

Online Privacy Perceptions of Older Adults

Eva-Maria Zeissig¹, Chantal Lidynia¹, Luisa Vervier¹, Andera Gadeib², and Martina Ziefle¹

¹Human Computer Interaction Center (HCIC), RWTH Aachen University, Aachen, Germany
{zeissig, lidynia, vervier, ziefle}@comm.rwth-aachen.de

²dialego AG, Aachen, Germany

Abstract. Nowadays, the majority of people is connected to the world-wide web. Online services are included into everyday life to such a degree that non-use is almost impossible. Not only the young digital natives are online, also older users employ more and more online services. The amount of data created is vast but not without risks in terms of privacy behaviors. The present research addresses age differences in terms of attitude towards online privacy and privacy protection behaviors. Moreover, factors that can predict protection behavior and privacy concern, respectively, are examined. Via an online survey in Germany (N=200), privacy concerns, trust in online companies, awareness of and experience with online data misuse, as well as their self-efficacy regarding protective measures was explored, contrasting younger and older users. It was found that older users significantly differ in their awareness of privacy issues and protect their data more actively than younger users. Furthermore, it was found that said protection behavior is mainly influenced by privacy self-efficacy, followed by privacy concern and trust. Privacy concern, in turn, is predicted through awareness and previous experience with data misuse.

Keywords: Online privacy • Privacy awareness • Privacy concern • Privacy protection behavior

1 Introduction

The digital world has become ubiquitous for many users. More and more formerly of-fline areas of live are going online and every online action generates “Big Data” [1]. This provides opportunities not only for the individual and companies, but also for society, and healthcare (ibid). In Germany – an average country concerning internet use in Europe [2] – only 55% of those older than 65 years are using the internet, compared to almost 100% of the so-called generation of the “digital natives”, that was upraised with digital technologies [3,4]. This world-wide phenomenon has been labeled the “grey” digital divide [5].

The online world offers an enormous potential for the older generations, those sometimes referred to as the “silver surfers” [6,7]. Not only can older adults stay socially connected with those they have not seen in decades, with friends and families living far away, or get to know new people with similar interests [8,9]. Digital technologies also offer opportunities for “aging in place” by supporting daily activities, or alerting family members in case of emergency [9]. Access to health-related information as well as expanded opportunities for lifelong learning are more advantages, that show how the quality of life of the older generations can be improved through digital technologies [8].

However, there are also drawbacks and reasons why people do not use digital technology. Van Dijk [10] distinguishes four kinds of barriers which restrict the access. He calls it the “material access” (no possession of computer or network connections), the “skill access” (lack of digital skills), “usage access” (no usage opportunities), and the “mental access” (e.g. no interest). The latter describing personal attitudes. As such, concerns about privacy when using online services are high (e.g., [4,11–13]). For ambient assisted technologies, those technologies designed to help people staying independent in older age, privacy and security concerns have even been identified as one of the main barriers for acceptance [14,15]. Privacy perceptions and behaviors have been extensively studied in the last decades (e.g., [16-18]) and the phenomenon of the privacy paradox, i.e. users reporting to be concerned about privacy but behaving contradictory by divulging a lot of information, has been discussed excessively (e.g., [19,20]). The “digital natives” make use of many different online services while protecting their privacy (e.g., [21,22]), thus, being able to profit of the digital world as they are reassured to have reduced the risks. Older internet users have been reported to be even more concerned about privacy risks [23-26], but also to use fewer protective measures [23,25,26]. This seems paradoxical, as concerns usually motivate protective behavior [27].

Older adults represent a special group concerning the usage of information and communications technologies. They are usually more cautious in adapting new technologies and often less experienced [28]. They also show less confidence in dealing with the internet and privacy protection (e.g., [26,29,30]). So far, technological developments, innovations and services have mainly been designed for generally younger target groups. Older people are catching up with the usage of digital media but they still lag behind [4]. In empirical research the focus has been predominantly put on younger users and their privacy attitudes (e.g., [22,23]). In order to narrow the empirical state of the art of older users and their approach to digital media, we especially focus on the older user and their attitudes concerning internet usage. The question arises if the perceptions and evaluation of private information differs from those of younger generations. Therefore, this study is designed to gain insights into the privacy perception – mainly privacy concerns, trust and protection behaviors – of older adults. In the following section we focus on the theoretical background concerning the concept of online privacy and privacy attitudes and behaviors.

2 Privacy, Attitudes, and Behavior in the Online Context

First, a definition of the term *privacy* will be given. Then an introduction follows to establish the concepts of the *privacy paradox* and *privacy protection behavior*. Summarizing existing studies effects of age on behavior and attitude are then described.

2.1 The Meaning of Privacy

A multitude of definitions for the construct privacy exists from various scholarly fields. Some define privacy as a right, others as a state or even as a commodity [18]. Boundary regulation theory by Irwin Altman defines privacy as the process of “selective control of access to the self” ([31], p. 8) According to this theory, individuals use a dynamic process of boundary regulation to achieve the optimal level of privacy in each situation. Altman describes behavioral mechanisms that individuals can use to regulate privacy, e.g., territorial behavior and verbal content. These relate to the interaction of individuals with each other. In the online context, the individual is confronted with several address-ees, e.g. other users, but also online companies. Logically, territorial behavior usually constitutes no mechanism for privacy regulation online. Still the notion of privacy exists also in this context, with types or *dimensions* of privacy differing. Burgoon, for example, differentiates between social, psychological, physical and informational privacy [32]. In the online context, focus lies on the dimension of informational privacy – “the ability to control who gathers and disseminates information about one’s self or group and under what circumstances” ([32], p. 134). Hereafter, privacy is used synonymously for information privacy.

Just as multifaceted as the definitions of privacy are also the possibilities to measure the latent concept. Empirical research has mostly focused on the concept of *privacy concern* (e.g., [33,34,17]). Privacy concerns are experienced when an individual’s actual state of privacy does not match the desired state of privacy [35]. Privacy concern can be very specific to one situation, but in this study the focus lies on general privacy concern, “which measures a person’s overall perception of privacy risks on the Internet” ([35], p. 32). Many different scales for measuring privacy concern have been developed over the years [17,36]. One popular example is the Internet Users’ Information Privacy Concerns (IUIPC) scale by Malhotra et al. [37]. It consists of three subscales – control, awareness, and collection – which also illustrate the multidimensionality of this construct.

2.2 Attitudes vs. Behavior

Research in the field of privacy concern accelerated since the turn of the millennium. One phenomenon has gained much attention: the so-called *privacy paradox* [19].

Several studies report high levels of information privacy concern in the online context (e.g., [4,11,38,13]). Logically, one would assume that this leads to the internet users being very careful in order to reduce their concerns. However, actual usage behavior, e.g., public self-disclosure on social network sites (SNS), shows that users do not behave accordingly. Empirical studies even demonstrate that personal information is traded for very small monetary rewards [39,40]. This discrepancy between attitudes and behavior is usually referred to as *privacy paradox* [19].

According to Altman's theory, Internet users that are concerned about privacy should regulate their behavior to gain the optimal level of privacy. One regulating mechanism is to not use online services or to not disclose personal information. But it seems that not many users refrain from using services or from disclosing information. Luckily, the online context gives users additional possibilities for privacy protection, e.g., using protective software or providing false information. This protection behavior is often not included in empirical studies concerning the privacy paradox, but it needs to be taken into account to fully understand users' privacy management.

Protection motivation theory by Rogers assumes that protection behavior is triggered by a risk evaluation [27]. Thus, again, a high level of concern should motivate internet users to protect their privacy. Recent studies confirm the assumption, as privacy concerns are positively correlated with protection behavior [41,42]. But protection motivation theory includes other factors as well: Protection is only motivated when, first, the individual perceives the protective measures to be effective, and, second, feels competent in applying them [27]. The latter, self-efficacy in applying protective measures, matches the self-efficacy to protect one's privacy in the online context. Some scholars have already taken privacy self-efficacy or similar concepts into account when studying privacy attitudes and behaviors. Wohn et al. [43] and Chen & Chen [44] report that self-efficacy in privacy management and behavioral control does influence privacy protection behaviors.

Young internet users are often perceived as very vulnerable due to their excessive internet use and self-disclosure on SNS (e.g., [22,21]). They have therefore been studied extensively (e.g., [22,23]). Existing research also points out that young people are the internet users that exhibit much knowledge and self-efficacy regarding protective measures [26,29,45,46]. Correspondingly, studies report that young internet users apply privacy protection behaviors, e.g., adjusting privacy settings on SNS [22,23,25,26]. But what about older internet users? Do concerns motivate older internet users to either refrain from using internet technologies or to protect their privacy extensively? If they show low privacy self-efficacy does this lead to refraining? Are older users even aware of privacy issues and protective measures?

In the next section, we summarize what we already know about attitudes and behavior of older Internet users based on literature.

2.3 Older Adults' Privacy Attitudes

Privacy concern: The concept of privacy concern has been addressed in many studies, but results concerning age differences are contradictory. No significant differences in the level of privacy concern between older and younger internet users were reported by Hoofnagle et al. [47] and Taddicken [48]. Higher levels of concern for older adults were found, e.g., in studies by [23–26]. Sheehan [49] and Paine et al. [50] reported older internet users to be either very concerned or not concerned at all, respectively. That differences in privacy concern also depend on context was shown by Bergström [51]. She found older adults to be more worried concerning data misuse about credit cards, whereas younger users worry more about privacy on SNS (see also [46]).

Trust: Trust is a factor closely related to privacy concern. Rousseau et al. define trust as “a psychological state comprising the intention to accept vulnerability based upon

positive expectations of the intentions or behavior of another” ([52], p. 395). Empirical studies have, in the past, considered trust as an antecedent, a consequence, a mediator, or moderator to privacy concern and the intention to use technologies, respectively. Regarding age differences, Blank & Dutton [53] found that older people are trusting the internet less than younger people.

2.4 Older Users’ Privacy Behavior

Privacy protection is not black and white. There exist many ways of protection that provide different security. Apart from using protective technologies (Privacy Enhancing Technologies), users can, for example, refuse to use services and disclose information, provide false information, or adjust privacy settings of applications and services (e.g., [41]). Previous studies reported that young internet users show much more protection behavior than older internet users [22,23,25,26]. Altman’s and Rogers’ theories suggest that privacy concerns motivates protection behavior [27,31]. With some studies reporting higher privacy concern in older adults (see section 2.3), their lower protection behavior is paradoxical.

2.5 User Characteristics Influencing Privacy Concern and Protection Behavior

Most privacy theories assume that attitudes influence behavior [54]. However, there are other variables that play important roles as well. Included in this study are *experience*, *awareness*, and *privacy self-efficacy*. Additionally, effects of gender are examined.

Privacy Self-efficacy: Privacy literacy [55], data protection confidence [45], or privacy self-efficacy [22]: several names have been used in the literature to describe the confidence users have in their ability to control privacy settings and to protect their data. Older users are in general often less confident in using new technologies (e.g., [28,56,57,58]). That this holds true also for privacy protection has been shown by several authors, e.g., [26,45,46]. Privacy self-efficacy has also been shown to affect privacy protection behavior [43,44].

Awareness: Privacy awareness - “the extent to which an individual is informed about organizational privacy practices and policies” [59] – has been shown to influence privacy concerns, such that high awareness raises concerns. (e.g.: [18,59,60]).

Experience: Experiences shape people’s attitudes and beliefs. Individuals who experienced violations of privacy in the online contexts show a higher level of privacy concern (e.g., [11,35, 61]). Debatin et al. [62] also report that personal experiences of privacy invasion motivated participants to change their privacy settings in online social networks.

3 Questions addressed and logic of the empirical approach

The present study is designed to gain insights into older users’ (>54 years old) privacy attitudes and behaviors regarding the use of internet technologies in general. A national survey was conducted to answer the following research questions: (1) Do older internet users differ in their privacy attitudes and privacy protection behavior from younger us-

ers? (2) Which constructs can predict protection behavior and privacy concern, respectively? The focus lies on privacy concern and trust as well as on privacy protection behavior when using online technology. As explanatory variables, *experience*, *awareness*, and *privacy self-efficacy* are included as well. Figure 1 depicts the empirical approach with the relevant variables under study.

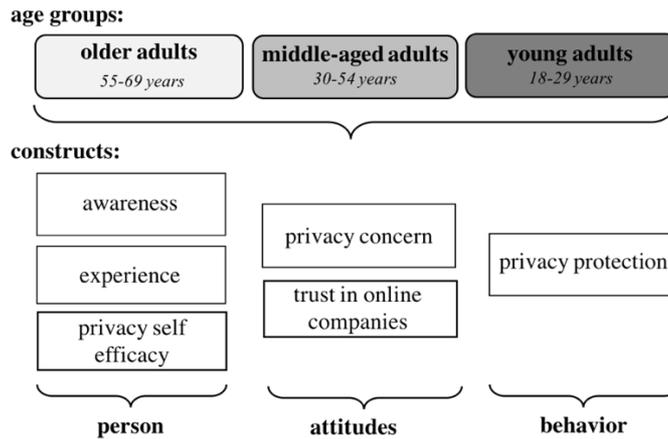


Figure 1. Empirical approach and studied variables.

3.1 Hypotheses

Based on Rogers' protection motivation theory [27] it is assumed, that online privacy protection behavior is motivated by privacy concern and privacy self-efficacy. Also it is inferred that trust reduces motivation to protect privacy. Privacy concern is hypothesized to be positively influenced by awareness of privacy issues as well as experience with privacy violations. Differences between age groups are hypothesized based on previous studies and theory (cf. section 2). Our hypotheses concerning age differences read as follows:

- H 1: Older adults report a higher level of privacy concern than younger age groups.*
- H 2: Older adults report less trust in online companies than younger age groups.*
- H 3: Older adults scale higher on protection behavior than younger age groups.*
- H 4: Older adults report less privacy self-efficacy than younger age groups.*
- H 5: Older internet users report a higher level of awareness than younger age groups.*
- H 6: Older internet users report less experience with privacy violations than younger age groups.*

4 Method

In a quantitative approach, a study was conducted in the form of an online questionnaire. The questionnaire study focused on older users' privacy attitudes in conjunction with their privacy behavior. Items used were based on literature and a prior focus group

study. The questionnaire was distributed by a market research company. It was delivered online to their panel and took about 20 minutes to complete. Participants were remunerated by the market research company as by their practice.

4.1 The Questionnaire

Participants were invited to take part in the study by the market research company. First, a screening was conducted to select participants across all age groups with symmetrical gender distribution. The questionnaire itself consisted of three parts: user characteristics (1), online behavior (2), and privacy attitudes (3). All items are listed in Table 1. Scales from literature were partly changed after translation due to comprehensibility in the German language, consistency with the overall style of items, and adaption to the context of general internet use. Additionally, some scales were abridged.

User characteristics: Age, gender, education level, privacy self-efficacy, experience and awareness were assessed. To measure *privacy self-efficacy*, items of the scale “locus of control when interacting with technology” [63] and the subscale “competence” of Karrer et al.’s “technical affinity” scale [64] were adapted to the context of privacy settings and protective privacy measures. *Experience* was assessed with three items measuring experience with online privacy violations that have been adapted from [65] and translated into German. The scale *awareness* was developed based on [59] to measure awareness of online privacy issues in society and media.

Behavior: First, participants selected which of the following widespread online services they use: social networks, location-based services, chat applications, video chat applications, online banking cloud services and e-commerce (*usage of online services*). Second, they evaluated four items indicating whether they actively use measures to protect their online privacy (*protection behavior*).

Attitudes: A scale measuring *privacy concern* was developed from an extensive literature search by comparing and paraphrasing existing items. The new German scale contains three items translated and adapted from [40], [47] and [48]. *Trust in online companies* was assessed via the 3-item subscale *Benevolence* (institution-based trust) by [68]. Additionally, participants evaluated five statements concerning the reasons why they do or do not protect their online privacy, as taken from the preceding focus group study.

All scales were measured on a 5-point Likert scale ranging from “I agree” to “I do not agree.” The only exception was the use of online services for which the answers were either “I use this kind of service” or “I do not use this kind of service.”

Cronbach’s α was calculated for a reliability analysis. Results and items are illustrated in Table 1. Except for experience and trust in online companies, all scales included at least one reverse coded item. The number of items ranged from 3 to 6. The reverse coded items and small number of items per scale contribute to a small Cronbach’s α . Thus, values of $\alpha > .6$ are assumed acceptable and indexes were calculated.

Table 1. List of items used in the questionnaire with their source. The respective scale's reliability is listed as Cronbach's α .

Item	Scale	
I believe that my online privacy was invaded by other people or organizations. [65]	Experience $\alpha=.746$	
I have had bad experiences with regard to my online privacy before. [65]		
I experienced misuse of data from friends or family.		
I follow the news and developments about privacy issues and privacy violations. [59]	Awareness $\alpha=.637$	
I cannot comprehend the relevance of the issue privacy because I do not care about it.		
I pay closer attention to privacy issues and privacy violations since they have become so prominent in media.		
I know most privacy settings of the applications I use. (<i>adapted from</i> [64])	Privacy Self-efficacy $\alpha=.691$	Person
Because I have had no problems with privacy settings so far, I am confident for future privacy tasks. (<i>adapted from</i> [63])		
I do not read privacy policies because I do not understand them. (<i>adapted from</i> [63])		
I always change my privacy settings when I start using a new device. (<i>adapted from</i> [63])		
I always change my privacy settings when I start using a new application. (<i>adapted from</i> [63])		
I feel helpless with privacy settings and measures, so I do not change anything. (<i>adapted from</i> [63])		
In general, I am concerned about my privacy when I am using the internet. (<i>adapted from</i> [66])	Privacy Concern $\alpha=.686$	Privacy Attitudes
I do not see risks when providing data in the internet. (<i>adapted from</i> [59])		
With some type of information collected in the internet I do not feel comfortable. (<i>adapted from</i> [67])		
I feel that most online companies would act in a customers' best interest. [68]	Trust in Online Companies $\alpha=.858$	
If a customer required help, most online companies would do their best to help. [68]		
Most online companies are interested in customer well-being, not just their own well-being. [68]		
I use every option that I know to protect my online privacy (e.g., deleting cookies, anti-virus software).	Protection Behavior $\alpha=.686$	
I specifically search for more options to protect my online privacy.		
I use the default settings of my devices and applications without changing them.		
I use the default settings of my devices and applications without installing additional software to protect my privacy.		
Privacy protection does not work. Whoever wants to can still access my data.	Additional Attitudinal Items	
I feel comfortable providing data on the internet because I get rewards (e.g., individualized advertisement, information from friends).		
I do not have enough time to keep informed and apply privacy protection.		
Privacy protection has become so complex that I do not know how to protect my privacy anymore.		
Friends and family tell me to be (more) careful with providing data on the internet.		

4.2 Participants

In total, 200 German internet users between the age of 18 and 69 ($M=44.8$, $SD=13.7$) took part in the study (of which 50.5% were male and 49.5% female). Data was collected in December of 2016. The overall goal was to get a heterogeneous sample with regard to age, gender, and education level. The education level varied across all participants: 38% reported a university degree and 16.5% a vocational training but between the age groups, the level of education did not differ significantly. However, the familiarity with using the internet was high as all participants are test persons in the panel of the online market research company and, thus, they use the internet regularly, at the very least for taking part in studies.

For analysis of age-effects, the sample was split into three age groups. The group of “older adults” was formed by 59 persons between 55 and 69 years of age ($M=61.0$, $SD=4.7$), often referred to as the “silver surfers” [7,6]. A base group of the “middle-aged” consisted of 100 people between the ages of 30 and 54 years ($M=43.1$; $SD=6.9$), sometimes classified as the “digital immigrants” [7,3]. For contrast, also a group of “young adults”, or so-called “digital natives” [7,3], was formed with 41 persons aged between 18 and 29 years ($M=25.5$, $SD=3.1$).

4.3 Data Analysis

Grouped differences were analyzed by ANOVA procedures which are quite robust even when the assumption of standard distribution is violated. Nevertheless, non-parametric tests were used for comparison and revealed the same results. Therefore, only the ANOVA findings are reported. Moreover, data was analyzed by multiple linear regression.

Significance level was set at 5%. For post-hoc procedures, either Hochberg’s test was used for unequal group sizes or Games-Howell post hoc test, if homogeneity of variance could not be assumed. To quantify the different scales, overall scores were calculated as the average of single ratings of the items.

5 Results

In this section, the descriptive results for the group of “older adults” and differences between age groups will be presented. Then, regression results will be shown.

5.1 Differences in Privacy Attitudes and Online Behaviors

Usage of online services: Figure 2 depicts the percentage of participants using popular types of online services. The group of older adults uses, on average, less online services than young and middle-aged adults. The usage of e-commerce, online banking, location-based services, cloud services, and video chats does not significantly differ between the age groups. But significantly more young adults use social networks (83%) than do middle-aged (59%) and older adults (58%) do ($\chi^2(2) = 8.43$, $p < .05$). Chat applications are popular with young (80%) and middle-aged adults (76%), but significantly fewer older adults use them (42%) ($\chi^2(2) = 23.22$, $p < .001$).

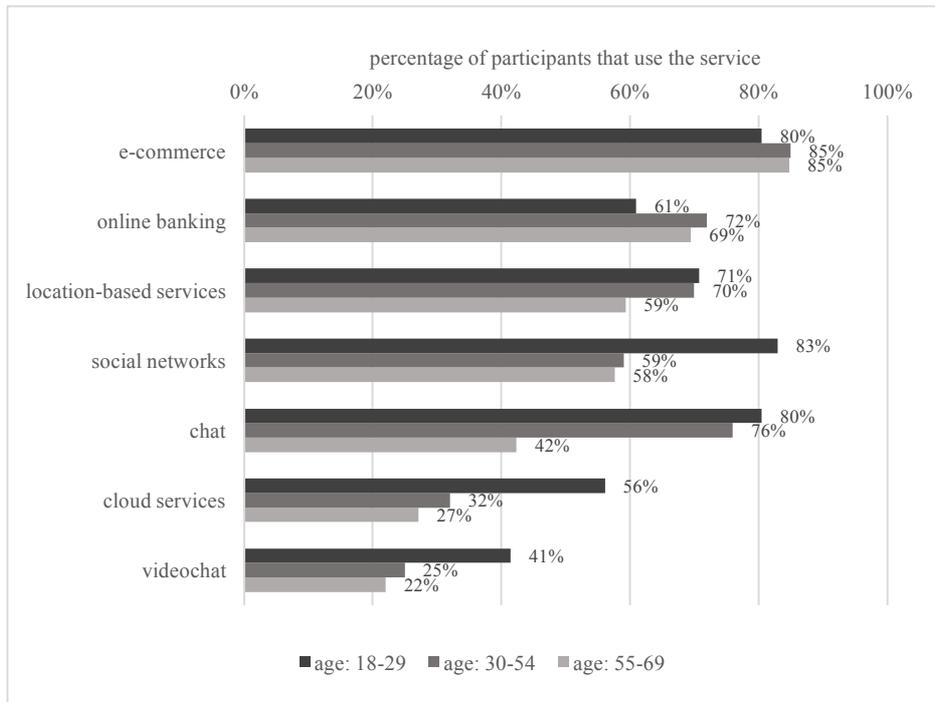


Figure 2. General usage of popular types of online services in percent differentiated by age group (N=200).

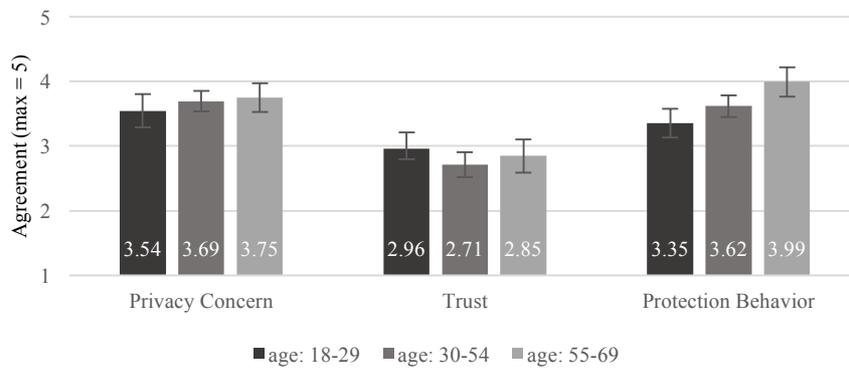


Figure 3. Mean values of overall scores of privacy concerns, trust, and protection behavior differentiated by age group (with 95% confidence intervals; N=200).

Privacy Concern: Privacy concerns are reported to be on average 3.68 out of 5 points ($SD=0.82$), see Figure 3. As hypothesized, concern seems to be higher with older inter-

net users, but there are no significant differences (Hypothesis 1). The pie charts in Figure 4 show how many percent of participants of each age group did fully, partly or not at all agree to have concerns about their online privacy. No respondent reported to be free of any privacy concerns, but 11.5% fully agreed with all statements. 15% of the older adults, 12% of the middle-aged, and 5% of the younger adults are very concerned.

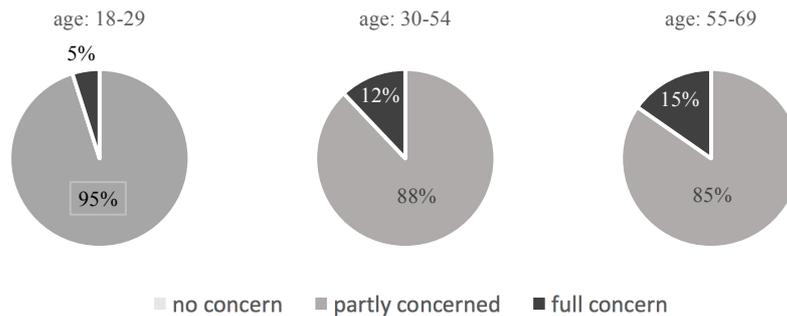


Figure 4. Percentage of participants that do not agree at all, partly agree or fully agree to the privacy concern items; differentiated by age group (N=200).

Trust: Trust in online companies on the other hand, was reported lower than the midpoint, with $M=2.80$ ($SD=0.93$) (s. Figure 3). Middle-aged participants reported the lowest trust on average ($M=2.71$, $SD=0.97$) and young participants the highest ($M=2.96$, $SD=0.8$). However, the differences are not significant.

Protection Behavior: Protection behavior is high on average in the sample ($M=3.67$, $SD=0.86$), see Figure 3. Older adults show a significantly higher protection behavior ($M=3.99$, $SD=0.87$; $F(2,197)=7.63$, $p<.001$) compared to young ($M=3.35$, $SD=0.71$, $p<.001$) and middle-aged adults ($M=3.62$, $SD=0.85$, $p<.05$). Young adults reported to exhibit the lowest protection behavior.

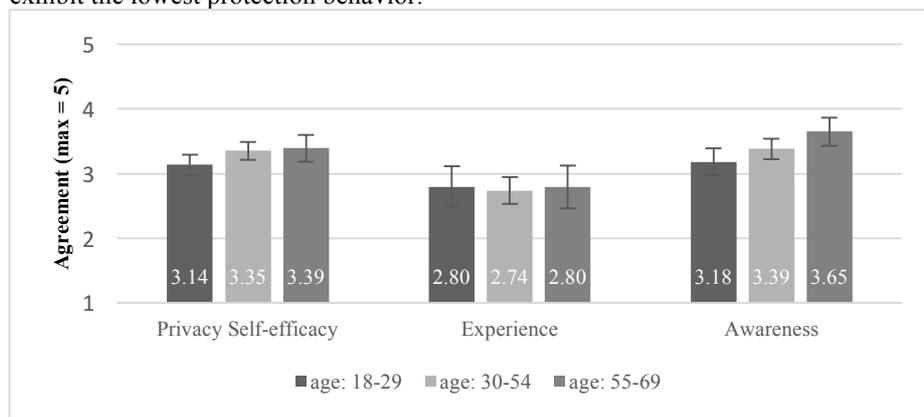


Figure 5. Mean values of overall scores of privacy self-efficacy, experience, and awareness differentiated by age group (with 95% confidence intervals; N=200).

Privacy Self-efficacy: No significant differences can be reported between age groups concerning privacy self-efficacy (Welch-Test $F(2,110)=2.87, p=.06$). Privacy self-efficacy is, on average, 3.3 points out of 5 points max ($SD=0.74$). Young adults report less privacy self-efficacy ($M=3.14, SD=0.49$) than older ($M=3.39, SD=0.80$) and middle-aged adults ($M=3.35, SD=0.71$), with older adults reporting the highest level of privacy self-efficacy, see Figure 5.

Experience with privacy violations: Experience with privacy violations averages to $M=2.77$ out of 5 points max and shows with $SD=1.1$ more variation than the other constructs (variation between $SD=0.70$ (privacy self-efficacy) and $SD=0.94$ (trust) with the maximum of 5 for all scales). No age differences could be found.

Awareness: Awareness of privacy issues is reported to be $M=3.4$ out of 5 points max ($SD=0.79$) and there is a significant effect of age on level of awareness ($F(2,197)=4.63, p<.05$). Figure 5 shows that young users report the lowest ($M=3.18, SD=.65$) and older adults the highest level of awareness ($M=3.65, SD=0.83$). Hochberg's post hoc test reveals the difference between young and older adults to be significant with $p<.01$.

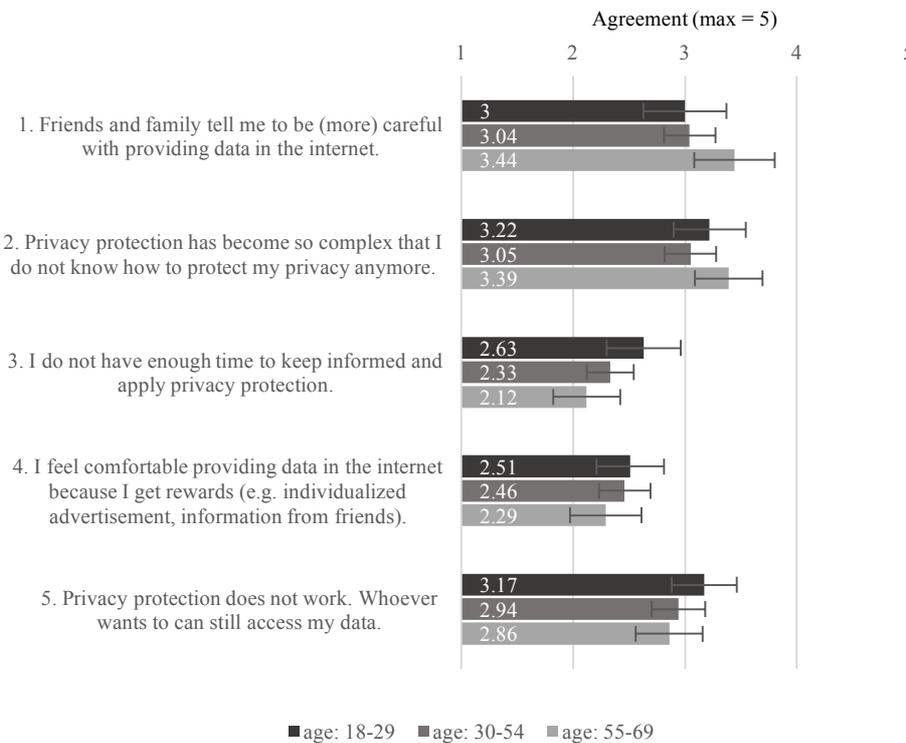


Figure 6. Mean values for each statement differentiated by age group (N=200).

Additional attitudinal items: In addition to the standardized constructs, five statements describing different attitudes towards privacy protection were evaluated by the participants. The results are depicted in Figure 6. Older adults agree more than the other age groups that friends and family caution them to be more careful (Item 1: “Friends and

family tell me to be (more) careful with providing data in the internet”) and that privacy protection is too complex (Item 2: “Privacy protection has become so complex that I do not know how to protect my privacy anymore”). In the opposite direction, older adults agree less that time is too short for privacy protection (Item 3: “I do not have enough time to keep informed and apply privacy protection”), that rewards outbalance concern (Item 4: “I feel comfortable providing data in the internet because I get rewards (e.g. individualized advertisement, information from friends”), and they are also less resigned considering the effectivity of protection measures (Item 5: “Privacy protection does not work. Whoever wants to can still access my data”). However, none of these differences is statistically significant.

5.2 Regression Analysis

So far, the results gave insights into the general assessment of each variable or overall score of variables distributed via the three age groups. In the following, the level of content will be left and variables will be analyzed regarding their interrelation.

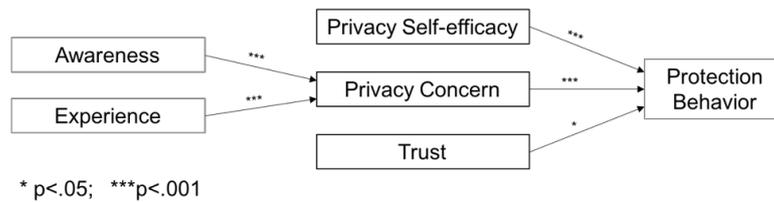


Figure 7. Influences of variables on each other testes by regression analysis

To analyze the influence of privacy concern, trust, and privacy self-efficacy on protection behavior, and in a second model the influence of experience and awareness on privacy concern, multiple linear regressions was calculated (cf. Figure 7). The results for protection behavior are shown in Table 2 and for privacy concern in Table 3.

Table 2. Linear model for protection behavior, with 95% bias corrected and accelerated confidence intervals reported in parentheses. Confidence intervals and standard errors based on 1000 bootstrap samples.

	B	SE B	β	t	p
Constant	1.049 (0.395, 1.686)	0.314		3.225	.001
Privacy Concern	0.259 (0.132, 0.369)	0.063	.249	4.261	.000
Trust	-0.122 (-0.225, -0.025)	0.052	-.134	-2.411	.017
Privacy Self-efficacy	0.606 (0.456, 0.764)	0.078	.499	8.763	.000

$R^2 = .43$, $F(196,3)=48.62$, $p<.001$

Influences on Protection Behavior: Protection behavior is significantly predicted by privacy concern, trust, and privacy self-efficacy (see Table 2). Trust has a negative effect on protection behavior. Privacy self-efficacy has the greatest influence. The overall model explains 43% of variance in protection behavior.

Influences on Privacy Concern: Awareness and experience significantly predict privacy concern, with awareness showing a greater influence (see Table 3). The model explains 31% of variance in concern.

Table 3. Linear regression model for privacy concern, with 95% bias corrected confidence intervals reported in parentheses. Confidence intervals and standard errors based on 1000 bootstrap samples.

	B	SE B	β	t	p
Constant	1.597 (1.098, 2.105)	0.276		6.199	.000
Awareness	0.395 (0.239, 0.537)	0.076	.249	5.995	.000
Experience	0.217 (0.110, 0.317)	0.053	-.134	4.669	.000

$R^2 = .31$, $F(196,3)=29.21$, $p<.001$

6 Discussion

With the ever more prevalent inclusion of online services into everyday life, possible benefits as well as risks of misuse and abuse of the available digital data gain more importance. Therefore, a study was conducted to gain insight into the prevailing assumptions and behaviors people exhibit when dealing with digital services. For the present article, the focus was put on the influence of age on constructs such as privacy concern, trust in online services, awareness of and experience with online data misuse, as well as their self-efficacy regarding protective measures. Based on the literature, and a focus group study, different hypotheses have been formulated and tested with an online questionnaire.

The findings revealed both, patterns related to age and related to other variables. Regarding privacy concerns, the results show that older adults do not report a significantly higher level of privacy concerns than younger adults (rejecting Hypothesis 1). Perhaps it is, as Sheehan [49] and Paine et al. [50] have reported, that the group of older adults consists of either very concerned or not at all concerned internet users. On the other hand, it could be hypothesized that, with the more and more widespread use of internet technologies also by the older adults, the so-called “grey” digital divide is getting narrower. To fully resolve this issue, previous studies should be repeated using the same research design to get up-to-date results and the latest baseline for the relevant and often cited phenomenon of the digital divide.

Even though other studies report older adults to be less protective of their data than younger adults, our study showed them as more protective, thereby confirming Hypothesis 3. Furthermore, it could also be shown that the more concerned an individual, regardless of age, is for their privacy, the more protective behavior is exhibited. This is in line with previous research as well as with Rogers' [26] theory that risk evaluations motivate protection behavior. No paradox can be reported in this study.

However, in contrast to the actual protection behavior, the present study examined a somewhat relative protective behavior. Instead of measuring if every available possibility to protect data was utilized, our sample confirmed to using "everything I know of." This operationalization measures the intention and motivation to protect privacy more than actual behavior – in other words, it is more the wish to protect than the actual protection. Thus, the results show that older adults are trying their best to protect their privacy. A next step would be to relate actual protection behavior to our construct and include knowledge of privacy protective measures as well. If the trying is high but actual protection is low, it is not the intention that is lacking but probably the knowledge. Other reasons should be further investigated as well. It is very much possible that protective measures are very complex in their application and easy to understand guidance is lacking. Also, it could be possible, that older adults are perfectly aware of the importance of adaptive protection behaviors in the internet, however, they could have a different understanding of which information is private, and thus, worth protecting, and which information can be shared from their perspective. The latter refers the fact that the meaning of quality of life is different from that of younger persons ([69]–[71]). Here, future research has to explore the privacy motives of seniors and reasons to protect or share digital information. Furthermore, research into the perception of the sensitivity of different types of information is interesting, especially concerning age differences.

The present study has also confirmed that trust and privacy self-efficacy also influence protection behavior. The more persons trust in online companies in general, the less they pay attention to protection behavior. No differences in trust levels between the age groups could be reported. Self-efficacy could explain the most variance in protection behavior in our data: The more confident users are in protecting their privacy the more protection behavior was reported. This is again in line with previous studies and with Rogers' protection motivation theory [26]. Against our hypothesis (H4), privacy self-efficacy was highest with the older adults and lowest with the younger participants. Again, this could be an effect of relativity: Confidence in the own protection abilities is not equivalent with the comprehensiveness and completeness of these abilities. Thus, again, the relation of privacy self-efficacy and actual protection abilities needs to be studied further. In line with the above hypothesis, that applying protective measure is complex, also evaluating the effectiveness of what one has done is hard. This could be one possible explanation for a discrepancy between abilities and confidence in these abilities.

Nonetheless, the considerations up to this point do not include one important restriction: The present data is based on a sample of participants, that are used to participate in market research via the internet and, thus, may consist of more technically ex-

perienced, affine, and confident people than the average population – especially concerning the older age group. This could have veiled potential age differences in a less technically affine sample. Nevertheless, the data shows older adults to be even more confident and protective than younger age groups. Furthermore, trust in online companies in general was relatively low with all age groups and privacy concern was, on the other hand, still high.

The present study also investigated awareness of privacy issues and previous experience with privacy violations as antecedents of privacy concern. Regarding age, no differences between groups could be found for experience, but awareness was much higher with older adults and the lowest with younger adults. In regression analysis, it could be confirmed that both variables predict privacy concern, with awareness being the better predictor. Protection motivation theory by Rogers' assumes an evaluation of risks as the central element to motivate protective behavior [26]. Perception of risks is in this study operationalized as privacy concern and awareness of risks is a precondition for these concerns. But we know that concern is influenced by many different factors, not the least being the personality and disposition of individuals to worry and to feel a need for privacy (e.g., [59],[72],[11],[65]). Awareness of privacy issues may be the very first step to motivate privacy protection behavior. This study took a very general approach to all constructs in the context of general internet use. Further investigation should be done to get a better understanding of how being aware of specific risks motivates people in different contexts to take protective measures.

We live in an ever more networked world where not being online is, for many people, no feasible alternative anymore. Apart from numerous benefits, data collection also brings about risks and the internet does not forget. Older users have, in the past, been more reluctant to participate in online activities, but they are catching up on using different online services. Increasingly more studies conclude that privacy is still very important to most and privacy concerns are especially high with the older adults. Taking protective measure could reassure users and, thus, yield more online participation. But the privacy paradox phenomenon shows that there is a missing link somewhere between attitude and behavior. At the same time, taking protective actions mostly lies in the responsibility of each individual internet user, regardless of the actual awareness or capability to protect oneself. It is very important to study people's motives and barriers to internet use but also to privacy protection behavior, so that the digitalized world can utilize its full potential, without leaving many behind or vulnerable to harm. Our results are a precursor and impulse for more detailed research into the relationships between awareness, privacy self-efficacy, concern, and behavior.

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