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Individual differences in Fear of Missing Out (FoMO): Age, gender, and the Big Five personality trait domains, facets, and items

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ABSTRACT

Fear of Missing Out (FoMO), or the anxiety of missing out on exciting or interesting events happening, has received substantial attention over the past years, but its associations with age, gender, and personality are less researched. The aim of this work was to investigate these relationships. 3370 German participants completed the 10-item FoMO scale and the 45-item German Big Five Inventory in 2018. The results showed no gender differences in experiencing FoMO. Younger people had higher FoMO scores. Neuroticism domain, its facets, and items robustly positively correlated with FoMO, while Extraversion, Openness to Experience, Agreeableness and Conscientiousness were negatively associated with FoMO on the domain-level (with small correlations). In addition to Neuroticism, Conscientiousness had consistent negative (yet small) links with FoMO on domain-, facet-, and item-level data. This study contributes to the field by outlining individual differences in FoMO as well as by emphasizing the need to investigate personality-outcome associations on a more detailed level.

1. Introduction

The Fear of Missing Out (FoMO) is defined as “a pervasive apprehension that others might be having rewarding experiences from which one is absent” (Przybylski et al., 2013, p. 1841). Yet, little is known about FoMO’s associations with age, gender, and personality traits. Most studies correlating socio-demographic variables with FoMO have mainly done so as part of a secondary analysis in the relationship between FoMO and problematic digital technology use (Alt & Boniel-Nissim, 2018; Elhai, Yang, & Montag, 2020; Rozgonjuk et al., 2020; Stead & Bibby, 2017). FoMO has been linked to younger age with small-to-medium sized associations (Blaichnio & Przepiorka, 2018; Blackwell et al., 2017; Elhai et al., 2018), and small effects in gender differences have been reported, with women scoring higher (Beyens et al., 2016; Elhai et al., 2018; Stead & Bibby, 2017). Others have not found a significant correlation between age and experiencing FoMO (Rozgonjuk et al., 2019). The use of college students with little age variance may have contributed to mixed findings. However, knowledge about gender differences may be useful in research on FoMO in relation to digital technology use where analyses may benefit from controlling for

potential gender effects. The current study could provide evidence on whether this practice is essential. Studying age differences in FoMO could also provide insights into potential generational differences and perhaps even the developmental course of this phenomenon.

With regards to personality research, the Big Five personality traits approach is one of the most popular conceptual frameworks. Its essence lies in that one’s personality traits could be broadly described by five domains: Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness (McCrae & Costa, 2003). One cannot undervalue the role of these traits in everyday life. For instance, negative and positive affect are at the core of Neuroticism (Hisler et al., 2020); therefore, experiencing mood-related psychopathology has been associated with higher Neuroticism (Widiger, 2011). Higher levels of Conscientiousness predict longevity (Kern et al., 2009). Higher Agreeableness is related with higher satisfaction with relationships (Malouff et al., 2010). Relevant to this work, FoMO has been associated with higher Neuroticism (Alt & Boniel-Nissim, 2018; Blackwell et al., 2017; Stead & Bibby, 2017) as well as more Agreeableness (Hamutoglu et al., 2020).

Of relevance, research has demonstrated some gender differences in

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personality; yet, findings are mixed and may be contingent on the level of measurement (e.g., domain- vs facet-level data), personality scales used, as well as culture (Kaiser et al., 2020). Finally, younger adults have higher levels of Neuroticism and lower levels of Agreeableness and Conscientiousness than middle-aged adults, somewhat suggesting that these personality traits may change with age (Möttus & Rozgonjuk, 2019; Soto et al., 2011).

A handful of studies have reported associations of personality with FoMO. Generally, studies have demonstrated the link between higher trait Neuroticism on the domain-level (see below) and FoMO (Alt & Boniel-Nissim, 2018; Blackwell et al., 2017; Stead & Bibby, 2017). Another recent study by Hamutoglu et al. (2020) found no link between Neuroticism and FoMO, instead demonstrating a positive correlation between Agreeableness and FoMO. As with age and FoMO, effect sizes tend to be small-to-medium. Mixed findings could also be attributed to small sample sizes which may produce underpowered study results where the relationships between FoMO and personality are small. Using a larger sample size could overcome this potential limitation.

Because the organization of personality traits is hierarchical, it may also be fruitful to investigate characteristics at a more granular level. Each of the Big Five domains comprises facets which, in turn, are composed of a cluster of items aiming to measure aspects of one's personality. Therefore, personality traits form a hierarchical structure where the Big Five domains can be narrowed down more specifically to facets (Soto et al., 2011) as well as items/nuanced traits (Möttus et al., 2017). It has been demonstrated that, in addition to investigating domain-level data, facets and items could provide information on unique developmental patterns of personality (Möttus & Rozgonjuk, 2019). In addition, facet-level data have already provided insights into relations between personality and, e.g., sex differences (Kaiser et al., 2020), and motor vehicle accident involvement (Landay et al., 2020). Hence, examining narrower traits could provide more detailed and accurate insight into personality's role in everyday life. In the context of this work, while we aim to provide empirical insight into associations between FoMO and the domain-level Big Five data, this study is unique, since it also more granularly explores links with Big Five's facets and items.

The aim of the current work is to explore relationships between experiencing FoMO, age, gender, and the Big Five personality traits on domain-, facet-, and item-level. Findings regarding FoMO's associations with these variables have been previously mixed. However, our study may provide more firm empirical evidence, since it encompasses responses from more than three thousand men and women across different age groups. Therefore, this study could clarify (a) if men and women differ in experiencing FoMO; (b) if age and FoMO are associated; and (c) how and which particular personality traits (across domains, facets, and items) are specifically associated with experiencing FoMO. Given the literature, we hypothesize that higher FoMO is linked to younger age, female gender, higher Neuroticism, and higher Agreeableness. Since this is the first study investigating the links between FoMO and more detailed levels of personality traits, no specific hypotheses regarding FoMO's associations with facet- and item-level personality data are posited.

In addition to bivariate correlation analysis, we also use exploratory graph analysis (EGA), a data-driven network analysis that aims to identify the dimensions of (item-level) data (Christensen & Golino, 2020). This approach provides more robust results, because of partialling out the potential effects of all other associations, replicating these models for 1000 times with random sample permutations, and implementing completely data-driven dimension detection for links between FoMO and personality on varying levels of data (e.g., domain-, facet- and item-level data). In addition, EGA graphs provide a visual overview of these associations.

2. Methods

2.1. Sample and procedure

The study participants were recruited via various German language-based media channels (e.g., radio, television, magazines and newspapers, and social media). People were invited to participate in an online study investigating relationship between digital technology use and individual differences. The data were collected in 2018, and the current study is one part of the larger project.

The study was hosted on the platform SurveyCoder (Kannen, 2018). There was no monetary incentive for study participation, but participants were provided feedback about, e.g., their personality based on their responses. This feedback aimed to motivate people to take part in the study and provide truthful responses in order to receive valid feedback.

In total, this part of the project received responses from 3510 people. We included only participants from Germany eligible for study participation ($n = 3372$). Two people were excluded for responding with the same response option consecutively to more than 40 personality questionnaire's items.

The effective sample comprised $N = 3370$ people (age $M = 32.50$, $SD = 11.54$; 2120 men, 1250 women). 1773 (53%) of participants reported having a university (/of applied sciences) degree, while 1597 (47%) of respondents reported not having graduated from a university.

The study project was approved by the local institutional review board. Participants provided informed consent electronically; if a participant's age was 12 to 17, he/she needed to state that his/her legal guardian approved participation. Participation in the study was anonymous.

2.2. Measures

In addition to asking about participants' socio-demographic variables (age, gender, education level, and country of residence), the following scales were administered.

We used the FoMO scale originally developed in Przybylski et al. (2013) and adapted to German (Spitzer, 2015). The 10-item FoMO scale measures the extent of experiencing apprehension regarding missing out on interesting events of others on a 5-point scale (1 = "not at all true of me" to 5 = "extremely true of me"). The scale is unidimensional, and it has been validated against measures of smartphone use (Gugushvili et al., 2020) as well as negative affect in an experience sampling study (Elhai, Rozgonjuk, et al., 2020). The internal consistency for the effective sample was acceptable (see Table 1).

The Big Five Inventory (BFI) is a 45-item personality assessment questionnaire initially developed by John et al. (1991) and adapted to German in Rammstedt and Danner (2017). It uses a five-point response scale (1 = "very inapplicable" to 5 = "very applicable"). The BFI consists of five domains which consists of facets and items (number of items is presented in brackets):

1. Neuroticism (8): Anxiety (4) and Depression (2);
2. Extraversion (8): Assertiveness (5) and Activity (2);
3. Openness to Experience (10): Aesthetics (3) and Ideas (5);
4. Agreeableness (8): Altruism (4) and Compliance (3);
5. Conscientiousness (9): Self-discipline (5) and Order (2).

Importantly, not all items of the BFI belong to facets. In addition, we did not use the 45th item, as also suggested in Rammstedt and Danner (2017). For descriptions of facets (as well as which items underlie them), see John et al. (1991) and Rammstedt and Danner (2017). Reverse-coded items were firstly recoded, and summed scores for facets and domains were computed.

The internal consistency statistics for domains and facets can be found in Table 1.

Table 1
Descriptive statistics and correlations.

Variable	M	SD	Min	Max	ω/α	r with FoMO	r (Men)	r (Women)	cor diff p
1. FoMO	24.67	6.56	10	50	0.76/0.81	1	1	1	–
2. Neuroticism	22.68	6.13	8	40	0.87/0.87	0.318***	0.335***	0.306***	0.365
3. Extraversion	26.37	6.17	8	40	0.88/0.88	–0.096***	–0.103***	–0.088	0.672
4. Openness to Experience	36.57	5.98	14	50	0.83/0.82	–0.129***	–0.140***	–0.112**	0.425
5. Agreeableness	31.19	4.92	13	45	0.76/0.76	–0.129***	–0.120***	–0.145***	0.476
6. Conscientiousness	30.54	5.69	10	45	0.85/0.85	–0.209***	–0.202***	–0.228***	0.445
7. Age	32.50	11.54	12	75	–	–0.381***	–0.393***	–0.363***	0.327
Facets									
N: Anxiety	11.65	3.41	4	20	0.80/0.80	0.298***	0.316***	0.287***	0.371
N: Depression	5.39	1.90	2	10	.41 ^b	0.300***	0.313***	0.281***	0.325
E: Assertiveness	16.20	4.35	5	25	0.86/0.86	–0.100***	–0.105***	–0.095*	0.777
E: Activity	6.86	1.59	2	10	0.42 ^b	–0.111***	–0.119***	–0.100*	0.590
O: Aesthetics	10.58	3.00	3	15	0.84/0.83	–0.087***	–0.105***	–0.061	0.214
O: Ideas	18.57	2.90	6	25	0.67/0.65	–0.128***	–0.118***	–0.144***	0.459
A: Altruism	13.94	2.54	4	20	0.66/0.65	–0.053*	–0.045	–0.069	0.500
A: Compliance	10.43	2.08	4	15	0.52/0.49	–0.171***	–0.175***	–0.165***	0.773
C: Order	6.13	2.01	2	10	0.48 ^b	–0.111***	–0.101***	–0.131***	0.394
C: Self-discipline	16.87	3.19	5	25	0.74/0.74	–0.247***	–0.245***	–0.256***	0.742

Notes. M = mean; SD = standard deviation; Min = observed minimum score; Max = observed maximum score; ^b = Pearson correlation coefficient (for scales that contain less than three items); ω/α = internal consistency statistics McDonald’s omega and Cronbach’s alpha; cor diff p = correlation difference test (using Fischer’s r-to-z transformation) between genders. Pearson correlation coefficients (r) are displayed between variables and summed FoMO scores. P-values were adjusted for multiple testing with the Holm’s method for a given column.

- * p < .05.
- ** p < .01.
- *** p < .001.

2.3. Analysis

We used the R software version 3.6.3 (R Core Team, 2020). We screened the data for careless responses with the *longstring()* function from the *careless* package v. 1.1.3 (Yentes & Wilhelm, 2018). Then, we calculated internal consistency statistics for scales, followed by regression analysis (dependent variable: FoMO score; predictors: age and gender) and Pearson correlation analysis with p-values adjusted for multiple testing with the Holm’s method. Finally, we implemented exploratory graph analysis (EGA; Christensen & Golino, 2019) for variables of interest. In the current work, we bootstrapped EGA over 1000 replications for four models that included the summed FoMO score in association with Big Five (a) domains, (b) facets, and (c) items, and a model with (d) item-level data for both personality and FoMO. In addition to computing these network models for the full sample, we computed the same analyses separately for male and female subsamples (graphical depiction of the resulting networks for these samples are in Supplementary Figs. C1 and C2, respectively).

The data as well as analysis script are shared in a public repository within the Open Science Framework: <https://osf.io/gf6v3/>.

3. Results

3.1. FoMO, age and gender

Regression results showed that age and gender explained 14.6% of FoMO’s variance (adjusted $R^2 = 0.146$, $F(2,3367) = 286.70$, $p < .001$). Age had a significant association with FoMO ($B = -0.217$, $\beta = -0.382$, $t = -23.945$, $SE = 0.009$, $p < .001$), while gender (coded as 1 = male, 2 = female; $B = -0.264$, $\beta = -0.019$, $t = -1.217$, $SE = 0.217$, $p = .224$) did not. Descriptive statistics for domains, facets, and items split by gender can be found in Supplementary Table A1.

3.2. Descriptive statistics and correlation analysis

The descriptive statistics and bivariate Pearson correlations among study variables for summed scores of the FoMO scale, BFI, and age are presented in Table 1. In addition, descriptive statistics for item-level data and correlations with summed FoMO scores are in

Supplementary Table A2.

Table 1 shows that while FoMO correlated with all Big Five domain and facet scores and age, most of the effects were rather small. Specifically, FoMO moderately positively correlated with Neuroticism and its subscales Anxiety and Depression. Higher levels of FoMO were associated with younger age, and lower levels of Extraversion, Openness to Experience, Agreeableness, Conscientiousness, and the facets of these domains. Albeit, effect sizes for FoMO’s negative associations with personality domains and facets were small, ranging from $r = -0.054$ to -0.244 .

Highly similar results were found in total, male, and female samples. However, interestingly, while Extraversion domain scores and the Aesthetics facet from the Openness to Experience domain had a small negative correlation with summed FoMO scores across the total sample and in male participants, these associations were not significant in the female sample. Similarly, there was a small negative yet significant correlation between summed FoMO scores and the Altruism facet from the Agreeableness domain at the total sample level – however, this association was not significant on the male- and female-sample levels.

Additionally, examining item-level correlations of personality traits and summed FoMO scores (see Supplementary Table A2), one may find that the only domain with items consistently significantly correlated with FoMO across the total sample as well as subsamples based on gender, are the Neuroticism (positively) and Conscientiousness (negatively) domain items.

3.3. Exploratory graph analysis for FoMO and the Big Five personality traits

Next, we modeled associations between summed FoMO scores and the Big Five (a) domains, (b) facets, and (c) items in the EGA framework. The graphical depiction of these models is presented in Fig. 1. The networks showed great stability in bootstrap analysis, with models replicating in more than 90% occasions. Network loadings are presented in Supplementary Table B1.

Fig. 1 shows that on all personality levels, FoMO summed scores were assigned into the same dimension as the Neuroticism domain, its facets (Anxiety and Depression), as well as items (Fig. 1a, 1b, and 1c). Item-level FoMO data formed a unique dimension, but these items were

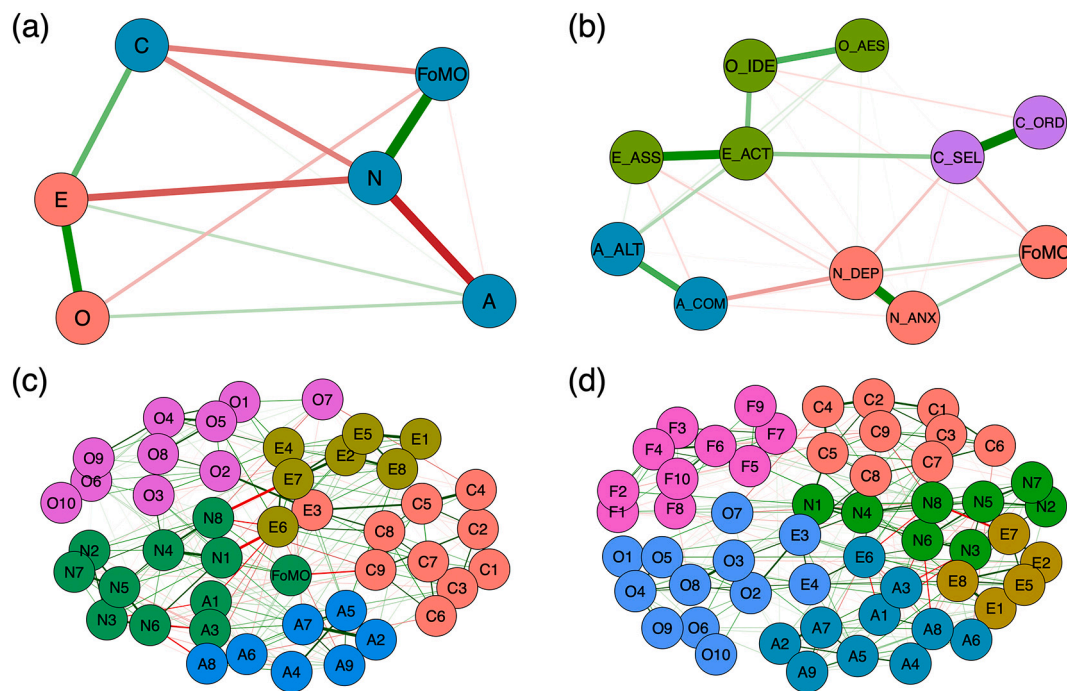


Fig. 1. EGA models for (a) domain-, (b) facet, and (c) item-level data with summed FoMO score, and (d) item-level personality and FoMO data for the full sample ($n = 3370$). *Notes.* Colors of nodes depict empirical data clusters, thicker edges indicate stronger relationships, and red and green colors of edges depict negative and positive relationships, respectively. N = Neuroticism; E = Extraversion; O = Openness to Experience; A = Agreeableness; C = Conscientiousness; N_ANX = Anxiety; N_DEP = Depression; E_ASS = Assertiveness; E_ACT = Activity; C_SEL = Self-discipline; C_ORD = Order; O_IDE = Ideas; O_AES = Aesthetics; A_COM = Compliance; A_ALT = Altruism; F = FoMO item-level; FoMO = FoMO summed score. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

primarily linked with Neuroticism items (Fig. 1d). It can also be observed that FoMO did not form links only with Neuroticism – other traits, too, seem to be correlated to FoMO even in a network approach. It seems that FoMO did not correlate with Extraversion – at least at the domain- and facet-levels. While FoMO positively correlated with Neuroticism, it was negatively associated with all other traits.

It should be noted that highly similar network structures were also visible in the male and female subsamples (see Supplementary Figs. C1 and C2).

4. Discussion

The aim of the current work was to investigate FoMO's associations with personality, as well as age and gender.

The results showed that, contrary to some previous findings (Beyens et al., 2016; Stead & Bibby, 2017), there were no gender differences in experiencing FoMO. In addition, as has been demonstrated in some studies (Blackwell et al., 2017; Elhai et al., 2018), FoMO was associated with younger age. Hence, our hypothesis was in part supported by the data.

Previous studies have demonstrated the positive association between FoMO and Neuroticism (Alt & Boniel-Nissim, 2018; Blackwell et al., 2017; Stead & Bibby, 2017). Another study did not find that link, and demonstrated a positive correlation between FoMO and Agreeableness (Hamutoglu et al., 2020). However, these – somewhat mixed – results have been reported at the domain-level of personality data. In the current study, we also analyzed lower-level personality traits.

The results of this study on domain level show that, as found in some studies, Neuroticism is positively associated with FoMO. These results were evident in bivariate correlation analysis and EGA, where summed FoMO score was assigned to the same dimensions as Neuroticism domain scores, Neuroticism facets (Depression and Anxiety) scores, and Neuroticism items. However, FoMO was also associated with other

domains and facets. Those correlations were all negative and yielded small effect sizes.

Examining item-level data, several items of Extraversion, Agreeableness, and Openness to Experience did not correlate with summed FoMO score. Interestingly, the results suggest that when FoMO is modeled as a summed score, it seems to be a dimension (or facet) of Neuroticism. After all, FoMO has a negative affect component (as the word “fear” would imply) which would fit well with the theoretical underpinnings of Neuroticism trait. On the other hand, when FoMO items are included in the EGA model, they form their own dimension – while still having item-level associations with mainly Neuroticism items.

Research has consistently shown that Neuroticism is typically higher in women and could decrease over the life span (Kaiser et al., 2020; Möttus & Rozgonjuk, 2019). While higher FoMO is associated with younger age, there were no gender differences in FoMO. Furthermore, on the facet-level Big Five and FoMO clustered together with Neuroticism facets in EGA, yet FoMO formed a separate dimension in item-level EGA. These results suggest that there may be a high overlap between FoMO and Neuroticism, yet FoMO seems to constitute a separate trait. This finding warrants further interest in subsequent studies.

It has been demonstrated that FoMO is associated with more disrupted activities due to smartphone push-notifications (Rozgonjuk et al., 2019) as well as procrastination (Müller et al., 2020). (For a broader discussion on app-design and FoMO, see Montag et al. (2019)). Importantly, these findings could also hint to lower self-discipline (not staying on-task and reacting to interruptions) which is a facet of Conscientiousness. This may offer some explanation to the negative association between FoMO and the Conscientiousness domain, facets, and items in the current study. In addition, the mentioned findings could also be related to conceptualizing FoMO into state and trait FoMO, where the former is more associated with the creation of an urge to use internet-based communication tools which could elicit situational FoMO, e.g., due to push notifications (Montag et al., 2019; Wegmann et al., 2017).

The main contribution of the current study lies in providing empirical evidence regarding the mostly weak associations between FoMO, age, gender, and the Big Five personality domains, traits, and items (although associations with Neuroticism were weak-to-moderate). While previous research has also, to some extent, investigated these relationships, the current study has several advantages, robust results, and novel findings with regards to facet- and item-level data analysis. Previous findings have been mixed. One potential reason for that is the lack of sufficient statistical power necessary to detect small effects; the large sample size of the current study allows to overcome that limitation. In addition, our analyses showed that it may be also important to take into account the level of aggregation regarding personality traits. Our results show that within-domain variation on the facet- as well as item-level data may have unique information contributing to understanding FoMO.

However, this study had a potential limitation, as the sample was self-selected, since the initial project was focused on smartphone use related aspects which may attract respondents with certain characteristics. This may pose restrictions to generalizability of the findings. On the other hand, many previous studies on FoMO relied on college student samples and amounted to a few hundred participants (Rozgonjuk et al., 2019; Wolniewicz et al., 2019). Our study includes more than three thousand people varying in age, potentially providing more robust and generalizable results.

Another potential limitation is relying on the short version of the BFI. Although domain-level analyses are likely comparable to works using other Big Five measures, such as the NEO-PI-R (Terracciano et al., 2005), the measure used in this study included domains with two facets; other, longer scales typically include six facets and hundreds of items that could provide more information especially on the facet- and item-level of personality (e.g., see the work by Möttus & Rozgonjuk, 2019). Nevertheless, the results of the current study could serve as a valuable contribution as well as further input both to FoMO-related as well as personality research. Finally, it should also be noted that we relied on self-reports. Including behavioral measures could further validate the findings.

In conclusion, we found that men and women did not differ in FoMO scores, but younger people experienced greater FoMO. Neuroticism (across different personality levels) was quite robustly positively associated with FoMO, while Conscientiousness was negatively correlated to FoMO. Although other traits also showed negative links with FoMO, analyzing item-level data did not show those links as straightforward. It should be noted, however, that only Neuroticism (on its different levels) yielded medium effect sizes, while other statistical associations were rather small (Cohen, 1992; Sawilowsky, 2009). The findings showed that (a) there may be generational differences in (and perhaps developmental course of) FoMO; (b) there are no gender differences in FoMO, meaning that men and women may be predisposed to this trait similarly; and (c) Neuroticism is a robust predictor of FoMO, suggesting that when carrying out research with both of these constructs, these covariate effects should be accounted for.

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.paid.2020.110546>.

CRediT authorship contribution statement

Dmitri Rozgonjuk: Writing – Original Draft, Study Conceptualization, Methodology, Formal Analysis, Data Curation, Visualization; **Cornelia Sindermann:** Writing – Review & Editing, Validation; **Jon D. Elhai:** Writing – Review & Editing; **Christian Montag:** Writing – Review & Editing, Study Conceptualization, Investigation, Supervision.

Data availability and pre-registration statement

The data as well as analysis script are shared in a public repository within the Open Science Framework: <https://osf.io/gf6v3/>. This study

was not pre-registered.

Declaration of competing interest

The authors report no financial or other relationship relevant to the subject of this article. Despite this CM mentions that he has received (to Ulm University and earlier University of Bonn) grants from the German Research Foundation (DFG) and the German Federal Ministry for Research and Education. CM 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. CM mentions that he is part of a discussion circle (Digitalität und Verantwortung: <https://about.fb.com/de/news/h/gesprachskreis-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.

JDE 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 U.S. National Institutes of Health and Department of Defense.

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