




Personality Associations With WhatsApp Usage and Usage of Alternative Messaging Applications to Protect One's Own Data

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Abstract: Data protection became an increasingly important topic in today's digital society. With regard to messaging applications, WhatsApp especially has been at the center of discussion. Despite the existence of alternative messaging applications seemingly protecting one's data more than WhatsApp does, individuals seem to rarely use these alternatives. The present study, therefore, investigated personality differences between individuals using WhatsApp versus alternative messaging applications which are deemed more protective of one's data. A total of $N = 7,874$ individuals ($n = 3,992$ men) participated in the present online survey. All of them provided information on whether they used WhatsApp and/or an alternative messaging application because WhatsApp was deemed to be non-data-protective. Additionally, they completed the Big Five Inventory. Most participants (69.27%) reported using WhatsApp but no alternative messaging application due to data protection concerns. This group showed the lowest scores on Openness. The group using neither WhatsApp nor another messaging application due to data protection concerns regarding WhatsApp showed the lowest scores on Extraversion. The highest scores on Agreeableness were found in the group using WhatsApp and at least one alternative messaging application due to WhatsApp-related data protection concerns. These results reveal initial insights into who is using seemingly data protective versus non-data-protective messaging applications. Personality may not be the only factor influencing the decisions about data protective messaging application use.

Keywords: WhatsApp, data privacy, data security, Big Five, data protection

In today's digital world, data privacy and security¹ have become increasingly important topics. Smartphones especially bear a great risk for data privacy and security violations. This is among other reasons due to the facts that (i) a vast amount of data can be accessed via smartphones, (ii) many individuals carry around their smartphones nearly 24/7 (see discussion on these and other features as reasons for why smartphones are used in psychological research, Miller, 2012; Montag et al., 2020). In the realm of data privacy on smartphones, especially the WhatsApp messaging application (app) has been critically discussed in light of the General Data Protection Regulation in Germany (Fuest, 2018; Müller & Benrath, 2018). In line with this, several alternative messaging apps exist which promote higher data privacy and security policies than does WhatsApp

(e.g., Telegram, 2020). Still, WhatsApp is the most often used messaging app in many countries across the world (We Are Social et al., 2019, 2020; but see recent statistics on messaging apps downloads in January 2021 showing that Telegram and Signal are often downloaded [Chan, 2021]). The knowledge of why people use WhatsApp versus alternative messaging apps to protect their data is scarce. Therefore, the present study aimed at investigating individual differences in personality associated with using WhatsApp versus alternative messaging apps promoting more data protection.

WhatsApp is owned by Facebook Inc. Despite its popularity, lack of data privacy is an often-discussed topic in light of WhatsApp (Fuest, 2018; Müller & Benrath, 2018). Additionally, Facebook itself has been in the center of discussions about data protection flaws, for example,

¹ We refer to data security when writing about securing data against unauthorized access, whereas we refer to data privacy when writing about protecting data against authorized access. We use the term data protection to subsume data privacy and security.

with regard to Cambridge Analytica (Hern & Pegg, 2018). WhatsApp, according to its website (WhatsApp, 2020), comes with several settings to protect one's data. However, reading through the privacy policies and especially which data are collected and shared with other Facebook companies indicates that WhatsApp collects and shares data not only about its users but also about each user's contacts (WhatsApp, 2018). However, a review and evaluation of the data privacy and security policy of WhatsApp are not in the scope of the present work. Instead, aside from the actual privacy and security policy and data protection regulations of WhatsApp, we propose that WhatsApp is seen as a risk for data protection by many (Schreiner & Hess, 2015). This is also undermined by the fact that most press reports on the topic of data privacy of messaging apps used WhatsApp as a negative example (Fuest, 2018; Müller & Benrath, 2018). Also, websites freely available on the Internet point toward the flaws of WhatsApp in data privacy and security regulations (Williams, 2020). Lastly, alternative messaging apps pronounce privacy and security much more than WhatsApp does (e.g., "Threema. – The messenger that puts security and privacy first" [Threema, 2020] or Telegram [Telegram, 2020]), which may further strengthen the idea of WhatsApp being least data protective.

Many of these alternative messaging apps exist. Some cost a usage fee (Threema, 2020), while others are freely available (e.g. Signal or Telegram). Most of them offer similar features to WhatsApp. Despite the existence of such alternatives to WhatsApp and their potential advantages with regard to data protection, they are barely used in comparison to WhatsApp (We Are Social et al., 2020; but also see Chan, 2021). Therefore, the question of who uses WhatsApp or other messaging apps in order to enhance one's data protection arises.

One way of investigating "who" uses specific apps, is examining individuals' personality characteristics. Personality traits have been brought into association with various behavioral variables such as social media use and data-protection related attitudes and behaviors (Brailovskaia & Margraf, 2016; Eşkisü et al., 2017; Halevi et al., 2013; Harari & Gosling, 2016; Montag et al., 2015; Ryan & Xenos, 2011; Schrammel et al., 2009; Sindermann, Duke, et al., 2020). Therefore, it can be assumed that personality might be associated with whether individuals use WhatsApp versus alternative messaging apps due to WhatsApp-related data protection concerns. The most prominent personality model is the Five-Factor Model. According to this model, personality can be split into five broad domains (Fiske, 1949; Tupes & Christal, 1992). Oftentimes these domains are referred to as the Big Five of Personality and comprise Openness (to Experience), Conscientiousness, Extraversion, Agreeableness, and Neuroticism (Goldberg, 1990; Rammstedt & Danner, 2017).

To shed further light on the potential specific personality associations with WhatsApp use versus use of alternative messaging apps that promote data protection, one can focus on the data protection aspect. In this regard, studies on data protective behaviors and their associations with personality are of importance. Studies from this field of research deal with various behaviors such as online information disclosure, privacy settings, and privacy protective/control behaviors on social networking sites, usage of privacy-enhancing technologies, or data securing behavior such as blocking one's screen when leaving, generating passwords, and updating/patching software (Gerber et al., 2017; Gratian et al., 2018; Halevi et al., 2013; Li et al., 2019; Matt & Peckelsen, 2016; Schrammel et al., 2009). In sum, these studies find various associations between personality and data-protective behaviors, but results are mixed. These mixed results might be due to the different specific behaviors and contexts investigated across previous studies. And, most importantly, none of the behaviors and contexts investigated in previous studies is directly comparable to the present study in which usage versus non-usage of messaging apps is investigated. Therefore, the results are primarily not directly transferable to the context of using WhatsApp versus alternative messaging apps to protect one's data. Most closely related to the present research endeavor is a study on a US adult sample, which found that only Agreeableness was significantly (negatively) related to privacy concerns regarding Facebook, which were in turn positively related to not using Facebook; however, the results were not replicated in a college student sample (Harari & Gosling, 2016).

In conclusion, the current study exploratively investigated the differences between individuals (only) using WhatsApp versus individuals (also) using alternative messaging apps due to reasons of data protection. The following research question underlies this investigation: Do personality traits differ between individuals using (1) WhatsApp, (2) WhatsApp and at least one alternative messaging app due to WhatsApp-related data protection concerns, (3) no WhatsApp but at least one alternative messaging app due to WhatsApp-related data protection concerns, and (4) neither WhatsApp nor any alternative messaging app due to WhatsApp-related data protection concerns?

Methods

Procedure and Sample

A detailed description of the data collection procedure can be found in the Electronic Supplementary Material, ESM 1.

After data cleaning, for example, only individuals who owned a smartphone were included in this paper (see ESM 1), a final sample of $N = 7,874$ participants ($n = 3,992$ men) remained. The mean age of the sample was $M = 33.51$ years ($SD = 13.10$ years) with a median of 31 years and a range from 12 to 100 years. Most participants reported a university degree (German: “Hochschulabschluss”, $n = 3,031$), A-level/High school diploma (German: “Abitur”, $n = 1,850$) or secondary school leaving certificate (German: “Mittlere Reife”, $n = 1,122$) as their highest educational degree. The majority of participants came from Germany ($n = 7,325$) versus from Austria, Switzerland, or Liechtenstein. The data analyzed in the present work is available on the Open Science Framework (<https://osf.io/ht3wf/>).

Materials

Messaging App Usage

Participants were first asked whether WhatsApp was installed on their smartphone (yes vs. no). Individuals reporting “yes” were deemed WhatsApp users (see limitations on this assumption in the Discussion section). Afterward, participants were asked whether they used another messaging app than WhatsApp because WhatsApp is not secure enough (yes vs. no; in German language and for laypersons, “secure” can be understood as both protecting one’s data privacy and security; this question was asked independently of the response to the WhatsApp question). We intentionally added the reason to use an alternative messaging app in the item as we were specifically interested in the use of alternative messaging apps due to concerns over data protection. Moreover, we rephrased the items on usage (vs. installation) of alternative messaging apps because WhatsApp can collect data just by being installed and irrespective of whether it is actively used (but more data can be collected when it is actively used). However, only usage (beyond installation) of alternative messaging apps other than WhatsApp might protect one’s data better than using WhatsApp. If participants indicated doing so, they were further asked which messaging app they used, with the response options Threema, Telegram, Signal, others. These apps were chosen because, in Germany, they have the highest user numbers after WhatsApp and Facebook Messenger (G+J et al., 2019). Based on these variables four groups were built: *Group 1*: participants using WhatsApp and indicating not using another messaging app due to WhatsApp-related data protection concerns, *Group 2*: participants using WhatsApp and using at least one of the alternative messaging apps due to WhatsApp-related data protection concerns, *Group 3*: participants not using WhatsApp but at least one alternative messaging app due to WhatsApp-related data protection concerns, *Group 4*: participants using neither WhatsApp nor any

alternative messaging app due to WhatsApp-related data protection concerns. Note that due to the formulation of items on alternative messaging app usage including the reason for usage, it is possible that individuals used an alternative messaging app but did not indicate it, because the reasons for usage are not WhatsApp-related data protection concerns. But because these apps are primarily intended for increased data protection, we do not believe it is likely that participants used one of the alternative apps for reasons primarily other than increased data protection.

Big Five of Personality

The German version of the Big Five Inventory (BFI) was used (Rammstedt & Danner, 2017). In this questionnaire, participants answered 45 items on a 5-point Likert-scale from 1 = *very inapplicable* to 5 = *very applicable*. Of note, the additional 45th item is only included in the German version. It was not included in our analyses to enable closer comparability to other studies. Internal consistencies in the present sample included Cronbach’s α of .79, .83, .86, .71, .85 for Openness (10 items), Conscientiousness (9 items), Extraversion (8 items), Agreeableness (9 items), and Neuroticism (8 items), respectively.

Statistical Analyses

The statistical software R version 3.5.2 and R-studio version 1.1.463 were used for data cleaning and analyses. First, descriptive statistics were calculated. Based on skewness and kurtosis of all metric variables (see criteria by Miles & Shevlin, 2001), all further analyses were conducted using parametric tests.

Associations of BFI scales with age and gender were analyzed by means of Pearson correlations and *t*-tests (Welch’s *t*-tests when necessary), respectively. The messaging app usage groups were compared regarding age and gender by means of an analysis of variance (ANOVA) and a χ^2 -test. These analyses were of importance to control for age and gender in subsequent analyses, if necessary (see differences in WhatsApp use in Germany in association with age and (partly) between men and women, ARD/ZDF-Onlinestudien, 2019; AudienceProject, 2019; Montag et al., 2015). Results are presented in ESM 1.

Next, BFI scales were compared between messaging app usage groups using multivariate multifactorial analysis of covariance (ANCOVA) and subsequently multifactorial ANCOVAs. Messaging app usage group and gender were included as independent variables and age as a covariate (see ESM 1). Moreover, effect sizes were calculated and Bonferroni corrected pairwise comparisons were implemented to examine pairwise differences between messaging app usage groups.

Results

Descriptive Statistics

Of the complete sample, $n = 7,221$ (91.71%) reported using WhatsApp and only $n = 653$ (8.29%) denied using WhatsApp. This illustrates the importance to investigate a large sample to ensure that the present research question can reliably be investigated. $N = 2,164$ (27.48%) reported using at least one alternative messaging app to WhatsApp due to WhatsApp-related data protection concerns.

More specifically, $n = 5,454$ reported using WhatsApp but no alternative messaging app due to WhatsApp-related data protection concerns (Group 1), $n = 1,767$ reported using WhatsApp and at least one alternative messaging app due to WhatsApp-related data protection concerns (Group 2), $n = 397$ reported not using WhatsApp but using at least one alternative messaging app due to WhatsApp-related data protection concerns (Group 3), and $n = 256$ reported neither using WhatsApp nor any other messaging app due to WhatsApp-related data protection concerns (Group 4). Table 1 presents descriptive statistics of the BFI scales.

Differences in Personality Between Groups With Different Messaging App Usage

The multivariate multifactorial ANCOVA on differences in BFI scales revealed significant results for all factors (for associations of age and gender with variables of interest, see ESM 1; messaging app usage factor: $F(15, 23,589) = 16.07$, $p < .001$; messaging app usage factor by gender: $F(15, 23,589) = 1.67$, $p = .049$).

Separate multifactorial ANCOVAs on each BFI scale revealed significant differences between messaging app usage groups on Openness, $F(3, 7,865) = 42.54$, $p < .001$, $\eta_p^2 = .016$; Extraversion, $F(3, 7,865) = 6.67$, $p < .001$, $\eta_p^2 = .003$; and Agreeableness, $F(3, 7,865) = 14.98$, $p < .001$,

Table 1. Descriptive statistics of the Big Five Inventory scales in the complete sample

	Complete sample ($N = 7,874$) M (SD)
Openness	3.61 (0.61)
Conscientiousness	3.48 (0.67)
Extraversion	3.36 (0.78)
Agreeableness	3.50 (0.55)
Neuroticism	2.88 (0.78)

Note. N = number of participants; M = mean; SD = standard deviation.

$\eta_p^2 = .006$. Descriptive statistics and subsequent pairwise comparisons by Bonferroni corrected p -values of t -tests (for Openness, Extraversion, and Agreeableness) are presented in Table 2. Group 1 showed the lowest score in Openness compared to all other groups. Regarding Extraversion, Group 4 showed the lowest score and differed significantly from Groups 2 and 1. The highest score in Agreeableness was found in Group 2, which was significantly higher than those of all other groups. These results are also presented in Figure 1.

A significant effect of messaging app usage group by gender was found on Neuroticism, $F(3, 7,865) = 4.36$, $p = .005$. In women, higher scores were found in Groups 1 and 2 compared to Groups 3 or 4. In the male sample, mean values in all messaging app usage groups were pretty similar.

Discussion

The present study aimed at investigating personality differences between individuals using WhatsApp and individuals using alternative messaging apps because they deem WhatsApp as non-data-protective.

Table 2. Descriptive statistics of the Big Five Inventory scales split by messaging app usage group

	Group 1: WhatsApp but no alternative due to data protection concerns ($n = 5,454$) M (SD)	Group 2: WhatsApp and at least one alternative due to data protection concerns ($n = 1,767$) M (SD)	Group 3: No WhatsApp but at least one alternative due to data protection concerns ($n = 397$) M (SD)	Group 4: Neither WhatsApp nor any alternative due to data protection concerns ($n = 256$) M (SD)
Openness	3.56 ^{a,b,c} (0.61)	3.72 ^a (0.58)	3.80 ^b (0.54)	3.70 ^c (0.64)
Conscientiousness	3.48 (0.67)	3.44 (0.66)	3.49 (0.60)	3.60 (0.67)
Extraversion	3.38 ^{d,e} (0.78)	3.34 ^f (0.78)	3.26 ^d (0.77)	3.19 ^{e,f} (0.75)
Agreeableness	3.48 ^{g,h} (0.56)	3.56 ^{h,i,j} (0.55)	3.46 ⁱ (0.53)	3.37 ^{g,j} (0.54)
Neuroticism	2.90 (0.78)	2.87 (0.78)	2.77 (0.73)	2.71 (0.77)

Note. Similar letters indicate significant differences between the two groups based on subsequent pairwise comparisons by means of t -tests and Bonferroni corrected p -values. Note that the p -values are also influenced by the differences in the sample sizes. M = mean; SD = standard deviation; n = number of participants.

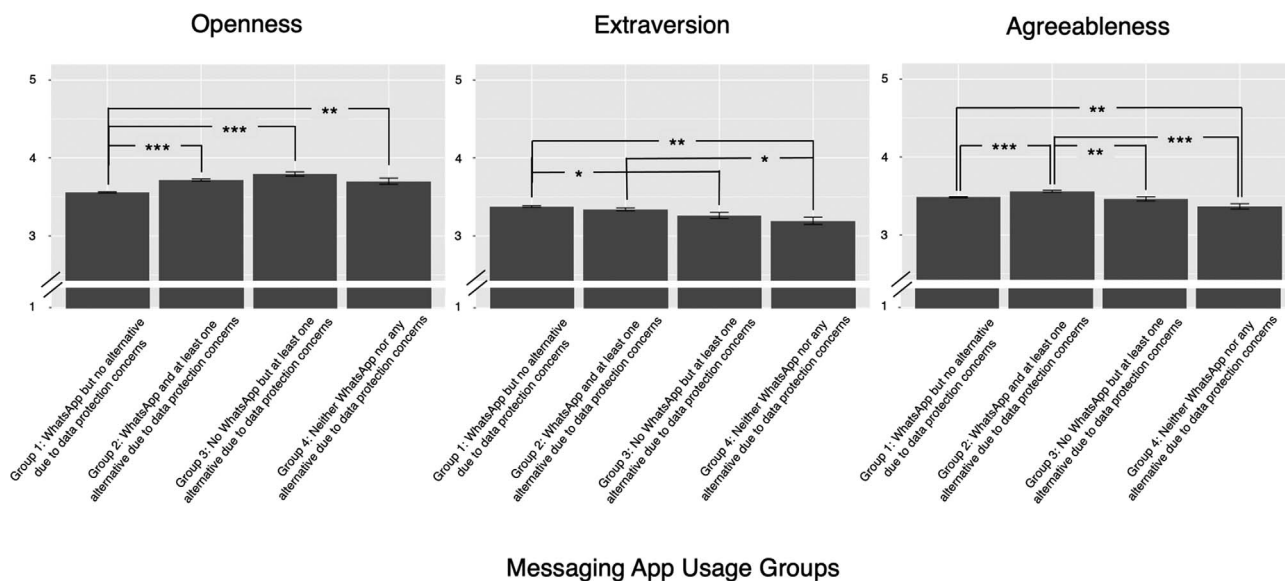


Figure 1. Mean values of Openness (left), Extraversion (middle), and Agreeableness (right) in the groups with different messaging app usage; Error Bars indicate ± 1 SE. *** $p < .001$, ** $p < .01$, * $p < .05$ (Bonferroni adjusted pairwise t -tests).

Firstly, participants using WhatsApp but no alternative messaging app due to data protection concerns showed the lowest scores on Openness compared to all other groups. Hence, groups using seemingly more data protective messaging apps due to data protection concerns (or neither WhatsApp nor any alternative) had higher scores on Openness. This result seems to be at odds with the results of another study reporting negative associations between Openness and online privacy behavior on Facebook (Halevi et al., 2013). However, several differences between this prior work and the present study must be acknowledged such as different times of data collection (2012/13 vs. 2019/20) and investigation of privacy settings on social networking sites vs. usage of various messaging apps. For the present findings, it is important to note that high scores on Openness describe being open to new ideas and acquiring knowledge (Rammstedt & Danner, 2017; Sindermann, Elhai, et al., 2020). Therefore, these results might point toward less open individuals not being drawn to try new technology or learn how to deal with alternative messaging apps or not being interested in learning about data protection. This issue might explain the comparatively low scores on Openness in the group using WhatsApp but no alternative messaging app due to data protection concerns. However, why these users show lower scores than those using neither WhatsApp nor any alternative messaging app due to data protection concerns cannot be explained in this way and by this study.

Moreover, the lowest scores on Agreeableness were found in the group using neither WhatsApp nor any alternative messaging app due to data protection concerns (but the

score was not significantly different from the score found in Group 3). This “neither-nor” group among others (but not exclusively) might comprise individuals not using any messaging app. Therefore, the low Agreeableness scores at the group level in part might be explained by individuals in the “neither-nor” group actually not using any messaging app: These individuals might show low scores in Agreeableness and, because of this, might not need to use messenger services to stay in contact with friends and others. Nevertheless, it is important to note that the “neither-nor” group could also comprise individuals who do not use WhatsApp but still use another messenger, however, not due to data protection concerns.

The highest scores on Agreeableness were found for the group using WhatsApp and at least one alternative messaging app due to data protection concerns, and this score was significantly higher than those from all other groups. This finding (especially with regard to differences to Groups 1 and 3) might be due to two reasons: (i) more agreeable individuals might follow recommendations of friends, family members, etc. to use more data protective messenger apps (see research on advice-taking [Dalal & Bonaccio, 2010] and Agreeableness measures comprising a compliance facet [Costa & McCrae, 1992]) and (ii) individuals who are more agreeable might use WhatsApp to stay in contact with friends who do not use more data protective messaging apps (even if they themselves also use more data protective messaging apps). This reasoning is also in line with a study reporting “friends use it” being one reason to use a certain messaging app (De Luca et al., 2016). A more elaborate discussion can be found in the ESM 1.

Lastly, the group of participants using neither WhatsApp nor any other messaging app due to data protection concerns showed the lowest scores on Extraversion and differed significantly from those using WhatsApp and at least one alternative messaging app due to data protection concerns and the group using WhatsApp but no alternative messaging app due to data protection concerns.

Some limitations of this work need to be mentioned. First, the study is exploratory and therefore potential explanations for associations are post hoc. Following this, replication studies to test the robustness of findings are necessary. This is also underlined by the mostly small effect sizes (very mild to small for personality). Next, the present study was implemented in a western country located in the EU, where strict data protection regulations are predetermined. It remains unknown whether results are transferrable to other cultures and countries. For example in China, WhatsApp is prohibited and most individuals use WeChat rather than any other messaging app (We Are Social et al., 2019; see Montag et al., 2018 for information on WeChat). Additionally, the present sample is not representative of the general German population. It is possible that especially technologically interested individuals took part in the study given the context of the present online survey. It might, additionally, be possible that individuals concerned about data protection might not participate in online studies such as the present one due to being concerned about the data they provide; although the present study was anonymous. Next, the current study is cross-sectional, which is why no causal conclusions should be drawn. Nevertheless, as the Big Five are seen as rather stable traits whereas messaging app usage could be less stable, the Big Five might still causally explain messaging app usage. However, this needs to be clarified in future studies. Another limitation is the non-parallel phrasing of items on messaging app usage. We asked individuals whether they have WhatsApp *installed* on their smartphones but whether participants *use* other messaging apps (because WhatsApp is deemed non-data-protective). Although we had reasons to follow this procedure – as explained in the Methods section – this leads to the following issue: it is possible that our group of WhatsApp “users” included some individuals who had the app installed but did not actively use it, that is, did not send messages, and so forth via WhatsApp (perhaps due to data protection concerns); however, this number is likely to be negligibly small. Moreover, the overall topic of the study was social media use, hence, the study was framed to investigate *use* of smartphones and social media. Lastly, clearly more variables aside from personality seem to be of importance in the decision on whether to use a certain messaging app that does or does not protect one’s data. This is underlined by the small effect sizes found in the present study.

The combination of more factors aside from personality can be an important approach for future research.

Still, the present results have important implications not only for research but also in practice. The present findings indicate that demographic variables (see ESM 1) as well as – to a certain extent – personality predispositions are associated with whether individuals use specific technologies to protect their data. This knowledge can be used to (i) further investigate why individuals do not use technologies to protect their data with a focus on motives and factors aside from personality predispositions, (ii) initiate campaigns to enhance knowledge about and, therefore, usage of data protecting technologies. Enhancing knowledge and therefore ability to protect one’s data is of tremendous importance given the increasing incorporation of digital technologies in our daily life via smartphones and the Internet of Things. Of course, knowledge on how to protect one’s data may not necessarily go along with actually protecting one’s data.

In conclusion, the present study gives initial insight into the question of who uses WhatsApp, as well as alternative messaging apps due to WhatsApp-related data protection concerns. Results give insight into why individuals might decide to use seemingly data-protective software versus less protective software.

Electronic Supplementary Material

The electronic supplementary material is available with the online version of the article at <https://doi.org/10.1027/1614-0001/a000343>

ESM 1. PDF file including detailed information on data collection and data cleaning procedures, as well as results about age and gender effects and a more thorough discussion on Agreeableness results.

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Conflict of Interest

The authors report no conflicts of interest in this paper's study. It should be mentioned though that Prof. Montag has received (to Ulm University and the earlier University of Bonn) grants from agencies such as the German Research Foundation (DFG). Dr. Montag has performed grant reviews for several agencies; has edited journal sections and articles; has given academic lectures in clinical or scientific venues or companies, and has generated books or book chapters for publishers of mental health texts. For some of these activities, he received royalties, but never from the gaming or social media industry. Dr. Montag mentions that he is part of a discussion circle (Digitalität und Verantwortung: <https://about.fb.com/de/news/h/gespraechskreis-digitalitaet-und-verantwortung/>) debating ethical questions linked to social media, digitalization, and society/democracy at Facebook. In this context, he receives no salary for his activities. Finally, he mentions that he currently functions as an independent scientist on the scientific advisory board of the Nymphenburg group. This activity is financially compensated.

Outside the scope of the present paper, Prof. Elhai notes that he receives royalties for several books published on posttraumatic stress disorder (PTSD); is a paid, full-time faculty member at University of Toledo; is a paid, visiting scientist at Tianjin Normal University; occasionally serves as a paid, expert witness on PTSD legal cases; and receives grant research funding from the US National Institutes of Health.

Authorship

Christian Montag designed the present study and implemented data collection. Cornelia Sindermann wrote the present manuscript and implemented data cleaning and analyses as well as interpretation of the data. Bernd Lachmann critically revised the manuscript and independently checked the statistical analyses. Christian Montag and Jon D. Elhai critically revised the present manuscript. All authors approved the final version of the manuscript.

Open Data

The data analyzed in the present work are available on the Open Science Framework (<https://osf.io/ht3wf/>).

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