

A peer-influence perspective on compulsive social networking site use: Trait mindfulness as a double-edged sword

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Highlights

- Increase in peer activity on Social Networking Sites (SNS) drives compulsive use.
- One's ability to fend-off social pressures to use SNS reduces compulsive use.
- Trait mindfulness is a double-edged sword in the case of compulsive SNS use.
- It augments the negative effect of social pressure self-efficacy on compulsive use.
- It enhances the positive effect of increase in peer SNS activity on compulsive use.

Abstract

There is an increasing concern regarding the emergence of harmful compulsive use patterns among some social networking sites (SNSs) users. Although SNSs are efficient social interaction tools, there is a dearth of research that seeks to understand peer-influence determinants of compulsive SNS use. This study attempts to bridge this gap and tests a model that accounts for the effects of peer-influence mechanisms on compulsive SNS use. Because mindfulness is important for the observation of and cognitive deliberation regarding peer influences, the model also accounts for possible moderating effects of mindfulness. To test this model we conducted a two-wave survey of 155 SNS users from the US. Findings based on hierarchical regression models show that while observed increase in peer SNS use augments compulsive SNS use, social pressure self-efficacy reduces it. Trait mindfulness was found to accentuate these influences and serve as a double-edged sword: it strengthened the inhibiting effect of social pressure self-efficacy on compulsive SNS use, but increased the positive effect of observed peer use increase on compulsive SNS use. Moreover, about 11% of our sample met presumed rudimentary clinical compulsiveness screening criteria. Logistic regression showed that the likelihood of meeting these

criteria is reduced with increases in SNS experience and social pressure self-efficacy. These findings can serve as a basis for the development of interventions that target such factors.

Keywords: Compulsive SNS use, mindfulness, social pressure self-efficacy, social media, peer increase in SNS use, social identity theory

1. Introduction

Compulsive use of Internet applications is a growing concern in modern society (Rumpf et al., 2017). It refers to inability to control or cease Internet application use, even though the use of a specific Internet application results in harmful consequences (Dalley, Everitt, & Robbins, 2011). It can manifest in symptoms such as salience, relapse, intrusive thoughts, withdrawal, mood modification, need to increase the activity, conflict with important other activities and the consequent infringement of normal functioning (Kuss, Griffiths, & Binder, 2013). People with high degrees of such compulsiveness feel an obligatory desire to seek to perform and engage in the rewarding behavior, while significantly discounting the harm caused by their behavior (Weiss et al., 2001). Examples include persistently and compulsively using social media while in class (Turel & Qahri-Saremi, 2016) or while driving (Turel & Bechara, 2016a). One study reported that the global prevalence rate of compulsive Internet use in 2014 has been around 6% and can range from 2.6% in Northern and Western Europe to 10.9% in the Middle East (Cheng & Li, 2014). Social media sites (SNSs) such as Facebook have particularly shown high compulsive use potential (Griffiths, 2012), as their use can sensitize brain reward circuits and produce brain alterations (He, Turel, & Bechara, 2017) that drive compulsive behaviors (Turel, He, Xue, Xiao, & Bechara, 2014).

Given the importance of compulsive use of such technologies, and especially its adverse effects on younger individuals (Gentile, 2009), many studies have examined its possible predictors and outcomes (Aladwani & Almarzouq, 2016; Lee, Chang, Lin, & Cheng, 2014; McIntyre, Wiener, & Saliba, 2015; Muusses, Finkenauer, Kerkhof, & Billedo, 2014; Quiñones-García & Korak-Kakabadse, 2014; Quinones

& Kakabadse, 2015). Predictors can include an imbalance in the dual-system that governs behavior (Brand, Young, Laier, Wölfling, & Potenza, 2016), social anxiety and genetic factors (Weinstein, 2013), demographics and socio economic factors (Hur, 2006), psychological traits (Hong, Huang, Lin, & Chiu, 2014), and peer pressure (Balogh, Mayes, & Potenza, 2013). Such findings highlight the intricacy of compulsive technology use; and suggest that it can be rooted, at least in part, in deficient decision making as manifested in lack of awareness, low inhibition abilities, and heightened susceptibility to peer pressure (Chou, Condrón, & Belland, 2005; Weinstein & Lejoyeux, 2010).

Although SNS are efficient vehicles for conveying information about peers and peer influences, and in which users can constantly observe influential others' behaviors (Leonardi, 2015), little direct attention has been given to such aspects in the possible etiology of compulsive SNS use (exceptions include concepts such as social connectedness, see for example McIntyre et al., 2015). Nevertheless, social/ peer-related factors such as observations regarding peer behaviors and one's ability to fend-off peer influences have been shown to be important predictors of various compulsive behaviors (Haug, Nunez, Becker, Gmel, & Schaub, 2014; Russell, Trudeau, & Leland, 2015; Vink, 2016). Conceptual models of compulsive and possibly addictive Internet use also point to the importance of this family of factors in the etiology of this problem (Brand et al., 2016; Davis, 2001). Hence, this study attempts to bridge the abovementioned gap and test a model that accounts for the effects of peer-influence related factors on compulsive SNS use. To do so, it also accounts for the influences of mindfulness (i.e., the receptive attention to and awareness of present events and experiences occurring both internally and externally, see Brown & Ryan, 2003), because it is a key manifestation of one's ability to comprehend and take into account the cues he or she observes from the social environment. Focusing on this combination of psycho-social factors is important and potentially fruitful; such factors can be manipulated through system design (e.g., observations regarding peer behavior can be altered via system features) and/or therapy (e.g., mindfulness training), as a means to reduce compulsive use SNS.

We first argue that changes in peer behavior on the SNS are easily observable (Leonardi, 2015); therefore it can provide important social signals to SNS users. Based on social identity theory (Jetten, Spears, & Manstead, 1996; Tajfel, 1978; Tajfel & Turner, 1986), such cues convey important normative information regarding in-group behaviors and indicate to users what are acceptable SNS behaviors, what level of use is implicitly expected from them, and eventually compel users to engage in obligatory behavior on the SNS. Such normative information can drive obligatory behavior through at least two mechanisms. First, SNS users are part of a network and conforming to group norms in this network is desired by them. Such conformation is natural and advantageous to group members as it engenders stronger in-group identity (Hogg, 1996). Hence, when one's peers increase their SNS activity, social identity theory dictates that the person will likely feel obliged to increase his or her activity too. Second, there is social reciprocation obligation on social media sites. Specifically, people are expected to respond to others' posts and this can drive them to engage in automatic and obligatory SNS use (Turel, 2015), even at the expense of other life goals and when the behavior is harmful (e.g., when in class, driving, instead of working, or instead of sleeping) (Turel & Bechara, 2016a; Turel & Qahri-Saremi, 2016; Turel, Romashkin, & Morrison, 2016). The proposed effects of peer behaviors on one's compulsive behavior are also consistent with observations across many compulsive and addictive behaviors contexts, in which it has been shown that peer behavior plays an important role in shaping one's behavioral patterns (Haug et al., 2014; Russell et al., 2015; Vink, 2016). Hence, our first hypothesis is that **(H1)** observed peer increase in SNS use is positively associated with compulsive SNS use.

We next borrow from the compulsive drinking literature (Oei & Burrow, 2000; Young, Hasking, Oei, & Loveday, 2007). We suggest that the ability to fend-off implied peer pressures and cues to engage in SNS use is a counterforce that reduces obligatory SNS use. This ability is conceptualized in the context of SNS use as "social pressure self-efficacy" and is defined as the ability to refuse or resist SNS use in high-risk social situations, including situations where the person is exposed to peers using it. Conceptual models (Brand et al., 2016), neuroscience (Bechara, 2005) and empirical behavioral studies (Turel & Bechara,

2016b) implicate one's deficient inhibition abilities in driving compulsive behaviors. These three streams of research are consistent in suggesting that when people have low ability to exert control over their behavior and resist temptations, the subjective impulses they sense gradually become obligatory, and they consequently engage in compulsive and often disadvantageous behaviors. In contrast, when one's executive function is highly functional, as manifested in high social pressure self-efficacy in this study, he or she can inhibit desires to use Internet applications and prevent compulsive use (Brand, Young, & Laier, 2014; Choi et al., 2014; Dong, DeVito, Du, & Cui, 2012). Accordingly, we hypothesize that **(H2)** social pressure self-efficacy is negatively associated with compulsive SNS use.

The last component in our model is trait mindfulness, which can arguably accentuate the influence of social factors on compulsive SNS use. Mindfulness can have five facets including observing, describing, acting with awareness, non-judging, and non-reacting. The focus of this paper is on the "act with awareness" facet, since it is better aligned with the action (compulsive use)-prevention in response to the environment cues. When people are high in mindfulness, and especially rely on awareness before acting, they are better at reflecting on likely adverse outcomes of their target behavior and consequently at controlling behaviors. Therefore, they can better respond to social pressures and cues after reflection and they respond to such social influences in a less-automatic or obligatory fashion (Brewer, Elwafi, & Davis, 2013; McConnell & Froeliger, 2015). People high in mindfulness specifically learn that cues and pressures from the environment are transient and do not require rush, obligatory action (Heppner, Spears, Vidrine, & Wetter, 2015). Indeed, low mindfulness contributes to compulsive behavior etiology (Hsu, Grow, & Marlatt, 2008). Consequently, teaching people to develop stronger mindfulness is key to many treatment programs of compulsive behaviors (Black, 2014; Brewer et al., 2013; McConnell & Froeliger, 2015; Vidrine et al., 2016).

Considering the social factors we focus on, it appears that mindfulness can be a double-edged sword in the case of compulsive use of SNS. First, given that mindfulness increased the ability to exert behavioral control and screen irrelevant stimuli (Sanger & Dorjee, 2016), it is reasonable to expect that **(H3a)**

mindfulness moderates (enhances) the negative effect of social pressure self-efficacy on compulsive SNS use. This effect should be stronger (more negative) when people are high in mindfulness. When people are low in mindfulness they may not be able to properly motivate the mobilization of inhibition efforts. Because people who are low in mindfulness are unable to properly perceive their situation, even when they have high self-control abilities, they may fail to create sufficient drive to engage them (Frieze, Messner, & Schaffner, 2012; Gregg, Callaghan, Hayes, & Glenn-Lawson, 2007).

In addition, trait mindfulness can promote attention to stimuli (Carlin & Ahrens, 2014; Lutz et al., 2016; McHugh, Simpson, & Reed, 2010), including presumably social cues, and this awareness can too drive action in the direction of the observed cues. Mindfulness therefore has the ability to accentuate responses to stimuli (Brown, Goodman, & Inzlicht, 2013). It is therefore reasonable to expect that **(H3b)** mindfulness moderates (enhances) the positive effect of perceived peer increase in SNS use on compulsive SNS use. This happens, because mindful people are more likely to better observe cues from their social environment and integrate them into their action schemata (Jha, Krompinger, & Baime, 2007). In contrast, people low in mindfulness may not reflect properly on cues related to peer behavior, improperly integrate them into their decisions related to actions, and will fail to respond to them, even when peer increase in activity is deemed high.

2. Methods

2.1. Design

The study employed a cross-sectional survey design conducted in two waves, one-week apart. The first wave captured the control variables (age, gender, Facebook experience, and Facebook Contacts) and predictors (social pressure self-efficacy, peer increase in Facebook use, and mindfulness). The second wave survey captured the outcome variable (compulsive Facebook use). Inclusion criteria were: actively using Facebook and age over 18 years old. No grouping was employed.

2.2. Participants

Minimum sample size for an effect size of 0.15, desired power of 0.8, nine predictors (two direct effects, two moderation effects and a direct effect of the moderator, and four controls), and probability level of 0.05 was calculated to be 113. A sample of 155 Facebook users (62% response rate) including 65 women (coded as 1) was obtained. It included users with an average of 7.53 years of experience on Facebook (Range= 1 to 13, SD=2.61) and with an average of 413.28 friends on Facebook (Range=3 to 3,000, SD=416.85). The distribution of participants' ages was: 50 in the 18-20 years old bracket (32.3%), 76 in the 21-30 age bracket (49%), 21 in the 31-40 age bracket (13.5%), and 8 in the 41 or older age bracket (5.2%). Based on the Faber and O'Guinn (1992) criteria for compulsive shopping, the sample included 17 (10.97%) compulsive SNS users.

2.3. Materials

Scales were adapted to the context of SNS use from valid and reliable scales. They were tested for face validity and understandability with a sample of five Facebook users and then pilot tested with a sample of n=30 Facebook users. The scales were deemed to be valid and appropriate (all α s >0.80), and were used with no changes in the main study. Mindfulness items were adapted from the "act with awareness" dimension of the Five Facet Mindfulness Questionnaire (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006). Social pressure self-efficacy was adapted from the drinking refusal self-efficacy questionnaire (DRSEQ) (Young & Oei, 1996), part II by changing references from "drinking alcohol" to "using Facebook." Although the DRSEQ contains two other dimensions of self-efficacy (emotional and opportunistic), the focus on social-related factors in this study dictated our choice to use only the social pressure dimension. Observed increase in peer SNS use items were adapted from the measure of perceived SNS use increase by (Turel, 2015). Compulsive use of Facebook items were adapted from the compulsive buying scale by Faber and O'Guinn (1992) as adapted to the case of SNS use by Serenko and Turel (2015). The measurement items and their properties are summarized in Table 1.

Table 1. Measurement Items

Variables	Mean (SD)	Measurement Quality Indices	Items
Mindfulness (Baer et al., 2006)	3.49 (1.46)	$\alpha = 0.934$	<p>Please rate each of the following statements using the scale provided. [1=very rarely to 7=very often; all scale items are reversed]</p> <ul style="list-style-type: none"> - When I do things, my mind wanders off and I'm easily distracted. - I don't pay attention to what I'm doing because I'm daydreaming, worrying, or otherwise distracted. - I am easily distracted. - I find it difficult to stay focused on what's happening in the present. - It seems I am "running on automatic" without much awareness of what I'm doing. - I find myself doing things without paying attention.
		Guttman Split-Half coefficient = 0.908,	
		Corrected item-total correlations = 0.672-0.861,	
		% of variance explained = 75.559	
Social pressure self-efficacy (Young & Oei, 1996)	4.34 (1.20)	$\alpha = 0.863$	<p>The following items ask about your ability to handle Facebook use situations. Please use the provided scale to rate each statement that best describes how much you could resist using Facebook in each case. [1=very sure I would use Facebook to 6=very sure I would not use Facebook]</p> <p>How sure are you that you could resist using Facebook...</p> <ul style="list-style-type: none"> ...when you are out at dinner? ...when you see others on their social networking website? ...when you are at a party? ...when someone asks you to add him/her on this social networking website? ...when you want to feel more accepted by friends? ...when your spouse or partner is on Facebook? ...when your friends are on Facebook?
		Guttman Split-Half coefficient = 0.814	
		Corrected item-total correlations = 0.591-0.736	
		% of variance explained = 55.087	
Increase in peer SNS use (Turel, 2015)	4.20 (2.72)	$\alpha = 0.970$	<p>[1="Negative change" to 11="more than 200%"]</p> <p>Please estimate the increase in activity you observed in your peers' SNS use over the last 3 months</p> <ul style="list-style-type: none"> - Increase in times per day my close friends use Facebook. - Increase in the duration of use of each session with Facebook by my close friends - Increase in the time per day my close friends spend on Facebook. - Increase in the features of Facebook my close friends use.
		Guttman Split-Half coefficient = 0.961	
		Corrected item-total correlations = 0.955-0.971	
		% of variance explained = 91.835	
Compulsive	2.30	$\alpha = 0.852$	Please rate each of the following statements using the scale

Variables	Mean (SD)	Measurement Quality Indices	Items
SNS Use (Faber & O'Guinn, 1992; Serenko & Turel, 2015)	(1.11)	Guttman Split-Half coefficient = 0.802	provided. [1=strongly disagree to 7=strongly agree] - If I have any time left at the end of my day, I just have to spend it on Facebook.
		Corrected item-total correlations = 506-0.735	- I felt others would be horrified if they knew of my Facebook use habits - I spent time on Facebook even though I had other deadlines - I spent time on Facebook when I know I didn't have time to make up for it
		% of variance explained = 53.966	- I spent time on Facebook in order to make myself feel better - I felt anxious or nervous on days I didn't use Facebook - I made only minimum progress on my obligations as a result of my Facebook use

2.4. Procedures

SNS (specifically Facebook) users were invited via a class announcement to participate in a study of Facebook behaviors. The description of the study remained vague (i.e., about Facebook behaviors) such that it does not bias responses. Two course bonus points were used as an incentive. Participants who completed the first wave survey were emailed a link to complete the second wave survey a week later. All participants gave written informed consent when they started the study. The consent form was approved by the Institutional Review Board at the second author's institution. Participants were debriefed regarding the study's objective one week after data collection completion.

2.5. Statistical Analysis

Data were first tested for validity and reliability using Cronbach alpha, Guttman split-half coefficients, corrected item-total correlations, and an exploratory factor analysis procedure in SPSS 24. After establishing sufficient validity and reliability, factor scores (principal components) were generated for all multiple-item scales. These scores were entered in a hierarchical regression model in SPSS 24, with the following sequence. First, a model with just control variables was estimated. Second, a model with additional direct predictors was estimated. Third, a model that adds the moderator effects (direct effects and interactions) was assessed. Next, in order to overcome distributional assumptions concerns, model

estimation was repeated with bootstrapping with 500 resamples and a 95% confidence interval using SPSS 24. The moderation effects were plotted using the tools in <http://www.jeremydawson.co.uk/slopes.htm>.

As a supplementary analysis, participants were classified as presumed to be "compulsive users", by using the criteria specified in Faber and O'Guinn (1992) [classification cutoff= -1.34)] for compulsive buying. To do so, the 1-7 scale used here was converted to a 1-5 scale with 0.66 increments and was reverse-coded to match the original conceptualization. Multivariate analysis of variance in SPSS 24 was used for comparing the attributes of the presumed to be compulsive group with the characteristics of those who were presumed to be non-compulsive Facebook users. In addition, we estimated a logistic regression model with the classification (presumed compulsive Facebook user or not) as the dependent variable. This model included all controls, independent variables and moderators from the main model as predictors. It attempted to explore factors that contribute to this rudimentary classification.

3. Results

Table 1 demonstrated that all scales were valid and reliable. This was further supported with an exploratory factor analysis procedure with oblique rotation that produced the expected factor structure (four correlated components; $r=-0.18$ to 0.35) with the expected loading pattern ($0.67-0.79$ for compulsive use, $0.93-0.97$ for peer increase in SNS use, $0.77-0.93$ for mindfulness, and $0.67-0.83$ for social pressure self-efficacy). Hence, principal component scores were used for model analysis. A summary of the hypothesized relationships and results, as well as the results of the classification (logistic regression) model are presented in Table 2. Repeating the full moderation model using bootstrapping with 500 resamples and a 95% confidence interval produced virtually the same results. Moderation plots are provided in Figure 1 (low mindfulness= -1SD from the mean; high mindfulness= +1SD from the mean).

Table 2. Hypothesis Testing (n=155) ^{†, †††}

	Predictor	Base Model - Only	Main Effects	Moderation Model ^{††}	Logistic Regression
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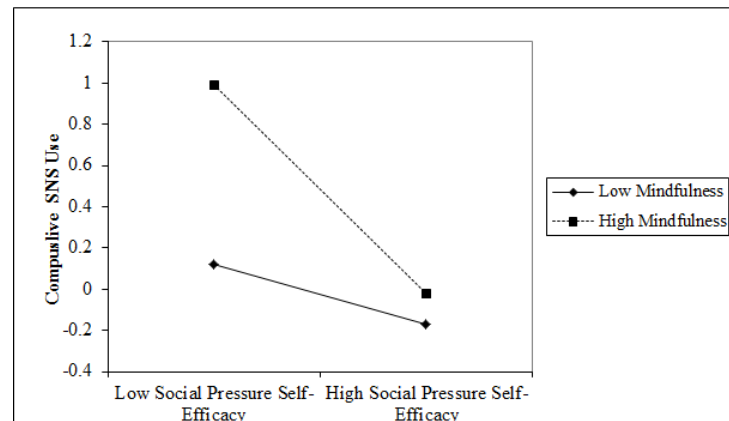
		Controls ^{††}	Model ^{††}		Model
Controls	Age	-0.193 (0.027)	-0.163 (0.048)	-0.081 (0.315)	0.312 (0.229)
	Gender	0.069 (0.399)	0.006 (0.941)	0.010 (0.891)	-0.673 (0.292)
	Facebook Experience	0.005 (0.955)	0.024 (0.772)	0.023 (0.767)	-0.287 (0.045)
	Facebook Friends	-0.006 (0.940)	-0.073 (0.364)	-0.053 (0.482)	0.000 (0.689)
Main Effects	Social Pressure Self Efficacy		-0.325 (0.000)	-0.325 (0.000)	-0.976 (0.013)
	Peer Activity Increase		0.194 (0.015)	0.204 (0.006)	0.441 (0.192)
Moderation	Mindfulness			0.255 (0.001)	0.448 (0.234)
	Mindfulness x Social Pressure Self Efficacy			-0.197 (0.008)	-0.487 (0.133)
	Mindfulness x Peer Activity Increase			0.157 (0.029)	0.615 (0.095)
Model Indices	R ²	0.046	0.165	0.288	Nagelkerke R ² = 0.342
	R ² Change (Significance)	0.046	0.119	0.123	
	Effect sizes- <i>f</i> ²	baseline	0.143	0.340	

† Two-tailed p-values are provided in parentheses next to the standardized coefficients; bolded values indicate $p < 0.05$

†† The outcome variable is Compulsive Facebook Use

††† Effect sizes, f^2 , were calculated using the formula $[R^2(\text{current model}) - R^2(\text{baseline})] / [1 - R^2(\text{current model})]$.

Panel A: Moderation of the social pressure self-efficacy effect



Panel A: Moderation of the peer increase in activity effect

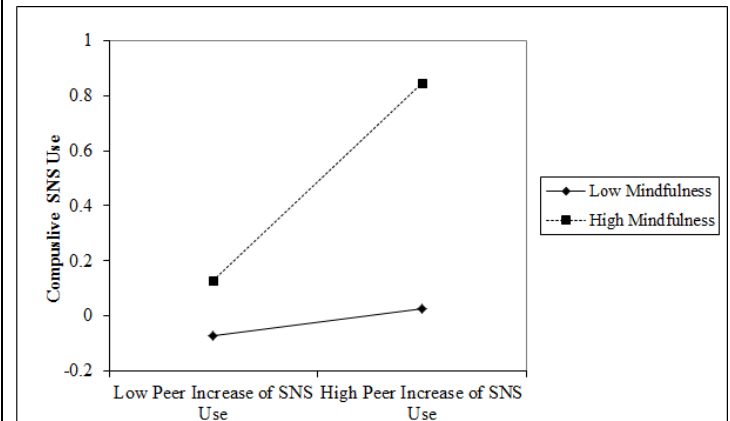


Figure 1. Interaction Plots

The regression models support our assertions and demonstrate that (1) social pressure self-efficacy reduces compulsive use of SNS, and (2) perceived increased activity by peers increases compulsive SNS use. They further demonstrate, as corroborated in the interaction plots, that mindfulness accentuates these social-related effects. Specifically, (3) mindfulness increases the ability of social pressure self-efficacy to reduce compulsive use of SNS, but also (4) increases one's sensitivity and attention to observed peer behaviors. The logistic regression model suggests that SNS experience and social pressure self-efficacy significantly reduce the likelihood of meeting presumed rudimentary compulsiveness criteria. Mindfulness did not influence the likelihood of this classification.

As an additional supplementary analysis, the attributes of the presumed to be compulsive and non-compulsive user groups were compared using multivariate analysis of variance. The results indicated that the compulsive group did not significantly differ from the non-compulsive group in terms of age, contacts and Facebook experience (Pillai's Trace =0.22, $F_{3,150}=1.148$, $p<0.332$). However, females were more dominant in the compulsive group (10 out of 17, 58.8%) compared to the non-compulsive group (55 out of 138, 39.9%), and this difference was significant at $p<0.056$ (Pillai's Trace =0.049, $F_{3,150}=2.581$).

4. Discussion

This study shows that peer-influence related factors (i.e., social pressure self-efficacy and peer SNS use increase) can contribute to the possible etiology of compulsive SNS use, and more broadly possibly to the family of Internet-related addictions. Specifically, consistent with social identity theory, models of peer contagion, and the established roles of peer behavior in various addiction contexts, the model demonstrated that observed peer increase in SNS activity is positively associated with obligatory use of the SNS. This provides support to H1. Consistent with cognitive and neuroscience-based models of compulsive behaviors emphasizing the role of inhibition abilities in preventing compulsive behaviors, H2 was supported by showing that social pressure self-efficacy is negatively associated with compulsive SNS use. In line with the role of mindfulness in enabling and motivating inhibition, the findings show that

social pressure self-efficacy is influential only when mindfulness is high. Hence, H3a was supported. Lastly, in accordance with the role of mindfulness in promoting attention to external cues and risks and motivating social compliance, the findings demonstrate that mindfulness augments the effect of peer increase in SNS use on compulsive use of SNS. This lent support to H3b. The model explained almost 30% of the variation in compulsive SNS use. Focusing on preliminary compulsive SNS use classification, we show that Facebook experience and one's ability to fend-off social pressures reduce the likelihood of meeting presumed compulsive SNS use criteria. The data further demonstrate that women are more at-risk compared to men as they had stronger presences in the "compulsive user" group compared to men. These findings have important implications.

First, the findings extend the compulsive and problematic Internet use behavior literatures by illuminating the possible roles of important peer-influence related factors in compulsive SNS use etiology. Given the social nature of many Internet applications, including SNS multiplayer videogames etc., it was surprising to see that social factors have not received much direct attention in prior research, albeit such factors have been alluded to in conceptual models of compulsive and addictive online behaviors (Brand et al., 2016; Davis, 2001). This study partially bridges this gap and points to two factors that relate to one's social interactions. The first factor relates to observed peer behavior, which is a key feature of social media sites (Leonardi, 2015; Turel, 2015), and can motivate compulsive use. The second factor is social-pressure self-efficacy, which relates to one's SNS-specific inhibition abilities and can help reducing compulsive SNS use. Because these factors explained 16% of the variance in compulsive SNS use, there can be many other factors that relate to one's social environment and can influence compulsive SNS use. These should be examined in future research. Moreover, the logistic regression model showed that Facebook experience reduces the presumed risk of compulsive use. This demonstrates that there is a possible learning process through which most SNS users learn how to control and manage their SNS use and that this process takes time. Novice SNS users are therefore more at risk to succumb to social pressures and develop compulsive use. This finding also suggests that compulsive SNS use is possibly transient, and

like cases of substance addiction, many people can overcome their SNS addiction and/or compulsive use without treatment (Platt, 1986). This may be especially possible in the case of SNS, since compulsive use of such sites does not involve neurotoxicity (like in the case of substances). As such, the prefrontal brain regions of compulsive SNS users (i.e., regions that are involved in inhibition and reflection) are typically intact, both structurally (He et al., 2017) and from an activation standpoint (Turel et al., 2014), and this makes self-management of behavior changes more possible. This idea, though, merits further research.

Similarly, our findings extend and contribute to the mindfulness literature. First, consistent with the role of mindfulness in many addiction and compulsive behaviors contexts, we show that it plays an important possible role in compulsive SNS use etiology. Mindfulness added 12.3% to the variance explained by the abovementioned peer-influence factors. We hence extend the mindfulness literature to the SNS context and integrate these two, typically, disjointed, streams of research. Second, the findings demonstrated that mindfulness accentuates the effect of environment observations and control abilities on compulsive SNS use. Hence, it is a potentially important overlooked target variable for interventions in cases of compulsive SNS use. Lastly, the literature on mindfulness in the context of addictions and compulsive behaviors largely emphasizes the positive effects of mindfulness and how it should be increased via treatment programs (Black, 2014; Vidrine et al., 2016). Our study demonstrates that in the case of SNS, mindfulness can be a double-edged sword that can increase compulsive use through one mechanism, but can reduce it via another. This idea is innovative, and merits further research in other compulsive behavior contexts. It implies that caution should be exercised when recommending increasing one's mindfulness as a means to reduce SNS compulsions.

From a practical standpoint, our findings point to several possible intervention targets that should be examined in future research. Because the findings suggest that increase in peer behavior can influence one's compulsive behavior, providing users with less visibility regarding peer behavior (e.g., delaying all notification to a pre-specified time, e.g., once a day; or allowing limited access to peer activity) can help. Our findings also show that peer pressure self-efficacy is an important inhibitor of compulsive SNS use.

Future research may consider ways to improve this individual-difference variable. For example, inhibition abilities may be improved via cognitive behavioral therapy (Butler, Chapman, Forman, & Beck, 2006), and ways to apply it to compulsive SNS use should be devised in future research.

Several limitations of this study that point to future research should be acknowledged. First, the generalizability of the findings can be extended with additional samples of users who reside in different countries and who use various technologies. Second, employing experimental and/or longitudinal designs can improve causality claims. Third, we focused on a single, but presumably salient and important dimension of mindfulness. Future research can extend our findings to other dimensions of mindfulness. For instance, the non-reactivity facet can be important in compulsive behavior etiology in the presence of disturbing thoughts and negatively valenced emotions. Fourth, given the existing body of work on the etiology of compulsive and addictive online behaviors, future research may extend our socially-focused model and integrate it with more predictors. Lastly, the viability, definition and prevalence of the concepts of compulsive use of the Internet and Internet addiction are still debated in the literature. DSM-5 just alludes to the potential existence of Internet Gaming Disorder, but provides no conclusive judgment on this concept. Future research should consider progress in this debate and adjust terminology and measurement accordingly.

5. Conclusions

Compulsive use of SNS is a growing concern for individuals and societies, as modern technologies are better designed for eliciting frequent obligatory use, compared to older technologies (Eyal & Hoover, 2014). The social aspect of some of these technologies (social media sites and massively multiplayer games, for example) is immense. Yet, it has not been thoroughly considered as a possible etiological factor in the quest for understating compulsive use of technologies. In this study we demonstrate that social pressure self-efficacy and observed peer increase in SNS use can explain, in part, compulsive SNS use, and that these effects are accentuated by mindfulness, which serves as a double-edged sword. We call

for future research to further examine peer-related influences and mindfulness impacts on various problematic technology use instances, and to develop interventions based on these findings.

References

- Aladwani, A. M., & Almarzouq, M. (2016). Understanding compulsive social media use: The premise of complementing self-conceptions mismatch with technology. *Computers in Human Behavior*, 60, 575-581. doi: <http://doi.org/10.1016/j.chb.2016.02.098>
- Baer, R. A., Smith, G. T., Hopkins, J., Krietemeyer, J., & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment*, 13(1), 27-45.
- Balogh, K. N., Mayes, L. C., & Potenza, M. N. (2013). Risk-taking and decision-making in youth: Relationships to addiction vulnerability. *Journal of Behavioral Addictions*, 2(1), 1-9. doi: 10.1556/jba.2.2013.1.1
- Bechara, A. (2005). Decision-making, impulse control, and loss of willpower to resist drugs: A neurocognitive perspective. *Nature Neuroscience*, 8(11), 1458-1463.
- Black, D. S. (2014). Mindfulness-Based Interventions: An Antidote to Suffering in the Context of Substance Use, Misuse, and Addiction. *Substance Use & Misuse*, 49(5), 487-491. doi: 10.3109/10826084.2014.860749
- Brand, M., Young, K. S., & Laier, C. (2014). Prefrontal control and Internet addiction: a theoretical model and review of neuropsychological and neuroimaging findings. *Frontiers in Human Neuroscience*, 8. doi: 10.3389/fnhum.2014.00375
- Brand, M., Young, K. S., Laier, C., Wölfling, K., & Potenza, M. N. (2016). Integrating psychological and neurobiological considerations regarding the development and maintenance of specific Internet-use disorders: An Interaction of Person-Affect-Cognition-Execution (I-PACE) model. *Neuroscience & Biobehavioral Reviews*, 71, 252-266. doi: <http://dx.doi.org/10.1016/j.neubiorev.2016.08.033>
- Brewer, J. A., Elwafi, H. M., & Davis, J. H. (2013). Craving to Quit: Psychological Models and Neurobiological Mechanisms of Mindfulness Training as Treatment for Addictions. *Psychology of Addictive Behaviors*, 27(2), 366-379. doi: 10.1037/a0028490
- Brown, K. W., Goodman, R. J., & Inzlicht, M. (2013). Dispositional mindfulness and the attenuation of neural responses to emotional stimuli. *Social Cognitive and Affective Neuroscience*, 8(1), 93-99. doi: 10.1093/scan/nss004
- Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: mindfulness and its role in psychological well-being. *Journal of personality and social psychology*, 84(4), 822-848.
- Butler, A. C., Chapman, J. E., Forman, E. M., & Beck, A. T. (2006). The empirical status of cognitive-behavioral therapy: A review of meta-analyses. *Clinical Psychology Review*, 26(1), 17-31. doi: 10.1016/j.cpr.2005.07.003
- Carlin, E. A., & Ahrens, A. H. (2014). The Effects of Mindfulness and Fear-Inducing Stimuli on Avoidance Behavior. *Mindfulness*, 5(3), 276-281. doi: 10.1007/s12671-012-0177-3
- Cheng, C., & Li, A. Y. L. (2014). Internet Addiction Prevalence and Quality of (Real) Life: A Meta-Analysis of 31 Nations Across Seven World Regions. *Cyberpsychology Behavior and Social Networking*, 17(12), 755-760. doi: 10.1089/cyber.2014.0317
- Choi, J. S., Park, S. M., Roh, M. S., Lee, J. Y., Park, C. B., Hwang, J. Y., . . . Jung, H. Y. (2014). Dysfunctional inhibitory control and impulsivity in Internet addiction. *Psychiatry Research*, 215(2), 424-428. doi: 10.1016/j.psychres.2013.12.001
- Chou, C., Condron, L., & Belland, J. C. (2005). A review of the research on Internet addiction. *Educational Psychology Review*, 17(4), 363-388. doi: 10.1007/s10648-005-8138-1

- Dalley, J. W., Everitt, B. J., & Robbins, T. W. (2011). Impulsivity, Compulsivity, and Top-Down Cognitive Control. *Neuron*, 69(4), 680-694. doi: 10.1016/j.neuron.2011.01.020
- Davis, R. A. (2001). A cognitive-behavioral model of pathological Internet use. *Computers in Human Behavior*, 17(2), 187-195.
- Dong, G. H., DeVito, E. E., Du, X. X., & Cui, Z. Y. (2012). Impaired inhibitory control in 'internet addiction disorder': A functional magnetic resonance imaging study. *Psychiatry Research-Neuroimaging*, 203(2-3), 153-158. doi: 10.1016/j.psychresns.2012.02.001
- Eyal, N., & Hoover, R. (2014). *Hooked: How to build habit forming products*. New York, NY: Portfolio Hardcover.
- Faber, R. J., & O'Guinn, T. C. (1992). A clinical screener for compulsive buying. *Journal of Consumer Research*, 19(3), 459-469.
- Friese, M., Messner, C., & Schaffner, Y. (2012). Mindfulness meditation counteracts self-control depletion. *Consciousness and Cognition*, 21(2), 1016-1022. doi: 10.1016/j.concog.2012.01.008
- Gentile, D. (2009). Pathological Video-Game Use Among Youth Ages 8 to 18: A National Study. *Psychological Science*, 20(5), 594-602. doi: 10.1111/j.1467-9280.2009.02340.x
- Gregg, J. A., Callaghan, G. A., Hayes, S. C., & Glenn-Lawson, J. L. (2007). Improving diabetes self-management through acceptance, mindfulness, and values: A randomized controlled trial. *Journal of Consulting and Clinical Psychology*, 75(2), 336-343. doi: 10.1037/0022-006x.75.2.336
- Griffiths, M. D. (2012). Facebook addiction: Concerns, critics, and recommendations: A response to Andreassen and colleagues. *Psychological Reports*, 110(2), 518-520. doi: 10.2466/01.07.18.pr0.110.2.518-520
- Haug, S., Nunez, C. L., Becker, J., Gmel, G., & Schaub, M. P. (2014). Predictors of onset of cannabis and other drug use in male young adults: results from a longitudinal study. *Bmc Public Health*, 14. doi: 10.1186/1471-2458-14-1202
- He, Q., Turel, O., & Bechara, A. (2017). Brain anatomy alterations associated with Social Networking Site (SNS) addiction. *Scientific Reports*, 7, 45064. doi: 10.1038/srep45064
- <https://www.nature.com/articles/srep45064#supplementary-information>
- Heppner, W. L., Spears, C. A., Vidrine, J. I., & Wetter, D. W. (2015). Mindfulness and emotion regulation. In B. Ostafin, M. Robinson & B. Meier (Eds.), *Handbook of mindfulness and self-regulation* (pp. 107-120). New York, NY: Springer.
- Hogg, M. A. (1996). Group Structure and Social Identity. In W. P. Robinson (Ed.), *Social Groups and Identities: Developing the Legacy of Henri Tajfel* (pp. 65-94). UK: Butterworth-Heinemann.
- Hong, F.-Y., Huang, D.-H., Lin, H.-Y., & Chiu, S.-L. (2014). Analysis of the psychological traits, Facebook usage, and Facebook addiction model of Taiwanese university students. *Telematics and Informatics*, 31(4), 597-606.
- Hsu, S. H., Grow, J., & Marlatt, G. A. (2008). Mindfulness and Addiction. In M. Galanter & L. A. Kaskutas (Eds.), *Research on Alcoholics Anonymous and Spirituality in Addiction Recovery* (Vol. 18, pp. 229-250).
- Hur, M. H. (2006). Demographic, habitual, and socioeconomic determinants of Internet addiction disorder: An empirical study of Korean teenagers. *Cyberpsychology & Behavior*, 9(5), 514-525.
- Jetten, J., Spears, R., & Manstead, A. S. R. (1996). Intergroup norms and intergroup discrimination: Distinctive self-categorization and social identity effects. *Journal of Personality and Social Psychology*, 71(6), 1222-1233.
- Jha, A. P., Krompinger, J., & Baime, M. J. (2007). Mindfulness training modifies subsystems of attention. *Cognitive Affective & Behavioral Neuroscience*, 7(2), 109-119. doi: 10.3758/cabn.7.2.109
- Kuss, D. J., Griffiths, M. D., & Binder, J. F. (2013). Internet addiction in students: Prevalence and risk factors. *Computers in Human Behavior*, 29(3), 959-966. doi: <http://dx.doi.org/10.1016/j.chb.2012.12.024>

- Lee, Y.-K., Chang, C.-T., Lin, Y., & Cheng, Z.-H. (2014). The dark side of smartphone usage: Psychological traits, compulsive behavior and technostress. *Computers in Human Behavior*, 31, 373-383. doi: <http://doi.org/10.1016/j.chb.2013.10.047>
- Leonardi, P. M. (2015). Ambient awareness and knowledge acquisition: using social media to learn "Who knows what" and "Who knows whom". *Mis Quarterly*, 39(4), 747-762.
- Lutz, J., Bruhl, A. B., Doerig, N., Scheerer, H., Achermann, R., Weibel, A., . . . Herwig, U. (2016). Altered processing of self-related emotional stimuli in mindfulness meditators. *Neuroimage*, 124, 958-967. doi: 10.1016/j.neuroimage.2015.09.057
- McConnell, P. A., & Froeliger, B. (2015). Mindfulness, Mechanisms and Meaning: Perspectives From the Cognitive Neuroscience of Addiction. *Psychological Inquiry*, 26(4), 349-357. doi: 10.1080/1047840x.2015.1076701
- McHugh, L., Simpson, A., & Reed, P. (2010). Mindfulness as a potential intervention for stimulus over-selectivity in older adults. *Research in Developmental Disabilities*, 31(1), 178-184. doi: 10.1016/j.ridd.2009.08.009
- McIntyre, E., Wiener, K. K. K., & Saliba, A. J. (2015). Compulsive Internet use and relations between social connectedness, and introversion. *Computers in Human Behavior*, 48, 569-574. doi: <http://doi.org/10.1016/j.chb.2015.02.021>
- Muusses, L. D., Finkenauer, C., Kerkhof, P., & Billede, C. J. (2014). A longitudinal study of the association between Compulsive Internet use and wellbeing. *Computers in Human Behavior*, 36, 21-28. doi: <http://doi.org/10.1016/j.chb.2014.03.035>
- Oei, T. P. S., & Burrow, T. (2000). Alcohol expectancy and drinking refusal self-efficacy: A test of specificity theory. *Addictive Behaviors*, 25(4), 499-507. doi: 10.1016/s0306-4603(99)00044-1
- Platt, J. J. (1986). *Heroin Addiction: Theory, Research, and Treatment* (2nd ed.). Malabar, FL: Robert E. Kreiger.
- Quñones-García, C., & Korak-Kakabadse, N. (2014). Compulsive internet use in adults: A study of prevalence and drivers within the current economic climate in the UK. *Computers in Human Behavior*, 30, 171-180. doi: <http://doi.org/10.1016/j.chb.2013.08.004>
- Quinones, C., & Kakabadse, N. K. (2015). Self-concept clarity, social support, and compulsive Internet use: A study of the US and the UAE. *Computers in Human Behavior*, 44, 347-356. doi: <http://doi.org/10.1016/j.chb.2014.11.019>
- Rumpf, H. J., Besser, B., Bischof, A., Meerkerk, G. J., Higuchi, S., & Bischof, G. (2017). Internet-related disorders: Development of the Short Compulsive Internet Use Scale (Short CIUS). *Journal of Behavioral Addictions*, 6, 47-47.
- Russell, B. S., Trudeau, J. J., & Leland, A. J. (2015). Social Influence on Adolescent Polysubstance Use: The Escalation to Opioid Use. *Substance Use & Misuse*, 50(10), 1325-1331. doi: 10.3109/10826084.2015.1013128
- Sanger, K. L., & Dorjee, D. (2016). Mindfulness training with adolescents enhances metacognition and the inhibition of irrelevant stimuli: Evidence from event-related brain potentials. *Trends in Neuroscience and Education*, 5(1), 1-11. doi: 10.1016/j.tine.2016.01.001
- Serenko, A., & Turel, O. (2015). Integrating technology addiction and use: An empirical investigation of Facebook users. *AIS Transactions on Replication Research*, Forthcoming.
- Tajfel, H. (1978). Social categorization, social identity, and social comparison. In H. Tajfel (Ed.), *Differentiation between Social Groups* (pp. 61-76). UK: Academic Press.
- Tajfel, H., & Turner, J. C. (1986). The social identity theory of inter-group behavior. In S. Worchel & W. Austin (Eds.), *Psychology of Intergroup Relations*. Chigago, IL, USA: Nelson-Hall.
- Turel, O. (2015). An empirical examination of the "vicious cycle" of Facebook addiction. *Journal of Computer Information Systems*, 55(3), 83-91.
- Turel, O., & Bechara, A. (2016a). Social Networking Site use while driving: ADHD and the mediating roles of stress, self-esteem and craving. *Frontiers in Psychology*, 7, 1-10.

- Turel, O., & Bechara, A. (2016b). A Triadic Reflective-Impulsive-Interoceptive Awareness Model of General and Impulsive Information System Use: Behavioral Tests of Neuro-Cognitive Theory. *Frontiers in Psychology*, 7. doi: 10.3389/fpsyg.2016.00601
- Turel, O., He, Q., Xue, G., Xiao, L., & Bechara, A. (2014). Examination of neural systems sub-serving Facebook "addiction". *Psychological Reports*, 115(3), 675-695. doi: 10.2466/18.PR0.115c31z8
- Turel, O., & Qahri-Saremi, H. (2016). Problematic Use of Social Networking Sites: Antecedents and Consequence from a Dual System Theory Perspective. *Journal of Management Information Systems*, 33(4), 1087-1116.
- Turel, O., Romashkin, A., & Morrison, K. M. (2016). Health Outcomes of Information System Use Lifestyles among Adolescents: Videogame Addiction, Sleep Curtailment and Cardio-Metabolic Deficiencies. *PLoS ONE*, 11(5), e0154764. doi: 10.1371/journal.pone.0154764
- Vidrine, J. I., Spears, C. A., Heppner, W. L., Reitzel, L. R., Marcus, M. T., Cinciripini, P. M., . . . Wetter, D. W. (2016). Efficacy of Mindfulness-Based Addiction Treatment (MBAT) for Smoking Cessation and Lapse Recovery: A Randomized Clinical Trial. *Journal of Consulting and Clinical Psychology*, 84(9), 824-838. doi: 10.1037/ccp0000117
- Vink, J. M. (2016). Genetics of Addiction: Future Focus on Gene x Environment Interaction? *Journal of Studies on Alcohol and Drugs*, 77(5), 684-687.
- Weinstein, A. (2013). Internet and videogame addiction and the neurobiological basis of behavioral addictions. *Journal of Behavioral Addictions*, 2, 5-6.
- Weinstein, A., & Lejoyeux, M. (2010). Internet Addiction or Excessive Internet Use. *American Journal of Drug and Alcohol Abuse*, 36(5), 277-283. doi: 10.3109/00952990.2010.491880
- Weiss, F., Ciccocioppo, R., Parsons, L. H., Katner, S., Liu, X., Zorrilla, E. P., . . . Richter, R. R. (2001). Compulsive drug-seeking behavior and relapse - Neuroadaptation, stress, and conditioning factors. In V. QuinonesJenab (Ed.), *Biological Basis of Cocaine Addiction* (Vol. 937, pp. 1-26).
- Young, R. M., Hasking, P. A., Oei, T. P. S., & Loveday, W. (2007). Validation of the Drinking Refusal Self-Efficacy Questionnaire - Revised in an Adolescent Sample (DRSEQ-RA). *Addictive Behaviors*, 32(4), 862-868. doi: 10.1016/j.addbeh.2006.07.001
- Young, R. M., & Oei, T. P. S. (1996). *Drinking expectancy profile: Test manual* (Vol. 13): Behavior Research and Therapy Centre, University of Queensland.