A reward and incentive-sensitization perspective on compulsive use of social networking sites – Wanting but not liking predicts checking frequency and problematic use behavior

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ARTICLE INFO

Keywords:
Social networking sites
Social media
Reward
Addiction
Wanting
Liking

ABSTRACT

The use of Social Networking Sites (SNSs) has exponentially increased over the past decade, leading to warnings about the addictive potential of this technology. Yet, the idea of SNS addiction remains controversial and more theory-driven research is required to understand the mechanisms of excessive and compulsive SNS use and to facilitate the development of targeted interventions helping affected users. In the present article we propose to utilize a reward-based approach to further our understanding of these behaviors. In particular, we suggest that concepts borrowed from the drug addiction literature that focus on incentive processes (incentive-sensitization and cue reactivity) can explain some SNS behaviors, such as compulsive checking. One elemental finding of the neurobiological drug addiction literature is that repeated exposure to a rewarding substance can render the brain's reward system oversensitive to cues related to the drug. We report preliminary findings from 358 participants showing that cue-elicited urges to use SNSs characterized both excessive and problematic use behaviors. Moreover, desires and urges to use SNSs (wanting responses) could be reliably dissociated from the enjoyment and pleasure (liking responses) associated with SNSs, with the latter being less predictive of the intensity and problematicity of behaviors than the former. Such divergence between motivational and hedonic processes is another hallmark finding in the literature on drug and food rewards. Together our initial findings thus suggest that examining alterations of reward processes holds promise to explain the compulsive use of SNSs and to identify potential avenues to help affected individuals.

1. Introduction

There are now more than 3.8 billion active social media users worldwide and the average user spends nearly two and a half hours per day on social networking sites (SNSs), such as Facebook, Instagram or Twitter (Hootsuite, & We Are Social, 2020). Restrictions on face-to-face social interactions during the COVID-19 pandemic have produced a further global increase in the intensity of SNS use (Nabity-Grover, Cheung, & Thatcher, 2020). With SNSs having taken over such an essential function in people's everyday routine in the past decade, concerns have been raised about excessive and compulsive patterns of SNS use (Andreassen, Torbjørn, Brunborg, & Pallesen, 2012; Griffiths, 2013). These behaviors can have substantial negative impacts on interpersonal relationships, workplace performance and physical/mental health (Andreassen, 2015). Similar to other behaviors carried out compulsively (e.g. online gaming), overuse of SNSs has been characterized as a form of addiction (Kuss & Griffiths, 2011). This view has prompted the development of different scales which define behavioral markers of social media addiction that are reminiscent of canonical substance use or gambling disorders (e.g., Van Den Eijnden, Lemmens, & Valkenburg, 2016). But whether such behavioral markers indeed reflect an underlying disease process comparable to drug addiction is still controversially discussed. SNS addiction is not formally recognized as a mental disorder, and different authors have warned of pathologizing behaviors related to modern technologies (Billieux, Schimmenti, Khazaal, Maurage, & Heeren, 2015; Kardefelt-Winther et al., 2017). In addition, a range of conceptual and methodological issues have been identified in past studies of SNS addiction that hamper progress of the field (Kuss & Griffiths, 2017). Notwithstanding these issues, there is an ever increasing presence of SNSs in society and, consequently, a mounting pressure to better understand compulsive behaviors related to these technologies.

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To date, etiological work focusing on SNS overuse is scarce. Yet, a more precise understanding of the mechanisms underlying compulsive SNS use is needed to enable a more targeted identification of problem users and/or to provide them with support. Most authors have drawn on broader models of problematic Internet or media use to explain compulsive use of SNSs (Turel & Serenko, 2012). According to these models, there are multiple pathways into SNS addiction, which reflect a complex interplay between pre-existing psychopathologies and maladaptive cognitions (Davis, 2001), lack of social skills or deficient self-regulation abilities (LaRose, Lin, & Eastin, 2003). Other work has centered on the 'uses and gratifications' that initiate SNS use in the first place (Ryan, Chester, Reece, & Xenos, 2014). Two fundamental social motives have been consistently identified that ultimately drive SNS use – the need to belong and the need for self-presentation (Nadkarni & Hofmann, 2012). Yet, these needs are present naturally in all humans (Baumeister & Leary, 1995; Leary & Kowalski, 1990). Hence, the question arises how such universally shared motives can produce compulsive use of SNSs in some individuals, and why satisfaction of these needs may not suffice to prevent overuse. In addition, it remains unclear why overuse is *maintained* after it develops initially, especially in healthy individuals without existing mental health issues and after harmful consequences have become tangible. Here we propose that one framework that can elucidate some of these questions is a neuro-cognitive perspective that focuses on the incentive and (social) reward processes associated with SNSs.

Use of SNSs can be highly rewarding. As outlined above, SNSs tap into basic social needs, offering a sense of belonging and ample opportunities for social approval (e.g. through 'likes'; Karapanos, Teixeira, & Gouveia, 2016). There is also growing neuroscientific evidence that aspects of social media activate the brain's reward system (Meshi, Tamir, & Heekeren, 2015). One particularly useful concept to explain how these rewards can lead to compulsive reward seeking/consumption is incentive-sensitization (Robinson & Berridge, 1993). Originally developed to explain substance use disorders, this theory argues that repeated exposure to a rewarding drug can render the brain's dopaminergic reward system oversensitive to the incentive properties of the drug. As a result, the affected individual experiences frequent states of strong drug wanting (craving/desires to take the drug), which are triggered by conditioned stimuli (=cues) associated with the drug reward. Importantly, heightened wanting is decoupled from the actual enjoyment or pleasure of taking the drug – the liking component of reward – which typically decreases rather than increases (Berridge & Robinson, 2016). This idea of drugs 'hijacking' the reward system and producing overwhelming urges in response to drug cues, which are dissociable from hedonic processes (pleasure), has strong explanatory power for a range of different substances (Berridge & Robinson, 2016) and has led to the exploration of new treatment approaches (Ihssen, Sokunbi, Lawrence, Lawrence, & Linden, 2017). Ample evidence exists for altered behavioral and neural responses to visual drug cues in addictive disorders (Carter & Tiffany, 1999; Chase, Eickhoff, Laird, & Hogarth, 2011). In addition, we have demonstrated that responses to reward cues can index addictive dispositions (Ihssen, Cox, Wiggett, Fadardi, & Linden, 2011).

Some evidence exists that SNS rewards have the potential to elicit intense wanting (urges to check or use SNSs) too, especially after prolonged abstinence (Stieger & Lewetz, 2018). Yet, it is unclear whether such motivational wanting states reflect a form of incentive-sensitization and indeed result in more frequent checking of SNSs and/or more time spent on SNSs, as well as more problematic use behaviors (e.g. use despite relationship problems, other activities are given up). According to the incentive-sensitization model, sensitization should be characterized by (1) a dissociation between motivational (wanting) and hedonic (liking) processes, and (2) heightened motivational responses to reward cues (Berridge & Robinson, 2016). If incentive-sensitization contributes to the development and/or maintenance of excessive and compulsive SNS use, we can thus predict increased self-reported wanting but no concurrent increase (or even a decrease) in liking in individuals who show higher usage (e.g. checking) and more problematic use behaviors. In addition, we can also expect increased reactivity to SNS cues (as another proxy of wanting). We present three studies offering initial evidence for a role of these basic mechanisms in excessive and problematic SNS use.

2. Methods and materials

Data from three separate online survey studies were analyzed to examine (1) the potential dissociation between wanting to use and actual use enjoyment in predicting use intensity/problematicity and (2) the association between use intensity/problematicity and visual cue reactivity (as an indicator of reward sensitization). Statistical analysis was carried out on data pooled across studies, using the Statistical Package for the Social Sciences (SPSS), Version 27.0. The data which support this publication are available on https://doi.org/10.6084/m9.figshare.13501902.

In our studies we used SNS logos to elicit cue reactivity, as these are highly salient signals which users see when accessing SNSs and thus are prime candidates for real-life cues imbued with reward. In addition, we asked participants to indicate their agreement with verbal descriptions of wanting to use SNSs and the pleasure of using them. Such self-report measures of wanting/liking have provided useful insight in previous studies that used other rewards (Pool, Sennwald, Delplanque, Brosch, & Sander, 2016). The use of an online study (instead of an experimental format) allowed for feasible acquisition of well-powered proof-of-concept data.

2.1. Participants

In total, 365 young adults took part in the studies conducted at Durham University (Study 1: N = 139, Study 2: N = 107, Study 3: N = 119). Participants were mostly students recruited through the internal credit-based recruitment platform of the Department of Psychology at Durham University. 7 participants had to be removed from the data set due to incomplete responses or age restrictions. Pooled sample sizes allowed for reliable exploration of medium-sized effects with a power of 99%. Participants had a mean age of 20.89 years (SD = 2.28; range = 18–35), comprising 236 females, 119 males and 3 others. Studies were administered using Online Surveys (https://www.onlinesurveys.ac.uk) and approved by the Ethics Sub-Committee in the Department of Psychology at Durham University. All participants provided fully informed consent.

2.2. Measures (see Appendix A)

SNS Use Measures (Studies 1–3): Participants reported their typical daily *time spent on SNSs* and *frequency of checking SNSs*. We also measured *problematic SNS use* by adapting items from the four symptom clusters of the DSM-V criteria for substance addiction (American Psychiatric Association, 2013).

Wanting and liking (Study 1 and 2): Four liking items measured enjoyment of SNS use and four wanting items measured urges to use SNSs.

Cue reactivity (Studies 1–3): Logo images of four widely used SNS platforms (Facebook, Twitter, Instagram and Snapchat) were individually presented to participants alongside a cue reactivity 5-point Likert scale. Study 2 additionally included the logo of the Chinese platform "Weibo", as recruitment specifically targeted Asian students.

Item analyses indicated good internal consistency (Cronbach's α) of all aggregate scores (problematic use α = 0.83, wanting α = 0.82, liking α = 0.86). Data were inspected for normality (skewness, kurtosis), homoscedasticity, linearity and other statistical assumptions of the chosen analyses, with no issues detected (for details see Appendix B).

Table 1
Associations between reward-related measures and three use variables.

	Time spent on SNSs	Frequency of checking	Problematic Use
Wanting (N = 240)	$r_s = 0.35, p < .001**$	$r_s = 0.57, p < .001**$	$r = 0.63, p < .001**$
Liking (N = 240)	$r_s = 0.14, p = .027$	$r_s = 0.02, p = .795$	$r = -0.04, p = .586$
Cue Reactivity (N = 358)	$r_s = 0.23, p < .001**$	$r_s = 0.25, p < .001**$	$r = 0.44, p < .001**$

Note: Non-parametric correlation analysis (Spearman's Rho, r_s) was used for *time spent on SNSs* and *frequency of checking,* for which interval scaling could not be assumed. P-values show uncorrected significance levels, asterisks indicate significance after Bonferroni correction (* p < .05, ** p < .01).

Table 2
Summary of regression analyses for the prediction of problematic use, frequency of checking and time spent on SNSs from wanting when controlling for liking.

Variable	R^2 change	F change	β	p
Problematic Use (Regression 1)				
Step 1				
Liking	0.001	$F(1, 237) = 0.30$	−0.035	0.586
Step 2				
Wanting	0.434	$F(1, 236) = 180.52$	0.674	<0.001
Frequency of checking (Regression 2)				
Step 1				
Liking	0.009	$F(1, 237) = 2.20$	0.096	0.139
Step 2				
Wanting	0.325	$F(1, 236) = 115.34$	0.584	<0.001
Time spent using (Regression 3)				
Step 1				
Liking	0.018	$F(1, 237) = 4.47$	0.136	0.036
Step 2				
Wanting	0.109	$F(1, 236) = 29.59$	0.339	<0.001

3. Results

3.1. Wanting versus liking

As shown in Table 1, wanting was significantly correlated with excessive and problematic use. In contrast, liking was not significantly associated with any use variable (after correcting for multiple comparison). Wanting and liking scores were also weakly correlated with each other ($r = 0.22, p = .001$).

A two-stage hierarchical regression analysis was used to assess the unique contribution of wanting above and beyond liking in predicting SNS use, with liking scores entered at stage one and wanting scores entered at stage two (Table 2). Liking scores did not predict problematic use, however the inclusion of wanting scores made the model significant

and explained 43.4% more of the variance. Similarly, liking scores did not predict frequency of checking, however the inclusion of wanting scores made the model significant and explained 32.5% more of the variance. Finally, liking scores predicted time spent using SNSs, explaining 1.8% of the variance. However the inclusion of wanting scores explained 10.9% more of the variance.

These results suggest that the experience of urges to use SNSs is a strong predictor of problematic and excessive use above and beyond the perceived enjoyment of using SNSs. They also suggest that liking is not substantially associated with these behaviors but exerts some minor influence on time spent on SNSs.

3.2. Cue reactivity

Cue reactivity scores were significantly correlated with all three use measures (see Table 1). The association between cue reactivity and problematic use was relatively stronger than the relationship with the other two use measures. This suggests that the predictive utility of cue reactivity is highest for behaviors indicative of the negative consequences of SNS overuse.

4. Discussion

Similar to food or drug rewards, social rewards (e.g. approval from peers) elicit hedonic and motivational responses which rely on the brain's general, domain-unspecific reward system (Fareri & Delgado, 2014). Our preliminary findings indicate that with repeated exposure to social rewards in the context of SNSs, individuals may become sensitized to their incentive properties, similar to drug users becoming sensitized to drug reinforcement. Consistent with the incentive-sensitization model (Robinson & Berridge, 1993), we found that excessive checking and problematic use of SNSs is reflected in a decoupling of motivational and hedonic processes: SNS wanting and liking were only weakly correlated with each other. However, individuals who reported more SNS wanting experienced more problematic SNS use, while a higher SNS enjoyment was unrelated to this variable. Similarly, responses to visual SNS cues also showed substantial co-variation with problematic use and some association with the other use measures. Finally, our results (correlation analysis and regression 2) showed that individual differences in the experience of SNS urges (wanting) co-varied with frequency of checking SNSs, while liking to use SNSs did not show such a relationship.

The link between hyperresponsiveness to visual reward cues and reward dysfunction is well established in drug addiction (Carter & Tiffany, 1999) and obesity (Boswell and Kober, 2016). In contrast, experimental studies using social media cues are scarce and existing work does not directly address the relevance of cue responses for compulsive use (Johannes, Dora, & Rusz, 2019; Van Koningsbruggen,
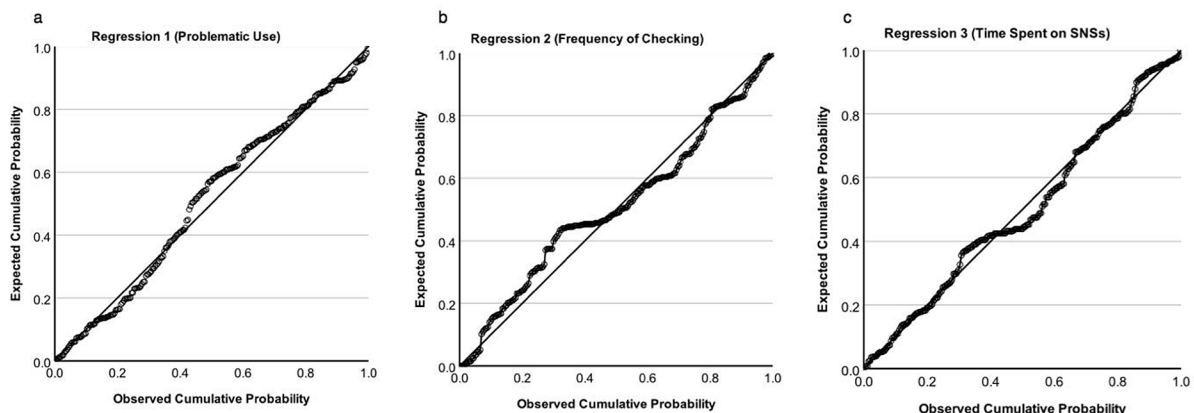

Fig. 1. Normal Predicted Probability plots of standardized residuals in all three regressions.
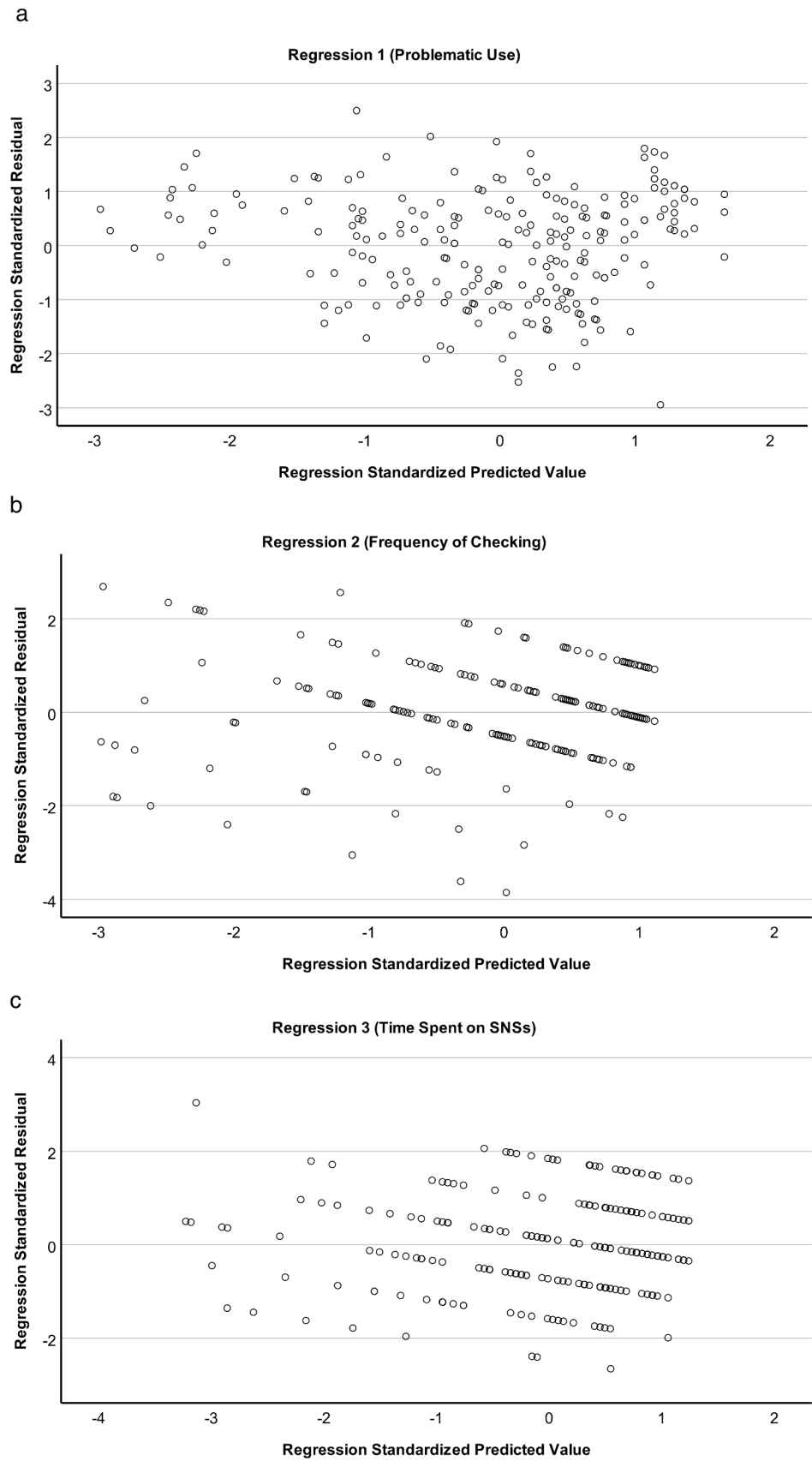
a

b

c

Fig. 2. Scatterplots of standardized residuals against predicted values in all three regressions.

Hartmann, Eden, & Veling, 2017). However, a growing number of studies have explored visual cue reactivity in other behavioral addictions, such as gambling disorder (Starcke, Antons, Trotzke, & Brand, 2018). Consistent with our results, these studies indicate that cue reactivity may constitute a useful proxy for incentive-sensitization even in conditions where sensitization is not caused by direct neurophysiological effects of a drug. Our results also corroborate a recent theoretical position offered by Veissière and Stendel (2018) who emphasize an ingrained human need to monitor others and be monitored by others, alongside basic reward processes (e.g. craving), as the core dimension underlying addictive smartphone use.

One criticism of research into problematic Internet and SNS use, which is pertinent to our own study, is its often only correlative and confirmatory nature (Billieux et al., 2015). This is further aggravated by well-known issues inherent in self-report data, which are prone to a variety of biases, including socially desirable responding and self-consistency (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Nonetheless, we believe that our study adds a new perspective to the field and propose the following steps to address these concerns: (1) Future studies of social media reward should incorporate experimental measures with tightly controlled stimuli (e.g. control logos) and compare 'baseline' measures of wanting with cue-elicited wanting. (2) Studies should incorporate direct neural measures (e.g. fMRI) or implicit (behavioral) measures of reward, such as the approach-avoidance task (Field, Kiernan, Eastwood, & Child, 2008). Some steps have recently been taken into that direction (Du, van Koningsbruggen, & Kerkhof, 2020) and there is a nascent literature investigating neurobiological correlates of social media behaviors (Meshi et al., 2015). Yet, results remain inconclusive and lack a common and coherent theoretical framework, which might be offered by the current approach. Critically, we do not propose that incentive-sensitization is an all-encompassing explanation of compulsive SNS use but that it can inform research in this area and be integrated with other theoretical models. As such, incentive-sensitization might constitute one important mechanism underlying the maintenance of excessive checking, following the development of problematic use due to other processes, such as coping or compensation of low social skills (Turel & Serenko, 2012).

5. Conclusions

Our results indicate that the assessment of wanting, liking and cue reactivity might be a useful tool to investigate SNS use. Social media now penetrate most facets of our social life. At the same time, there is growing concern about the consequences of excessive use. A focus on reward, especially the distinction between motivational wanting and hedonic enjoyment, may provide a promising avenue to distinguish between a healthy 'passion' to use and compulsive use. The reward perspective has stimulated a multitude of studies in other domains of excessive consumption (e.g. overeating, Kenny, 2011) and even generated novel interventions in these areas, such as the reduction of food or drug-related attentional biases or neurofeedback of wanting-related brain activation (Ihssen et al., 2017). Analogously, the current approach may ultimately help to predict and tackle harmful overuse of SNSs.

CRediT authorship contribution statement

Niklas Ihssen: Conceptualization, Methodology, Investigation, Supervision, Project administration, Writing - original draft. **Michael Wadsley:** Formal analysis, Writing - original draft.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

Appendix A. – Full list of measures

SNS use measures

Time Spent on SNSs: "How much time do you spend on social media[1] on a typical day?"
[1] < 30 min, [2] 30–60 min, [3] 1–2 h, [4] 2–3 h, [5] 3–4 h, [6] + 4 h
Frequency of Checking SNSs: "How frequently do you check your main social media account during the day (if you have the opportunity to do so)?"
[1] At least once every 15 min, [2] At least once every hour, [3] At least once every 2 h, [4] At least once every 6 h, [5] At least once a day [6], Not every day

Problematic SNS use

Social impairment

"I have given up other activities (e.g. social or recreational activities) due to my social media use."
"My social media use interferes with obligations at work, university or home."

Impaired control

"I usually spend more time on social media than intended."

"I have had unsuccessful attempts to cut down my social media usage."

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[1] Participants were explained that we used the more common term "social media" to refer to SNSs specifically.

Risky use

"I check my social media whilst driving."
"I check my social media whilst crossing the road."

Tolerance and withdrawal

"Over time I have felt the urge to use a larger number of different social media sites and/or a desire to spend more time on social media."
"If I do not check my social media accounts for a while, I begin to feel nervous and/or restless."

SNS cue reactivity

"This image makes me want to check my [Facebook/Instagram/Snapchat/Twitter]."

SNS Liking (agreement on 5-point Likert scale)
"Using social media is an activity that gives me pleasure."
"Using social media makes me happy."
"Using social media usually evokes a positive feeling in me."
"Using social media makes me feel better about myself."

SNS Wanting (agreement on 5-point Likert scale)
"When I wake up in the morning, I usually have a strong urge to check my Facebook, Instagram, Twitter or Snapchat."
"Before I go to bed I need to check my Facebook, Instagram, Twitter or Snapchat."
"When I see my phone, I experience a strong desire to check my Facebook, Twitter, Instagram or Snapchat."
"Seeing others using social media evokes a strong urge in me to check my Facebook, Instagram, Twitter or Snapchat."

Other measures: The three studies included different additional measures, which were embedded in the survey for exploratory reasons (e.g., assessment of intercultural differences). These were not related to the current research question and thus not included in the present report.

Appendix B. – Testing of assumptions for Statistical analyses

Normality

Skewness and kurtosis values were within +/- 1 for the majority of variables (Time spent on SNSs: 0.02, −0.45; problematic use: 0.21, −0.76; Liking: −0.26, −0.30; cue reactivity: −0.31, −0.86). Frequency of checking and wanting showed slightly left-skewed distributions with skewness values marginally below −1 (frequency of checking: −1.02, 1.44, wanting: −1.17, 0.81). However, given the comparatively large sample size, parametric tests were deemed appropriate for those variables for which interval scaling could be assumed (see Table 1).

Linear regressions

Inspection of Predicated Probability (P-P) plots indicated that there were no clear deviations from normality in the residuals of the three regressions (see Fig. 1 a-c). Durbin-Watson values were close to 2, demonstrating independence of residuals (regression 1: 1.81; regression 2: 2.08; regression 3: 2.07). Scatterplots of the standardized residuals and predicted values suggested no clear violations of homoscedasticity and linearity (see Fig. 2 a-c). A low variance inflation factor for wanting and liking of 1.05 suggested no evidence of multicollinearity. Analysis of Mahalanobis Distance (for wanting/liking) showed that the probability of each value was not below 0.001 for any case (max. value 12.03), indicating that multivariate outliers did not influence results. Inspection of cases with missing values revealed only one participant for which two measures were missing (frequency of checking and time spent on SNSs).

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