



Cognitive biases and excessive use of social media: The facebook implicit associations test (FIAT)



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HIGHLIGHTS

- Cognitive biases can drive excessive behaviors.
- Little is known about such biases in the context of excessive social media use.
- We present here the development of the Facebook Implicit Association Test (FIAT)
- Implicit attitude was positively associated with excessive social media use scores.
- Implicit attitude was sheltered against social desirability bias.
- Implications for studying, detecting and treating excessive use are discussed.

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ABSTRACT

Many theoretical accounts of addictive behaviors, including models of Internet use disorders, implicate cognitive biases in the formation and maintenance of excessive behaviors. Yet, little empirical evidence regarding the role of such biases, including implicit attitude, in the development and maintenance of excessive use of social media exists. We seek to bridge this gap in this study. To this end, we present the development of the Facebook Implicit Association Test (FIAT) and employ it in a sample of 220 Facebook users. The results (1) confirm the validity of the concept of implicit attitude and its measure in the context of social media, (2) demonstrate that implicit attitude is significantly positively associated with excessive use scores, in a magnitude similar to that observed for associations with substance use, and (3) show that implicit attitude is sheltered against social desirability bias, unlike self-reported and explicit measures, such as excessive use. Overall, this study builds theoretical and methodological foundations for further inquiries into the role of implicit attitude in research on the excessive use of social media.

1. Introduction

The use of social media sites is common and can benefit many individuals (Brevers & Turel, 2019; Turel & Serenko, 2012). However, the rewarding nature of such use, and especially the variability in the schedule of rewards (e.g., “likes”), can lead to repeated, difficult to control use of social media sites (Turel, Cavagnaro, & Meshi, 2018). In that sense, social media user behavior can resemble the pigeons’ compulsive and difficult to extinguish behavior in Skinner’s experiments, when they were rewarded on a sporadic schedule (Ferster & Skinner, 1957); through implicit learning, they gradually transition from affective and cognitive responses to triggers to automatic cue-reactivity and craving states (Brand et al., 2019). Indeed, the excessive use of social

media can manifest itself in typical behavioral addiction symptoms (Osatuyi & Turel, 2018; Turel, Poppa, & Gil-Or, 2018), which are consistent with the symptoms that DSM-5 articulates for Internet Gaming Disorder (the symptoms include salience, tolerance, mood modification, conflict, withdrawal, and relapse, see APA, 2013). Consequently, we view the excessive use of social media as a state of maladaptive dependence on the use of a social media site that generates typical behavioral addiction symptoms (Turel, Serenko, & Giles, 2011).

While excessive social media use has not been formally recognized as an addiction disorder by the American Psychiatric Association and the World Health Organization (Chen et al., 2019; Király et al., 2017; Pontes, Király, Demetrovics, & Griffiths, 2014); and the convention for describing it has not yet been agreed upon (Carbonell & Panova, 2017;

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Montag et al., 2018; Zendle & Bowden-Jones, 2019), a plethora of evidence suggests that some social media users have poor control over their use patterns, which can disrupt normal functioning in school, family, and workplace domains (Delaney, Stein, & Gruber, 2018; Meshi, Elizarova, Bender, & Verdejo-Garcia, 2019; Turel, He, Brevers, & Bechara, 2018). We therefore conceive the excessive use of social media as a possible public health issue that requires more research and possible intervention.

The substance and behavioral addiction literatures offer a variety of explanations (“addiction theories”) regarding the possible emergence and maintenance of addictive behaviors, including excessive social media use. These explanations touch upon a broad set of cognitive-emotional deficits in terms of pleasure seeking and withdrawal-pain avoidance, the habituation, automaticity and lack of prefrontal oversight of the addictive behavior, incentive sensitization, and cognitive dysregulation (Bechara et al., 2019). Such theories suggest that deficits in terms of reward expectation, processing, and inhibition, all of which are rooted in hyper- and/or hypo-activity of the dual system components that govern decision making and impulse control, can explain addictive behaviors (Bechara, Noel, & Crone, 2006; Bickel et al., 2007; Everitt et al., 2008). This view has been extended to the case of social media, conceptually, in summarizing frameworks (Brand et al., 2019; Brand, Young, Laier, Wöfling, & Potenza, 2016), in behavioral studies (Brand, Laier, & Young, 2014; Turel & Qahri-Saremi, 2016), and in neuroimaging studies of the dual-system (He, Turel, Brevers, & Bechara, 2017).

One important cognitive bias that underlies addictive behaviors is implicit associations. Implicit associations represent stable subconscious cognitive links in the brain (Greenwald, McGhee, & Schwartz, 1998). They are clinically significant, because after the repetition of a behavior, trigger-behavior-reward associations are formed, and these associations can be automatically and with little cognitive effort retrieved upon exposure to the external (e.g., seeing the subject related to the implicit association) or internal (e.g., recalling the subject related to the implicit association) cues (Greenwald, Poehlman, Uhlmann, & Banaji, 2009). Consequently, implicit associations can underlie many phenomena explained in the abovementioned theories of addiction (Brand et al., 2016). For example, they can represent cognitive-emotional deficits in pleasure seeking (associating rewards with social media use), which would create motivation to repeatedly engage in addictive behaviors, and support an opponent-process of addiction formation and maintenance (Solomon & Corbit, 1974). Similarly, they can underlie the habituation and automatic execution of technology use behaviors by creating a “attitude-behavior highway” (Serenko & Turel, 2019) and bypassing reflective processes and the development of conscious intentions; and as such, support the stimuli-response habit theories of addiction formation and maintenance (Smith & Graybiel, 2016).

Indeed, meta-analyses indicate that implicit associations relate to substance use (Rooke, Hine, & Thorsteinsson, 2008), and individual studies link implicit associations with problematic technology use patterns, such as addictive use of videogames (Yen et al., 2011), smartphones, the Internet (Roh et al., 2018), and online pornography (Snagowski, Wegmann, Pekal, Laier, & Brand, 2015). Implicit associations are therefore included in models that describe specific Internet use disorders (Brand et al., 2016). Nevertheless, the links between implicit associations and excessive social media use have not been empirically examined. It is important to validate such relationships for several reasons. First, establishing this association can provide some support for the applicability of the theories that underline addiction formation and maintenance (Bechara et al., 2019) to the case of social media, and inform this line of research. Second, they can provide support for specific aspects of models describing the formation and maintenance of disordered Internet use, such as the I-PACE model (Brand et al., 2016, 2019). Third, they can point to potential neural underpinnings of excessive social media use, because the neural correlates of implicit

associations in other addictive behaviors are known (Ames et al., 2013, 2014). Lastly, because implicit associations are typically not influenced by social pressures, they may provide a less biased indicator or marker (compared to self-reports) of excessive use; and can serve as targets for interventions in future research.

Implicit associations may exist in various forms, including implicit stereotypes (Ebert, Steffens, & Kroth, 2014), implicit self-concepts (Haines & Sumner, 2006), and implicit attitude (Cunningham, Preacher, & Banaji, 2001). Out of them, implicit attitude was selected as a focus of this study given the importance of attitudes, conscious or subconscious, in driving addictive behaviors (Huijding, de Jong, Wiers, & Verkooyen, 2005). Implicit attitude, in our context, is defined as a subconscious valenced evaluation of a social media site that is activated with little or no conscious effort in response to internal or external stimuli associated with this social media site (Serenko & Turel, 2019). Here, we seek to (1) present the development of the Facebook Implicit Association Test [FIAT]) to measure users’ implicit attitude, (2) test the link between implicit attitude toward a social media site and excessive use, and (3) examine whether the captured implicit attitude is relatively protected against social desirability, and whether this is the same or different for self-reported constructs.

Given that people’s urgency to act, often without thinking, is driven by strong implicit attitude (Ames et al., 2013, 2014), and that retrieving and acting upon this attitude is difficult to control (Frieze, Bargas-Avila, Hofmann, & Wiers, 2010; van Hemel-Ruiter, de Jong, & Wiers, 2011), it has been shown that implicit attitude can support addiction formation and maintenance (De Houwer, Crombez, Koster, & De Beul, 2004; Payne, McClernon, & Dobbins, 2007; Wiers & Stacy, 2006; Wiers, van Woerden, Smulders, & de Jong, 2002). We, therefore, hypothesize that the implicit attitude toward a social media site will be positively associated with the excessive use of this site. Given that this implicit attitude is largely beyond the conscious control of social media users, we expect that it will not be correlated with social desirability bias (individual-difference in trying to portray oneself in a way viewed positively by others). In contrast, because excessive use is a socially sensitive matter that tends to be under-reported (Turel et al., 2011), we expect self-reports of excessive use to be negatively correlated with social desirability bias.

2. Methods

2.1. Procedure

Data were collected in 2018 from American university students who met three inclusion criteria. They were: (1) over 18 years old, (2) Facebook users, and (3) Microsoft (MS) Excel users. Study procedures were approved by the Institutional Review Boards of the authors’ universities. Students were selected because they are familiar with and use both Facebook and MS Excel. MS Excel was selected because the administration of the FIAT requires two (target and non-target) categories. Excel is a good non-target (i.e., contrast) category in our context, because it is a productivity tool which is not associated with social media attributes (e.g., enjoyment and fun) and students generally develop a neutral attitude toward it. A course in MS Excel was a prerequisite for taking the course in which this study was conducted. Facebook was selected as the target social media site, because many students are likely to use Facebook very frequently and routinely (Turel & Qahri-Saremi, 2016, 2018). Students received course bonus points to incentivize participation. They completed two tasks in a randomized order: (1) the FIAT, and (2) an online survey that captured excessive Facebook use, descriptive and control variables. Specifically, after signing an informed consent, participants were randomly assigned to one of eight groups, which varied by the order of tasks (two sequences of survey/FIAT vs. FIAT/survey) and the order of blocks within the FIAT (four FIAT versions; see [Supplementary Materials](#)). Thus, possible task order and FIAT design effects were eliminated. The experiment was preceded by a

general description (i.e., without revealing the workings and purpose) and a technical demonstration of the IAT. The respondents completed the tasks in private, isolated spaces at a university's computer lab in small groups; distractions such as phones were forbidden.

2.2. Sample

The sample included 220 responses from 270 invitees (81.5% response rate, $M_{\text{age}} = 22.9 \pm SD = 4.6$, Range = 18–55). They had averages of $5.9 \pm SD = 2.1$ years of experience with Facebook (Range = 0.5–12), $421 \pm SD = 347.1$ Facebook friends (Range = 5–1,575), and $5.9 \pm SD = 3.8$ years of experience with Excel (Range = 0.5–20).

2.3. Measures

Implicit attitude toward Facebook was captured by employing the *FreeIAT* software tool (Meade, 2009), which has been shown to work well across studies and situations (Wright & Meade, 2012). This tool generated two *D* statistics measures that we used as two indicators of implicit attitude: 1) based on the first half of trials within each block, and 2) based on the second half of trials within each block. The use of two indicators of implicit attitude is required for testing the construct's reliability. The two-item implicit attitude construct was reliable (Cronbach's alpha = 0.71, Composite Reliability = 0.72, Average Variance Extracted = 0.75). An indicator score that reflects implicit attitude toward Facebook was therefore created by averaging the items. These implicit attitude measures were calculated as per the original formula and instructions (Greenwald, Nosek, & Banaji, 2003); therefore, no further transformation of the implicit attitude measures was needed. Example screens are provided in Fig. 1. The employed FIAT and its development are described in the Supplementary Materials file.

Excessive use of Facebook was captured with the nine-item technology-addiction scale by Charlton and Danforth (2007), which have been adapted to the social media use context (Serenko & Turel, 2015). These items tap into the core behavioral addiction symptoms as applied to social media use. They are largely consistent with the Internet Gaming Disorder symptoms as described in DSM-5 (Koo, Han, Park, & Kwon, 2017) and Gaming Disorder in ICD-11 (WHO, 2018). The scale was reliable (Cronbach's alpha = 0.92, Composite Reliability = 0.92, Average Variance Extracted = 0.75). An indicator score that reflects the excessiveness of social media use was created by averaging the items (see the Supplementary Materials file).

For descriptive and control purposes, we also captured sex (Male = 0), age band (1 = "18–19" to 5 = "26 and older"), years of Facebook use band (1 = "0.5–1" to 5 = "at least 8"), years of MS Excel use band (1 = "0.5–1" to 5 = "at least 8"), and number of Facebook friends band (1 = "5–100" to 8 = "over 701"). Last, we measured social desirability bias with the Marlowe-Crowne scale (Reynolds, 1982). This scale includes 13 brief statements and the respondents indicate whether these statements apply to themselves (true or false). The social desirability bias score, ranging from 1 to 2, was calculated by following the procedure of Crowne and Marlowe (1960), and the higher one's score, the stronger this person's social desirability bias. Overall, our sample was consistent in terms of the mean and distribution of implicit attitude (Serenko & Turel, 2019), excessive use (Serenko & Turel, 2015), and social desirability scores (Turel et al., 2011) with other comparable samples.

2.4. Analytical approach

All analyses were performed in SPSS 26. As a preliminary step, possible task-order and FIAT version-based differences were examined. A Multivariate Analysis of Variance (MANOVA) model was fit to the data with these two variables as fixed factors, the FIAT and excessive use indicators as dependent variables, and the control variables as

covariates. After ruling out order effects, we used correlation analysis to examine zero-order correlation and examine potential confounding effects of the control variables. Next, we performed partial correlation analysis to examine the association between implicit attitude and excessive use after accounting for the variance explained by the control variables. For this analysis, we used bootstrapping with 1000 resamples such that we produced a bias-corrected estimate, a 95% confidence interval, and avoided distributional assumptions (Mooney & Duval, 1993). The Kolmogorov-Smirnov test indicated that all variables were normally distributed at the 1% significance level (i.e., the test produced no statistically significant *p*-values at this level of significance).

3. Results

The MANOVA model showed that the order of tasks (Pillai's Trace = 0.05, *p* = 0.48), FIAT version (Pillai's Trace = 0.20, *p* = 0.17) and their interaction (Pillai's Trace = 0.22, *p* = 0.11) did not have significant omnibus effects on the model's items. Hence, it was concluded that the dataset could be analyzed as a whole. Next, a correlation matrix was generated (see Table 1; it also includes descriptive statistics).

Because implicit attitude and excessive use were significantly correlated, but were also associated with several controls, we performed a partial correlation analysis. It revealed a partial correlation of 0.20 (*p* = 0.003) between implicit attitude and excessive use [bias-corrected 95% confidence interval = (0.07; 0.32)], after accounting for associations with age, sex, Facebook and Excel experience, the number of Facebook friends, and social desirability bias. The partial correlation between implicit attitude and social desirability bias was non-significant [*r* = -0.09; *p* = 0.173, bias-corrected 95% confidence interval = (-0.22; 0.04)].

4. Discussion

This study sought to emphasize the need for survey-experimental research on excessive online behaviors to go beyond explicit processes, and to measure implicit attitude, which exists beyond user awareness. Implicit attitude is a common biasing factor that can inform the development and maintenance of excessive online behaviors, and it should be included in addiction frameworks. The importance of implicit attitude stems from its ability to influence the intensity of cue reactivity, craving, and attention (Brand et al., 2016), all of which are essential ingredients in theories describing the development and maintenance of addictive behaviors (Bechara et al., 2019). This study also aimed at introducing an application of the implicit association test to capture implicit attitude toward social media, "specifically Facebook," and to show that such concepts and approaches can inform research about this phenomenon. The motivation for such endeavors was built upon the studies showing that implicit attitude and addictive behaviors are associated (Dislich, Zinkernagel, Ortner, & Schmitt, 2015; Rooke et al., 2008), as well as on the general notion that a large proportion of human decision-making takes place beyond conscious awareness (Joseph, 1992). Unfortunately, the concept of implicit attitude has received insufficient attention in empirical research on the excessive use of social media, and this can limit the development of this research field.

Our findings point to several important theoretical and methodological implications. First, the observed zero-order and partial correlations between implicit attitude and excessive use demonstrate the relevance of implicit attitude for models of excessive online behavior development and maintenance. For example, in the I-PACE model, cognitive biases, such as having strong implicit attitude toward Facebook, are informed and developed through the gratification social media sites provide. Implicit attitude can also bias affective and cognitive responses to cues associated with the website, craving to use the website, urges for mood regulation by using the website, and

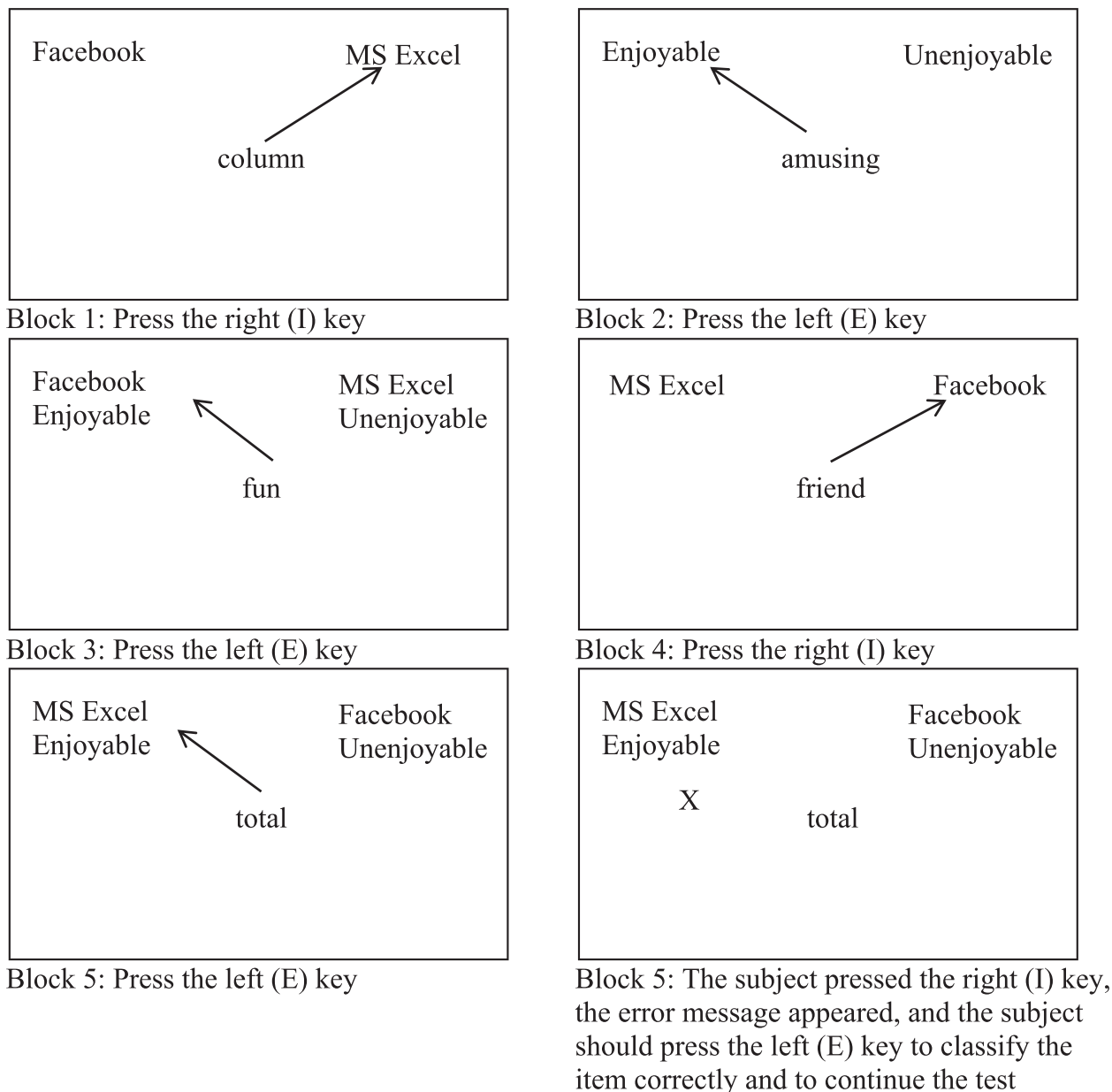


Fig. 1. Example Screens – The Facebook Implicit Association Test (FIAT; Version 1).

Table 1
Descriptive statistics and correlations.[†]

	Mean	St Dev.	Range	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Implicit Attitude	0.35	0.27	-0.40; 1.012	-						
(2) Excessive Use	2.25	1.17	1.00; 5.33	0.22**	-					
(3) Age	22.9	4.60	18; 55	-0.13*	0.02	-				
(4) Sex	53.2% male	n/a	0.03	-0.05	-0.02	-				
(5) Years of Facebook Experience	5.9	2.10	0.50; 12.00	0.12	0.02	-0.01	0.09	-		
(6) Number of Facebook Friends	421	347.10	5; 1,575	0.18**	0.14*	-0.24**	0.06	0.22**	-	
(7) Years of MS Excel Experience	5.9	3.80	0.50; 20.00	-0.15*	-0.01	0.51**	0.09	0.15*	-0.08	-
(8) Social Desirability Bias	1.51	0.20	1.00; 2.00	-0.09	-0.14*	0.03	-0.02	-0.02	-0.22**	-0.04

[†]* $p < 0.05$; ** $p < 0.01$.

attachment to the website (Brand et al., 2016, 2019). Thus, we call for future research to further embed implicit attitudes in models explaining excessive online behaviors.

Second, our findings point to an important similarity between excessive social media use, substance use, and gambling. Specifically, in

dual- and triple-system models of addictive behaviors (reward-inhibition-interoceptive awareness, see, for example, Wood & Bechara, 2014), implicit attitude reflects the sensitization of the reward system. Thus, the generation of implicit attitude is a necessary condition for developing and maintaining addictive behaviors (Ames et al., 2013, 2014;

Stacy & Wiers, 2010). Our findings show that implicit attitude is associated with excessive social media use, which is consistent with prior research on other addictive behaviors (Lindgren et al., 2015). Moreover, a meta-analysis of substance use association with implicit attitude showed an average correlation of 0.27 with a 95% confidence interval of 0.21 to 0.31 (Rooke et al., 2008). Our results point to a similar, yet slightly lower correlation (0.20) with a large overlap between confidence intervals (ours was 0.07 to 0.32). Our findings are also in line with neuroimaging studies that implicate the reward system in driving excessive use of social media (He, Turel, & Bechara, 2017; He, Turel, & Bechara, 2017, 2018; Turel, He, Xue, Xiao, & Bechara, 2014), and its association with implicit attitude (Ames et al., 2013, 2014). Therefore, we call for future research to integrate neuroimaging techniques with the IAT in the context of social media; this can further inform debates whether the excessive use of social media is similar to or different from established addictive disorders (Carbonell & Panova, 2017; Zendle & Bowden-Jones, 2019).

Third, one of the key advantages of the IAT is its relative shielding from social desirability bias (Crowne & Marlowe, 1960), which is particularly evident in contexts pertaining to the negative aspects of technology use (Turel et al., 2011). The present study confirmed that social desirability bias is negatively associated with self-reported excessive use symptoms and the number of Facebook friends (i.e., these are underreported by people with high social desirability tendencies). One explanation is that those who use Facebook excessively tend also to accumulate a large number of friends, but often want to conceal this fact from others. In contrast, implicit attitude was not associated with social desirability bias. This finding suggests that including implicit attitude in excessive online behavior research may help minimizing biases due to social desirability tendencies, and that caution should be exercised when interpreting self-reported data in the context of excessive social media use.

From a practical standpoint, our findings point to the feasibility of using the FIAT for measuring one out of many indicators of excessive use, which can be used for diagnosis and screening purposes. The fact that this measure is not biased by social-desirability, makes it a suitable candidate to be used in preliminary screening endeavors. Employing this measure in conjunction with existing scales may provide a more comprehensive view of the levels of excessive online behaviors. Since implicit attitude is associated with the excessive use of social media, therapists may shift their prevention and treatment strategies onto the factors leading to the development of implicit attitude toward the addictive technology. For example, this study may serve as a basis for developing techniques for eliminating the automatic pairing of Facebook use with rewards, and by so doing, indirectly reducing excessive social media use. The findings may also inform public policy, as we start seeing attempts to regulate social media service providers (Act, 2019).

Several limitations of this study are noteworthy. First, it focused only on one social media site, one population (US young-adults), and one hedonic attitude dimension (enjoyment) because it is highly appropriate in the context of Facebook. However, other attitudinal dimensions may be salient in other contexts, and generalizability to other social media and populations should be established. Second, whereas the IAT is widely used, other approaches (e.g., neurophysiological techniques) may be employed for implicit attitude measurement. Last, previous research has demonstrated a relationship between depressive symptoms and both excessive social media use (Shensa et al., 2017) and IAT measurements (Gemar, Segal, Sagrati, & Kennedy, 2001). Because we did not capture depression in this study, our findings should be interpreted with caution and we call for future research to account for possible comorbid disorders effects.

5. Conclusion

This study demonstrated that implicit attitude is a valid and

important concept in excessive social media use research, and that it can (1) inform research and debates about this topic, and (2) help overcoming social-desirability biases that are inherent in self-reported measures. We hope that this study forms the foundation for future inquiries into implicit processes in social media users' minds and their role in shaping users' states, decisions, and behaviors.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.addbeh.2020.106328>.

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