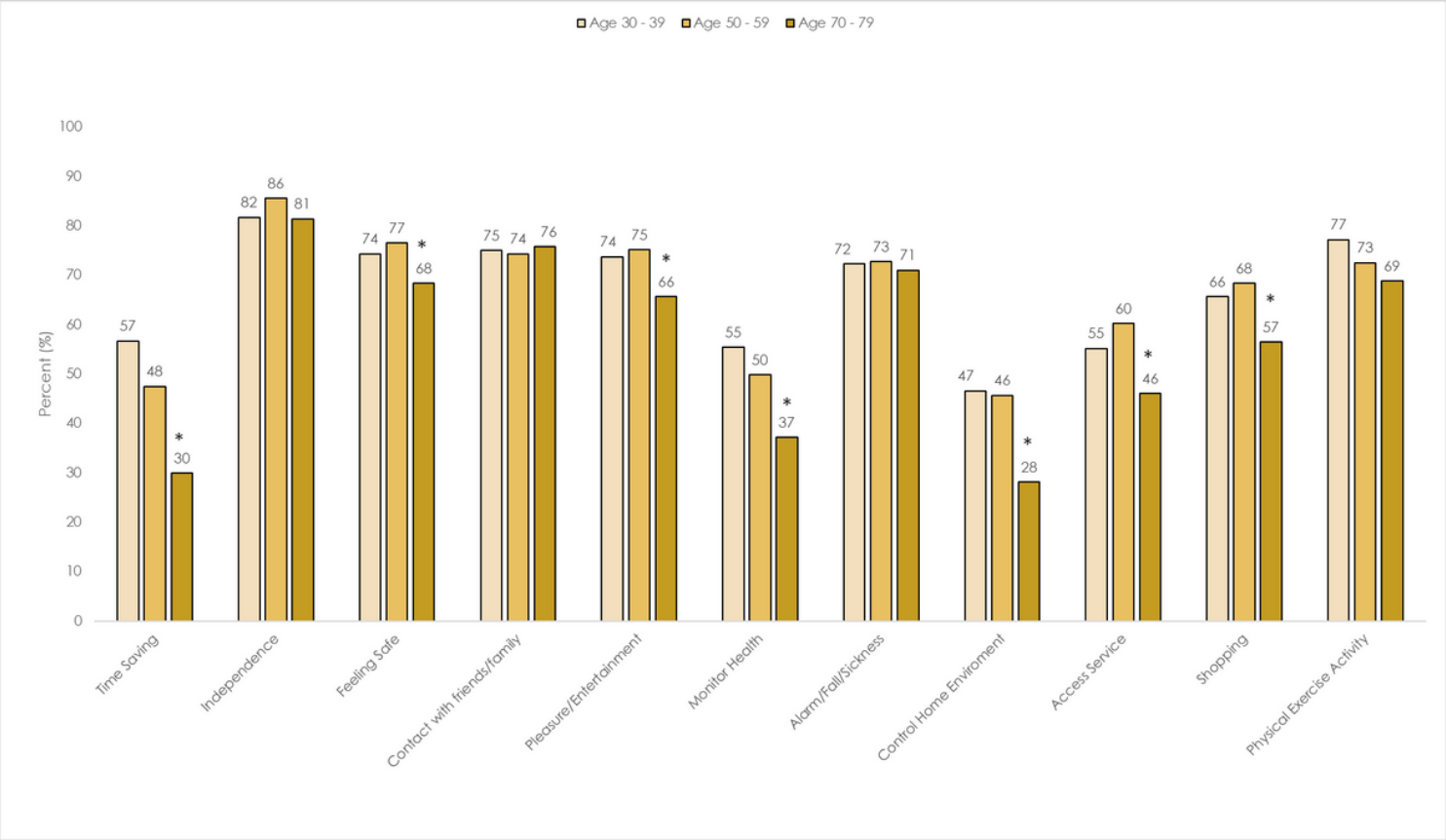

Figure 2

Note: Percentages rounded to the nearest integer. *Generation differs significantly from the other generations ($p<0.05$).

Figure 2. Respondents' reasons to use technologies to promote active and health ageing (N=2,121).

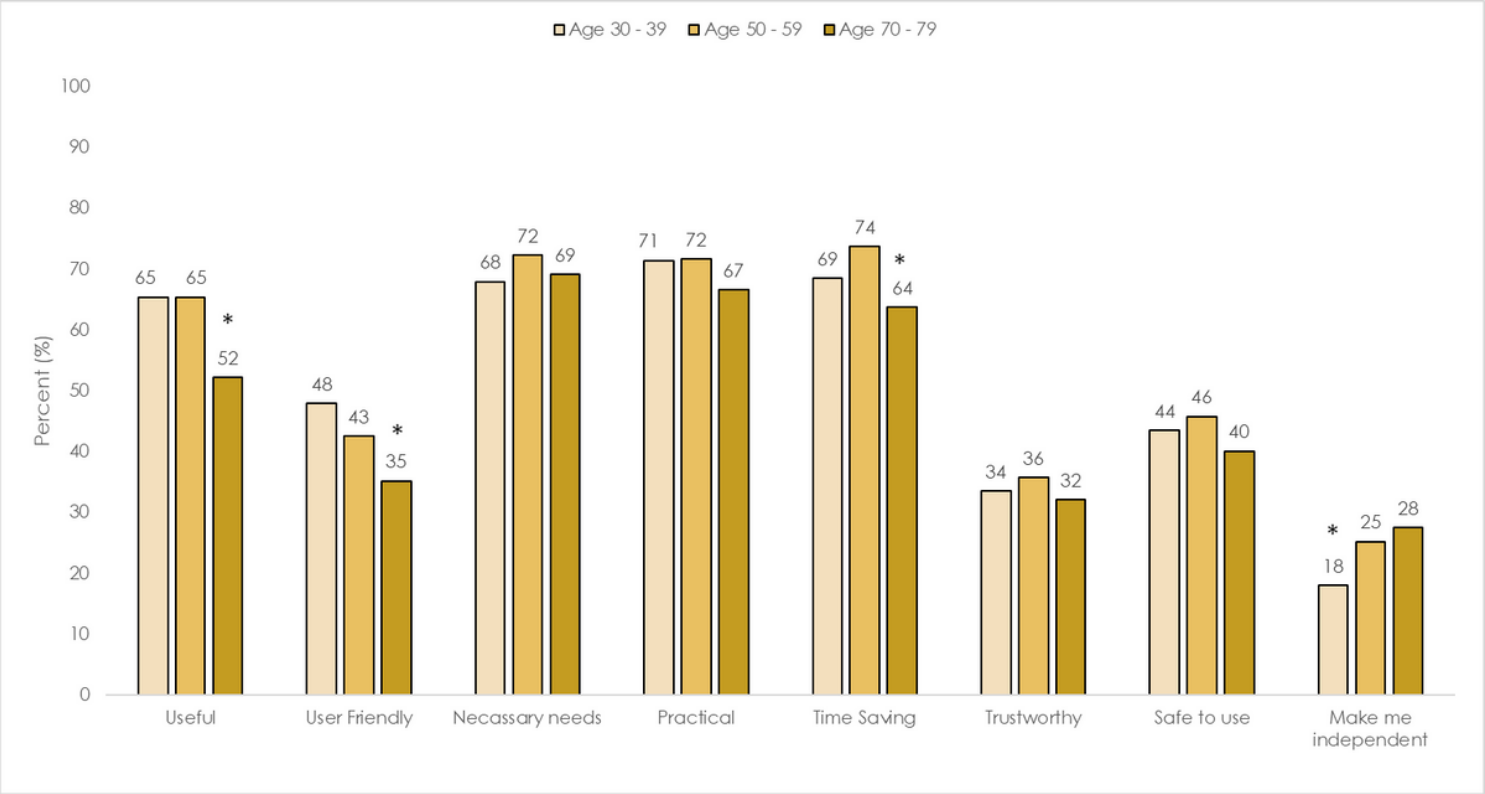

Figure 3

Note: Percentages rounded to the nearest integer.

* Generation differs significantly from the other generations ($p<0.05$).

Figure 3. Respondent attitudes towards household devices (N=2,121)

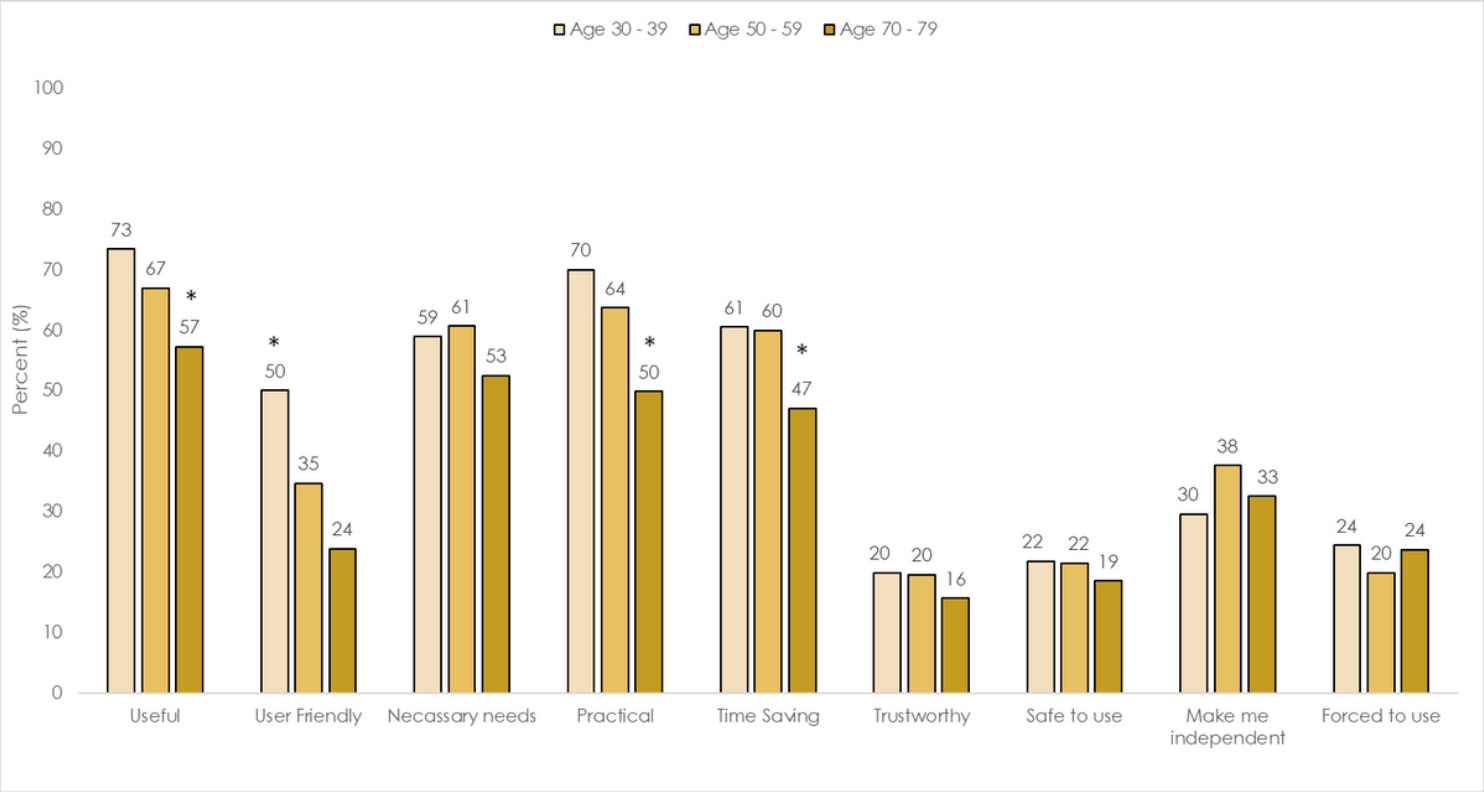

Figure 4

Note: Percentages rounded to the nearest integer.

* Generation differs significantly from the other generations ($p<0.05$).

Figure 4. Respondent attitudes towards ICT (N=2,121).

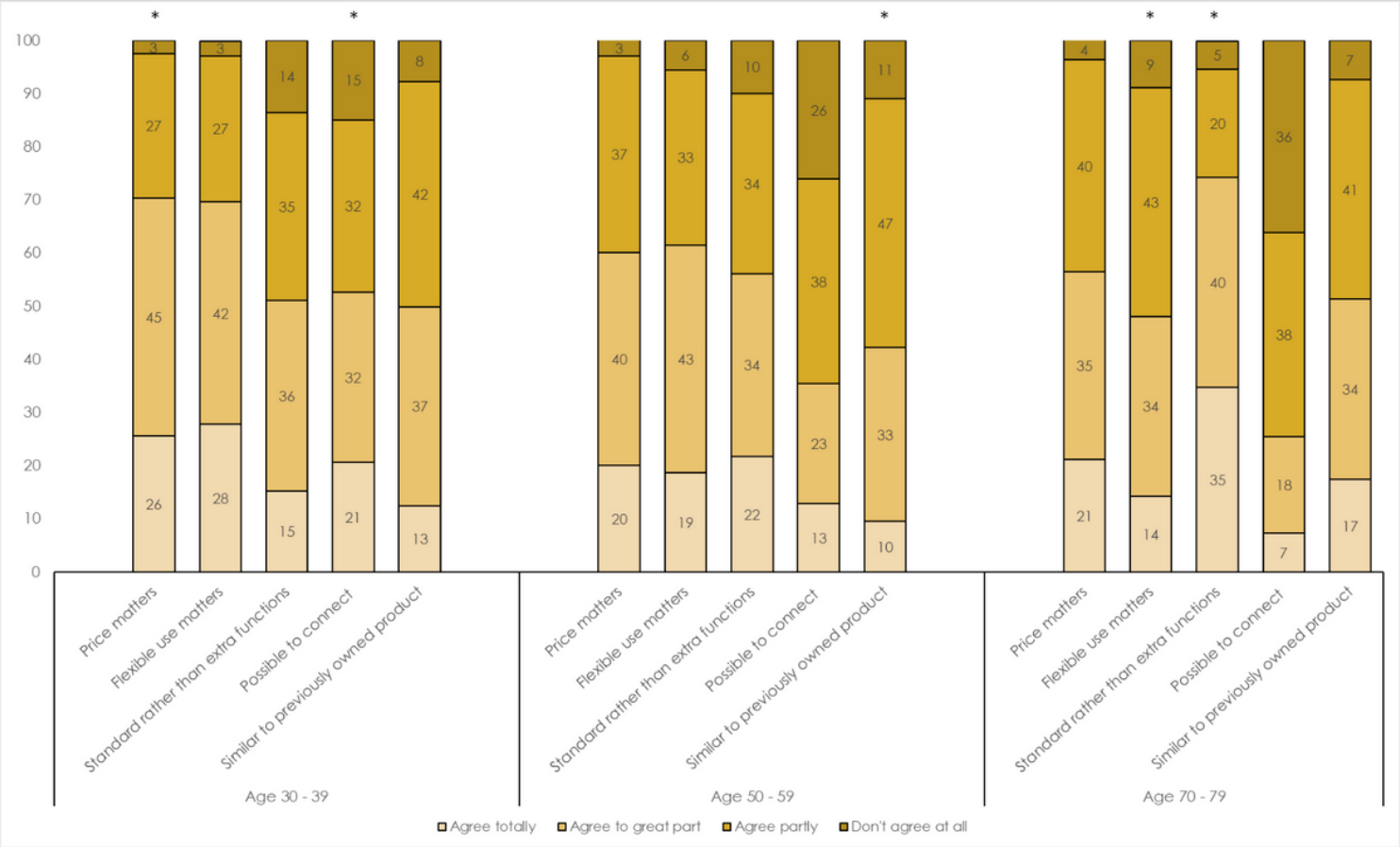

Figure 5

Note: Percentages rounded to the nearest integer.

* Generation differs significantly from the other generations ($p<0.05$).

Figure 5. The respondents' preferences, within each generation, when choosing new technology (N=2,121).

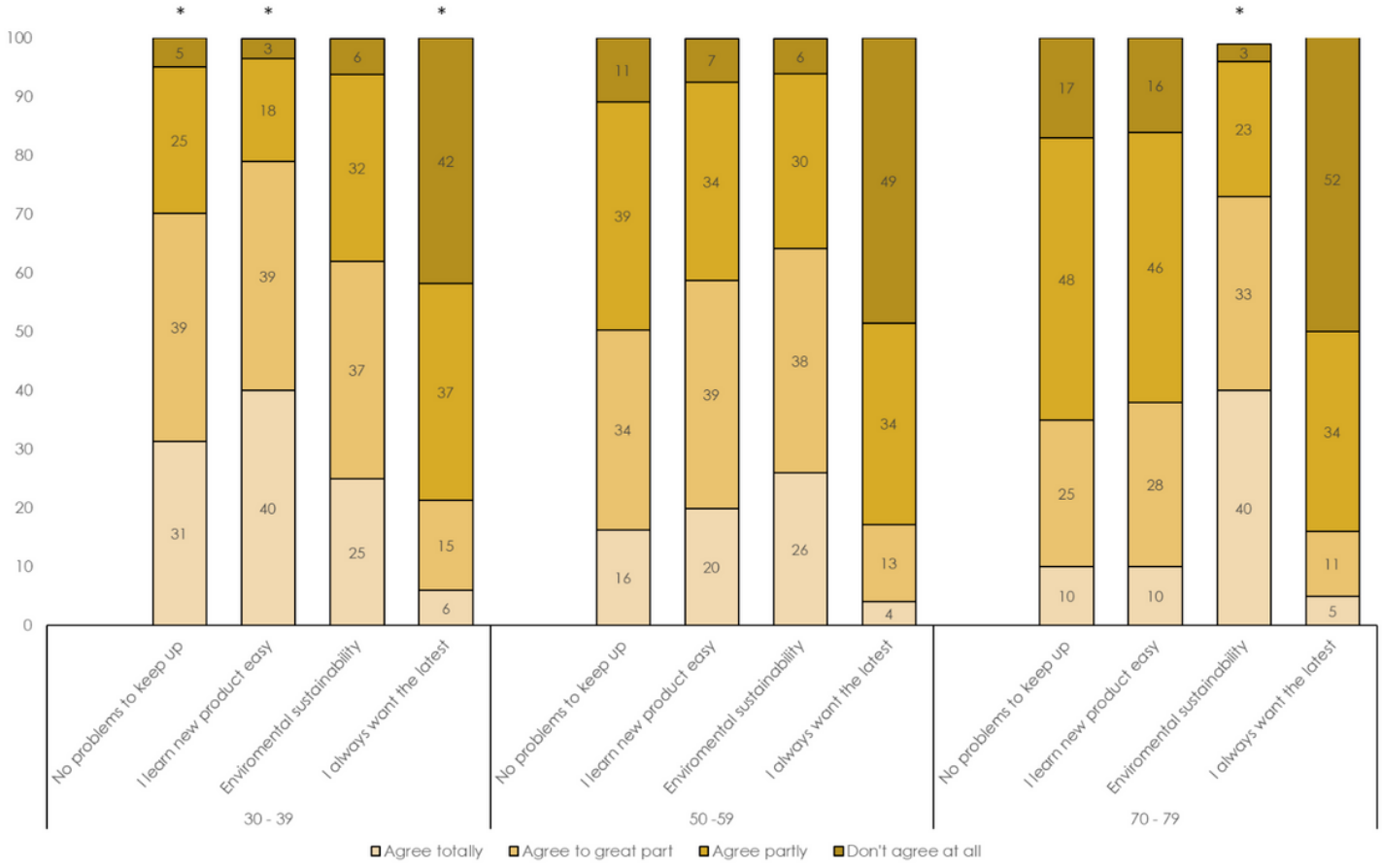

Figure 6

Note: Percentages rounded to the nearest integer.

* Generation differs significantly from the other generations ($p<0.05$).

Figure 6. The respondents' preferences, within each generation, when adopting new technology (N=2,121).