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Research Article

The Use of Digital Media and Security Precautions in Adulthood

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The use of digital media through chatting, online conferencing, or browsing has become a leisure activity for many people, but it is not necessarily characterized by caution. Given the possibilities for misuse of data, the question of whether users actually implement security precautions and pay attention to protection of their data is important. The present study examines whether the use of digital media or security precautions is associated with age, commitment to technology (feelings of competence and control in dealing with technology), and flexible goal adjustment (the capacity to adjust personal goals in difficult life situations). In addition, we examine whether age differences in the use of social media (e.g., Facebook, WhatsApp, Telegram, Skype, and Zoom) are moderated by the commitment to technology and flexible goal adjustment. A total of 841 adults between 19 and 71 years of age ($M_{age} = 43.57$; SD = 15.12) participated in a cross-sectional questionnaire study. Age was positively correlated with security precautions but negatively with the use of social media. Security precautions and the use of digital social networks were correlated significantly with general flexibility of goal adjustment and technology commitment, even after age and gender were controlled with a structural equation model. Moderation analyses revealed that the relation between social media use and age was weaker among participants with higher degrees of technology commitment and flexible goal adjustment. We discuss the extent to which flexible goal adjustment and technology commitment can provide a mental precondition that promotes both digitized leisure activity and security precautions.

1. Introduction

Many studies have shown that the use of digital social media has increased during the last years [1, 2]. Given the possibilities for data to be misused (e.g., misuse of personal data, hacker attacks), the protective role of security precautions (i.e., how users protect themselves) has become important [3, 4]. Digital media and social networking in leisure time are not only common in adolescence or young adulthood but also in middle and older adulthood. During the period 2005 to 2015, the percentage of Americans likely to use social media has increased from 5% to 51% for those aged 50 to 64 years and from 2% to 35% for those aged 65 years and older [5]. Studies on social media use and security precautions during adulthood are scarce, in particular in relation to interindividual differences in attitudes towards technology [6, 7] and motivational resources for changing developmental contexts such as flexible goal adjustment,

the tendency to adjust goals to constraints or changes [8]. The present study examines whether technology commitment and flexible goal adjustment are associated with digital social media use and can explain possible age differences. Understanding the psychological resources should contribute to the understanding of why social media are used and why age differences exist.

1.1. The Use of Digital Media in Adulthood. Although many older adults use digital media and communication technology, age differences exist. First of all, the younger generation may use digital media more frequently because they are, so to say, surrounded by computers and their use as the generation of the digital natives [9]. Contributing to the fast adoption of digital media among younger generations is the implementation of new technologies in lessons and schools. Older adults may lack motivation, openness to innovation, or confidence in their abilities [10–12]. Studies on age

differences have shown that older adults have greater anxiety about using new technologies and are less confident in their abilities to learn about new technologies [13].

Given the increased frequency of use, a potential problem for all age groups arises in regard to cybersecurity. Studies on age differences in the vulnerability to threats (e.g., to phishing attacks) are still scarce and not conclusive [10]. In the following article, we refer to security precautions as self-reported adherence to computer security advice [3]. In contrast to studies that examine risk behavior in concrete situations, for example, the task of creating a secure online password [14] or responding to phishing emails [15], security precautions include attitudes and intentions in behavior reports of the end-users. Egelman and Peer developed a security behavior intentions scale (SeBIS) that differentiates between four domains (proactive awareness, password generation, updating, and device securement). Security behavior was positively associated with a need for cognition and consideration of future consequences but rather negatively with impulsivity [3].

Few studies focused on age differences. Positive age correlations were found for all domains except for device securement [10], but the effects were only small or modest. A study on online privacy perception showed that older adults reported a significantly higher awareness of privacy than younger users and protected their data more actively [16]. Li et al. [17] explored the effects of generation on employee's cybersecurity behavior by comparing different cohorts (Gen Edge, Millennial, Generation X, and Baby Boomers). Significant differences between the generations were found, with awareness for cybersecurity being lower in the group Gen Edge (the youngest group) than the other groups. In studies with either unclear [18] or insignificant age effects [19], more than 75% of study participants were 35 years or younger. Aside from the ambiguity of the findings, one can argue that taking precautions is an adaptive response. Many studies have shown that fear of crime is stronger in older adulthood and that older adults behave more cautiously [20, 21]. Although that vulnerability to scam (e.g., susceptibility for telemarketing fraud) is high for older adults [22], several studies provided no evidence that older adults were more prevalent among online fraud victims than individuals of other ages (for an overview Shang et al. [23]). Thus, one could expect a positive association between age and security precautions.

In sum, it can be expected that age is negatively correlated with the frequency of the use of digital social media but positively correlated with security precautions. In the following, we argue why technology commitment and flexible goal adjustment are associated with both and possibly contribute to the explanation of age differences in social media use.

1.2. Attitudes and Commitment to Technology.
Attitudes are widely used to explain human action and behavior. People's beliefs about the extent to which they have the ability to use and learn new technologies (e.g., digital mindsets, self-efficacy beliefs) are seen as being important for their information processing and engagement in this context [24].

According to the *Technology Acceptance Model* [6], two primary factors (perceived ease of use and perceived usefulness) influence attitudes, which in turn predict the actual use of a system. Neyer and colleagues [25] developed a questionnaire on technology commitment that complements the concept of acceptance with its components technology competence and technology control. Attitudes including acceptance and competence have been found to be associated with behavioral intentions or actual behavior [7, 26]. A few studies have documented correlations with variables related to security precautions, for instance, an intention to use the information system's security measures [27], or trust and lower degrees of privacy concerns [26]. For a better understanding of the motivational prerequisites, we examine whether commitment to technology is associated with the use of digital social media and security precautions. Because both behavioral intentions presuppose a technical insight or competence, positive associations can be expected.

An additional research question is whether technology commitment moderates the negative association between age and use of digital social media. Based on research and evidence emphasizing the behavior-related power of mindsets [24, 28], one could expect that the negative age correlation should be reduced or absent if individuals are open to technology and feel a sense of control. In particular, the older adults who did not grow up with digital social media could benefit from technology-related feelings of competence.

1.3. Flexible Goal Adjustment.
The development of digital media is characterized by accelerated change [29]; this has implications for vocational education [30] as well as digital literacy education for older adults and their social participation [31]. Advances in technology do not only bring benefits; one must also cope with changes (see, for instance, the concept of *techno-stress*; [32]) and the individual needs to be sufficiently flexible. Flexible goal adjustment [8] denotes the capacity for self-regulation that helps to direct action resources to new goals. When individuals are confronted with difficulties or obstacles, the adjustment of goals, values, and the evaluations of threats become important. The protective function is seen in the maintenance of control [33], well-being, and resilience [8]. In moderated regression analyses [8, 20], flexible goal adjustment has been found to buffer the negative impact of losses on well-being in different life domains.

The development of digital media is increasing rapidly, which requires adaptation and rethinking from the users. Thus, we expect a positive correlation between flexible goal adjustment and both frequency of use of digital media and security precautions. In the present study, we also examine whether flexible goal adjustment moderates the association between age and the use of social media. We expect that older adults would benefit more from this adaptative capacity because younger adults are more familiar with social media and would need less general goal flexibility.

The present study has several aims. First, we want to replicate the findings that the use of social media is stronger among younger adults and among adults with a higher degree of technology commitment. In addition, we examine

whether security precautions are associated with age. In a second step, we investigate whether flexible goal adjustment and technology commitment are associated with the use of digital media and security precautions. Third, we examine whether flexible goal adjustment and security precaution moderate the association between age and the use of social media. This step would test the hypothesis that the negative age correlation is weaker or absent among adults with a higher degree of flexible goal adjustment and technology commitment.

2. Materials and Methods

2.1. Participants and Procedure. Participants were recruited through the online panel platform Cint AB for social research in Germany and received financial compensation for participation (ca. €4). Initially, 994 participants responded to the survey, but 94 were not considered because they failed the quality check. The quality check consisted of a question embedded in the questionnaire ("Please check the box with the number 2.") to make sure the participants were reading the instructions properly; 54 participants were removed due to questionable validity of the responses (e.g., extremely fast completion (less than four minutes, or monotonous responding). Prior to the analysis, we tested deviations from normality using graphical methods as well as skewness and kurtosis values. For use of social networks, security precautions, technology commitment, and flexible goal adjustment, values of skewness and kurtosis were between -1 and +1 and indicate no strong deviations from normal distribution. From the remaining total of 846 participants, five cases with extreme z scores ($> |+-3|$) were found to be univariate outliers and were deleted.

The final sample consists of 841 participants aged 19 to 71 years ($M_{age} = 43.57$, $SD_{age} = 15.12$). Gender ratio was balanced (49% female). The percentages of women in the three age groups 19-34 ($N = 283$), 35-54 ($N = 311$), and 55-71 years ($N = 247$) were 48, 50, and 49%, respectively. Eleven percent of the participants had a lower educational level, with 9 or fewer years of schooling, 31% had a medium educational level with 10 years of schooling, and 58% had a high level of education with 12 or more years of education (German Abitur); 46% had completed vocational training, and 41% had a university degree. Participation was voluntary. Before taking part, participants were given information about the study and data privacy. Afterwards, participants were required to confirm that they were at least 18 years old and to give informed consent by checking a box. The present study was approved by the ethics commission of the [anonymized for review].

2.2. Measures

2.2.1. Use of Digital Media. Media use was measured by the items private chat (e.g., WhatsApp, Signal, and Telegram), social networks (e.g., Facebook, Instagram), video calls (e.g., Zoom, Skype, Webex, and Jitsi), emails, and Internet surfing. We asked participants to indicate on five-point scales how frequently they used social media and how much

they enjoyed using it (see, e.g., Nikstat et al. [34]). Factor analyses indicated two dimensions: *use of social media* (private chatting, using social networks, and telephoning with video) and *emailing/surfing*. Because frequency and willingness were highly correlated (r's = .80 and .61), we calculated mean values for social media use (Cronbach's alpha = .89) and for emailing/surfing (Cronbach's alpha = .75).

2.2.2. Security Precautions. The *Security Behaviour Intentions Scale* (SeBIS) was used to measure security intentions [3]. SeBIS consists of four subscales that measure attitudes towards password generation, proactive checking, software updating, and device securement. Participants were asked to rate on a five-point Likert scale (1 = "never", 5 = "always") how frequently they use each of the security precautions. The Cronbach's alpha values ranged from .56 to .66. For the three scales, password generation, proactive coping, and software updating, we computed a total mean for the bivariate correlation analyses and later used these scales in a structural equation model. The subscale device securement was not included because of its low reliability ($\alpha < .60$) and reduced fit indices.

2.2.3. Commitment to Technology. The commitment to technology was measured using Neyer et al.'s brief measure of technology commitment [25]. It consists of three subscales that measure the facets: technology acceptance, technology competence convictions, and technology control convictions. Each of the three facets was assessed with four items, with a total of 12 items. The items were rated with a five-point Likert scale with the response options from 1 = "not true at all" to 5 = "completely true". The items in the technology competence convictions scale were negative statements and had to be inverted. Cronbach's alpha for the three subscales ranged between .76 and .90. Mean scores were calculated for all three facets and for the overall scale as commitment to technology. A higher mean value reflects a higher degree of technology commitment.

2.2.4. Flexible Goal Adjustment. The ACCO-5 scale [35], a questionnaire encompassing several facets of flexible goal adjustment, was used to measure accommodation. The items relate to how people deal with situations in which goals or plans may no longer be realized as one had wished. The subscales—lowering of aspirations/acceptance, positive reappraisal/personal growth, downward comparisons, reorientation, and detachment from goal—assess the general tendency to adjust one's goals in the face of threats to these goals. Participants were asked to rate the general appropriateness of every item on a seven-point Likert scale (1 = "not at all", 7 = "exactly"). Cronbach's alpha for the four subscales ranged between .76 and .85. The scales were highly correlated (.38-.70) and the mean score was calculated. Descriptive statistics and ranges of the central variables are presented in Table 1.

2.2.5. Control Variables. Openness to experience has been found to be significantly associated with self-reported cybersecurity behaviors [4] and commitment to technology in

TABLE 1: Descriptive statistics and correlations.

Variable	M (SD)	Range	1	2	3	4	5
(1) Use of social media	3.26 (.90)	1.00-5.00				.	
(2) Emailing/surfing	3.91 (.67)	1.50-5.00	.17***				
(3) Security precautions	3.56 (.62)	1.46-5.00	-.12***	.22***			
(4) Technology commitment	3.63 (.64)	1.83-5.00	.25***	.20***	.32***		
(5) Flexible goal adjustment	5.06 (.82)	2.42-7.00	.20***	.13***	.18***	.25***	
(6) Openness for new experiences	3.21 (.76)	1.17-5.00	.05	.08*	.10**	.17***	.24***
(7) Age	43.58 (15.12)	19-71	-.39***	.19***	.31***	-.17***	-.04
(8) Gender (1 = m, 2 = f)[a]		1-2	.13***	-.04	-.15***	-.29***	.02

$N = 841$; M = mean; SD = standard deviation. $***p < .001$; $**p < .01$; $*p < .05$. [a]The other gender category was excluded from the analyses due to insufficient sample size ($n = 3$).

young and middle-aged adults [25]. Furthermore, it has also been shown that individuals with high levels of openness are more likely to use social media [36]. Thus, the openness scale from the NEO-Five-Factor Inventory (NEO-FFI-30, [37] was used as a control variable in the analysis of partial correlations. Cronbach's alpha for the six items was .74. Because people who are currently employed may be more involved with digital technology, we used occupational status (0 = "no", 1 = "yes") as a control variable. Gender was included as a control variable because of its significant associations with central variables of the study.

As a first step in the analyses, we used bivariate correlations to examine our hypotheses more closely. As a second step, we specified a LISREL model to test whether the hypothesized associations remain stable when sociodemographic variables and openness are included as control variables. The third part of the analysis concentrates on the moderating role of technology commitment and flexible goal adjustment.

3. Results

In the first part of the results section, we report the bivariate correlations and focus on the relationship between use of digital media, security precautions, and technology commitment, flexible goal adjustment, and age.

3.1. Bivariate Correlations. The bivariate correlations (Table 1) replicate the finding from an earlier study [10] in which age was a positive predictor of security precautions (password generation, proactive checking, and updating). They show the expected negative association between the use of social networks and age, but emailing/surfing was positively associated with age. As expected, both security precautions and use of digital media (social media and emailing/surfing) were positively correlated with technology commitment and flexible goal adjustment. Although we had no hypothesis for the outcome variables, it is interesting to note that security precautions are negatively correlated with the use of social media but positively with emailing or using the Internet.

3.2. Analysis of Covariates. We used the correlation matrix to specify a LISREL model in which we tested whether the hypothesized bivariate associations remained stable when controlling for background variables. Besides age, gender and openness for new experiences were also correlated with the main variable. We specified a model in which age, gender, and openness were tested as predictors (control variables). Occupational status was also controlled. We tested the hypotheses using the partial correlations between technology commitment and flexible goal adjustment on the one hand and the use of social media and security precautions on the other. Because technology commitment contains three subscales, it was specified as a three-indicator factor; flexible goal adjustment was indicated by four subscales. Security precaution was specified with three indicators, however, without the facet *device securement* because of its low reliability and reduced model fit. For the three social media items we formed means for the frequency and for the willingness of use, respectively. These served as the two indicators for social media use. The same was done for emailing and surfing. In the final model, media use, security precautions, and flexible goal adjustment were allowed to correlate with each other. Residual variances (i.e., random errors of measurement and uniqueness of the indicators) were specified to be uncorrelated. The model was computed with LISREL 9.30 and based on maximum likelihood estimates. Because the likelihood ratio becomes sensitive to the most trivial discrepancies between the model and data in large samples [38], other indices (the root mean square error of approximation [RMSEA], the goodness of-fit-index [GFI], the adjusted GFI, and the normed fit index [NFI]) were computed to estimate the model fit.

Figure 1 depicts the model, which revealed good and satisfactory fit indices. $X^2 (145) = 512.53$; RMSEA = .055; GFI = .941; AGFI = .914; NFI = .904. The model shows only significant paths and partial correlations. The expected age associations with security precautions and social media use remained significant after controlling for gender, occupational status, and openness. Emailing/surfing was not associated with age after covariates were controlled. As anticipated, the technology commitment and flexible goal adjustment were significantly correlated with both security

Age
Gender 1 = m, 2 = f
Occupational status
Openness

Emailing/surfing
Use of social media
Security precautions
Commitment to technology
Flexible goal adjustment

−.44
.31
−.14
.15
−.10
−.33
.10
.10
.13
.14
.26

.26
.18
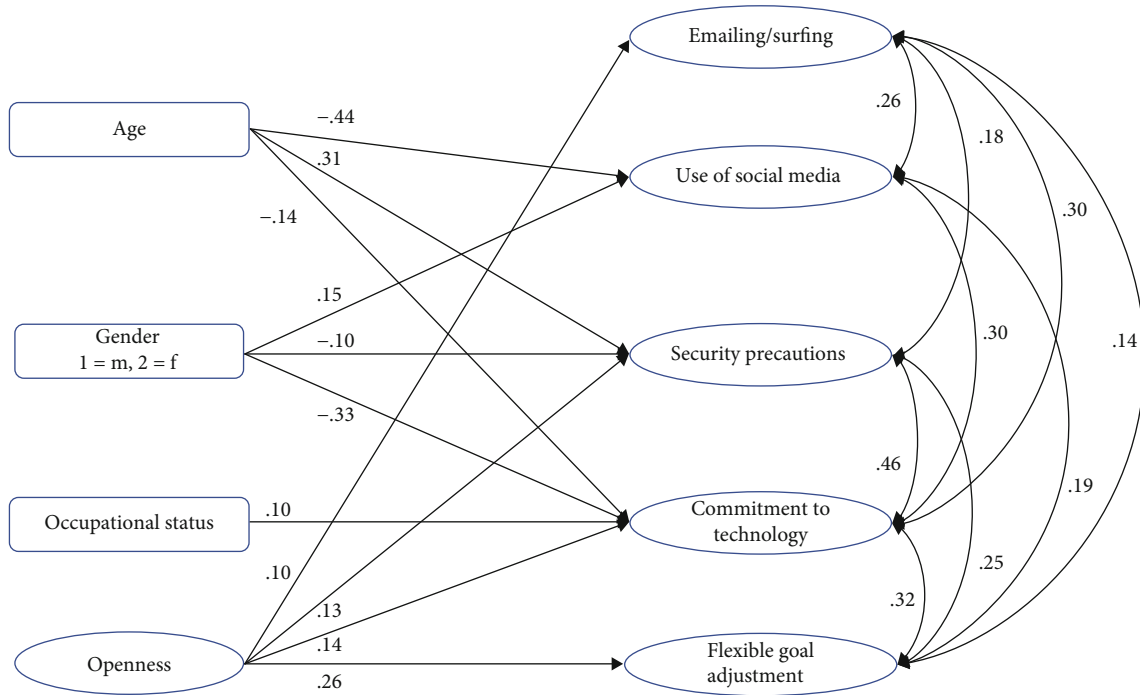.30
.30
.14
.46
.19
.25
.32

FIGURE 1: Relationships between the use of digital media, security precautions, and flexible goal adjustment. Structural equation model depicting the relationships between the use of digital media, security precautions, and flexible goal adjustment after controlling for sociodemographic variables and openness for new experiences. The third gender category was excluded from the analysis. Depicted are the significant standardized paths or partial correlations (for coefficients = $|.10|$: $p < .05$; for coefficients $\geq |.13|$: $p < .001$).

precautions and digital media use (social media use and emailing/surfing). One significant association, the rather low correlation between social media use and security precautions, became nonsignificant after controlling for the covariates.

3.3. Moderation Analyses.

We expected that technology commitment and flexible goal adjustment would moderate the age-related differences in use of social media. We conducted moderated regression analyses and computed two interaction models (by using z-transformed scores) and controlled for the first-order terms of age and technology commitment, and age and flexible goal adjustment, respectively. As expected, the moderation effects of flexible goal adjustment ($\beta_{\text{Age} \times \text{Flexible goal adjustment}} \longrightarrow$ Social media use = .07; $p < .05$) and technology commitment ($\beta_{\text{Age} \times \text{Technology commitment}} \longrightarrow$ Social media use = .11; $p < .001$) were significant after controlling for the first-order terms. Higher values of flexible goal adjustment (Figure 2(a)) and technology commitment (Figure 2(b)) decreased the negative correlations between age and use of social media. The relationship between age and emailing/surfing the Internet was absent or positive, depending on the degree of technology commitment. The moderation analysis was significant. ($\beta = .11$; $p < .01$). Figure 3 shows that age is correlated with using the Internet particularly when technology commitment is high, but not when technology commitment is low. The interaction effect between flexible goal adjustment and age for emailing/surfing was not significant.

3.4. Additional Analyses.

Because of its reliability, device securement was not considered as a facet of security precautions in the main analyses. In accordance with our hypotheses, its correlations with technology commitment and flexible goal adjustment were significant ($r's = .23$; $p < .001$). It is interesting to note that the age correlation was negative ($r = -.25$; $p < .001$), in contrast to our above findings. This pattern in the results is similar to the findings of Branley-Bell et al. [10], who also found a negative association, but positive age correlations for the other domains of security precautions. Finally, we tested whether the age differences in device securement depend on the degree of technology commitment and flexible goal adjustment. Both interaction terms were significant: $\beta_{\text{Age} \times \text{Flexible goal adjustment}} \longrightarrow$ Device-securement = .08; $p < .05$; $\beta_{\text{Age} \times \text{Technology commitment}} \longrightarrow$ Device securement = .08; $p < .05$. Older adults did not behave less securely than younger adults when the degree of technology commitment and flexible goal adjustment was high.

4. Discussion

The present study dealt with the use of digital media and security precautions in adulthood. In particular, the role of age, technology commitment, and flexible goal adjustment was examined. First, we discuss the findings on the use of digital media and the implications of the different age associations that were found for using social media and emailing or surfing in the Internet.
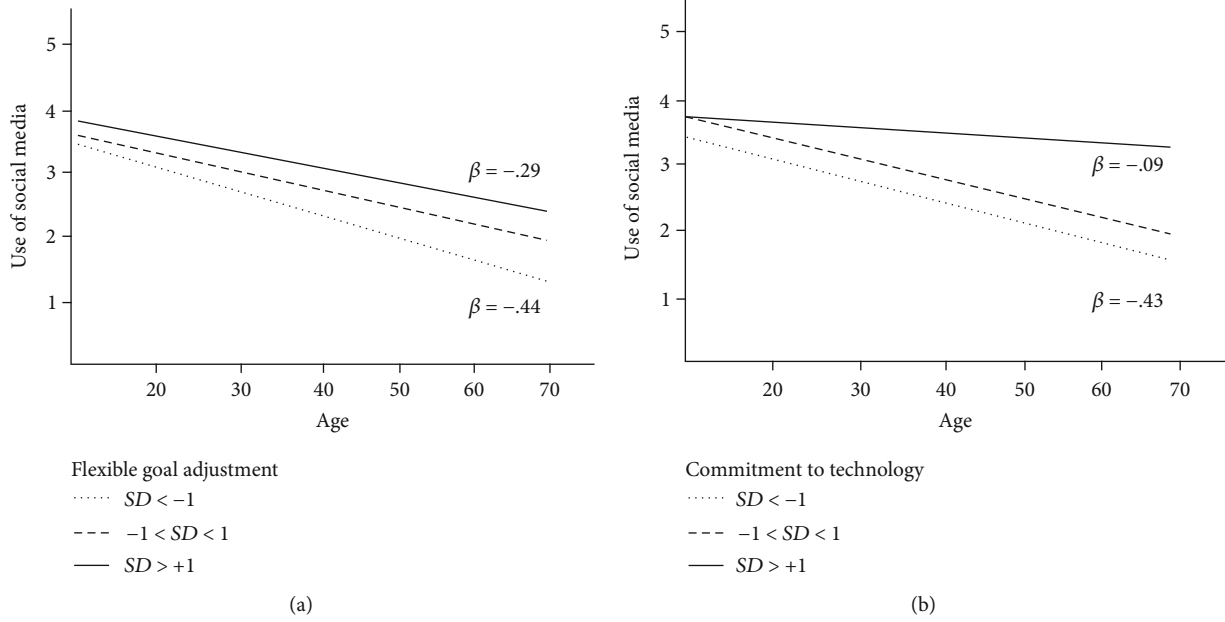
Figure 2: Use of social networks as a function of age and (a) flexible goal adjustment and (b) commitment to technology.
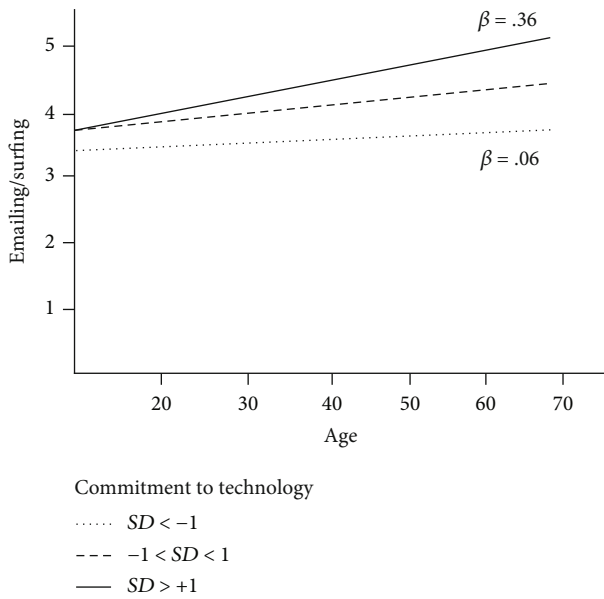

Figure 3: Emailing/surfing the Internet as a function of age and commitment to technology.

In accordance with previous studies [5, 39] and our hypotheses, age differences in the use of social media can be found in adults. The present study provided explanations for these age differences by considering interindividual differences in commitment to technology and flexibility in goal adjustment—high degrees in both are associated with frequent social media use. In addition, and as expected, moderation effects showed that higher degrees in technology commitment and flexible goal adjustment reduced the negative correlation between age and social media use. One possible interpretation, given the limits of cross-sectional data, is that interindividual differences in technology-related attitudes can explain why people use social media. Older adults with more interest or openness for technology use social networks to a degree similar to that of the younger ones; the younger adults do not need a special interest in technology because they have been more familiar with social media since their childhood. Because digital media is a domain that is characterized by ongoing development and change, we have assumed that the ability to adjust goals in the face of blockage would be a resource for the use of social media in general, and in particular for the older adults who are used to communicating with more traditional technologies that do not require ongoing learning and self-regulation on how to use or apply them. In accordance with this assumption, both technology commitment and flexible goal adjustment were correlated with social media use, even after considering control variables.

The second facet of media use, emailing/surfing in the Internet, showed a different picture. The correlations with technology commitment and flexible goal adjustment were significant, the age correlation however absent or rather positive. The high mean values suggest a widespread use and availability. Moderation analysis showed that high technology commitment is associated with emailing, in particular for older adults. This is consistent with the assumption that older adults benefit from technology-specific attitudes, even in behavior domains that have become so widespread and do not show age-related declines.

Given the potential dangers of digital media use, security precautions were examined in the second part of the study. As expected, and similar to the use of digital media, security precautions were associated with technology commitment and flexible goal adjustment. Perhaps more important, subsequent analyses that controlled for sociodemographic variables

and openness also revealed the anticipated relationships. Thus, it is reasonable to argue that security precautions require more motivational engagement which is reflected in attitudes towards technology and the ability to flexibly adjust goals after setbacks. The positive age correlation of security precautions is consistent with findings from other studies [10, 16] and studies from other domains emphasizing the protective function of precautious behavior for older adults [20].

Subsequent control analyses were directed at identifying the associations with device securement, a facet of security precautions that we did not include in the main analyses due to its low reliability. Nonetheless, its correlations with technology commitment and flexible goal adjustment were, as expected, positive and significant; the negative age correlation was surprising, is however consistent with the findings of Branley-Bell and colleagues [10] who also found the deviating negative correlation with age for this subscale, compared to the three other scales of the *Security Behaviour Intentions Scale* [3].

In sum, the expected correlations with technology commitment and flexible goal adjustment and the moderating role of both can be interpreted in the sense that they provide a regulating mindset which is involved in social media use behavior (frequency, willingness, and security precautions). Interestingly, security precautions were negatively correlated with social media use, but positively with emailing or surfing, a correlation pattern that replicates that of the age variable. Perhaps learned experience and subjective norms of security-related behavior are stronger or more prevalent for more traditional media use (which is not less frequent in older adults). Younger users are possibly less familiar with cyberthreats and possible dangers of data misuse which could explain their lower extent of or interest in security precautions.

4.1. Limitations. The present results are possibly biased in several respects. First of all, our participants were invited to take part via digital media and social networks; thus, the use of social media is possibly overestimated to some degree. We cannot totally rule out the possibility that people may have participated more than once or answered the questions dishonestly. In addition, we have only self-report data; actual "digital behavior" has not been considered. It therefore remains an open question how well and consequently intentions are transformed into activities. In addition, the present results are based on cross-sectional and not on longitudinal data. We cannot draw any firm conclusions about possible changes over time, nor can we shed light on the causal preconditions. Rapid changes, particularly in the field of digital development, can continue to be expected. The age differences that are currently emerging in the use of the present social media might diminish—or will only become visible in other domains of application brought about by future developments of digital communication technology.

5. Conclusion

With the use of digital media expanding over the last decade, users' security precautions in the digital environment are becoming increasingly important. Together, our results showed that the use of digital media and security precautions involve intentional processes such as domain-specific interests or attitudes (commitment to technology) and flexibility in goal adjustment—in both of which individuals can differ to a remarkable extent. The age-related differences in the use of social media are perhaps not so surprising at first glance. More important is that the differences vary depending on the degrees of technology commitment and flexible goal adjustment, which emphasize the explanatory value of the underlying motivational processes. Both are involved in action regulation by providing a stimulating feeling of competence in technology and contributing to a flexible adaptation of the self-concept in the face of difficulties. The present findings have implications for cybersecurity interventions (such as serious games). After such interventions one could test to what degree the effectiveness of the interventions depends on the two motivational variables in promoting people's secure use of social media. In future research, this would provide a more differentiated view of social media use and security precautions.

Data Availability

The survey data used to support the findings of this study are restricted by the ethics commission in order to protect the privacy of the participants. The survey data used to support the findings of this study have been deposited in the data archive of the University of the Bundeswehr Munich.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

Acknowledgments

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