

Are you keeping your Facebook passions and habit under control? A dual-system perspective on Facebook addiction-like symptoms

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ABSTRACT

After many years of techno-enthusiasm, public discourse has turned to the dark side of technology and notably the dysfunctional consequences (e.g., addiction-like symptoms) of excessive social media use. Recent research in this area draws on dual-system theory and demonstrates that while habit predicts use, it does not directly predict addiction-like symptoms. This is not surprising, since habit lacks valence and its measurement does not discriminate between desirable and undesirable use. To clarify the antecedents of addiction-like symptoms, this paper extends prior research by drawing on the dualistic theory of passions and argues that habit is a manifestation of harmonious and obsessive passions that are anchored in the user's identity. By applying structural equation modeling on survey responses from 225 U.S.-based users, we first replicate and confirm the main findings of prior studies and then proceed to show that harmonious and obsessive passion drive Facebook habit and use. Moreover, obsessive passion emerges as the exclusive driver of addiction-like Facebook symptoms while the restraining effect of self-control is mediated by the two passions, as well as habit and use. The main finding is that the dual-system explaining Facebook addiction-like symptoms comprises of obsessive passion as the direct driving force and self-control as the indirect preventative restraining force. Our analysis contributes to the debate about mitigating the negative effects of social media and opens up new questions for further research.

KEY WORDS

AND PHRASES: Addiction-like symptoms; dark side of IT; dual-system theory; habit; harmonious passion; Facebook; Facebook addiction; obsessive passion; self-control; social media

Users globally spent an estimated daily average of 144 minutes on social media in 2019 [20], with an average of 76 minutes [23] for the United States [18], of which 38 minutes [17] were on Facebook [19]. Several sources estimate that these figures did rise during the 2020–2021 pandemic [56]. As a consequence, there is broad public concern and scholarly research over the excessive use and the potentially negative consequences of social media and Facebook in particular [5, 57, 72, 73]. Among a variety of negative consequences, the literature emphasizes compulsive behavior and addiction-like symptoms, even though their nature, extent, veracity, and measurement remain a challenge [1, 32, 47].¹ While social media addiction is not a recognized disorder, excessive use of Facebook that uncontrollably disrupts other personal and social commitments is associated with addiction-like symptoms [89].

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Extant research has emphasized the role of habit in driving social media usage and of self-control in restraining usage and subduing addiction-like symptoms. In general, *habits* are defined as implicit associations between contextual cues and behavioral responses [108] (e.g., unreflectively opening the Facebook app in learned contexts), and *self-control* is defined as the voluntary regulation of behavior in pursuing deliberate goals [84] (e.g., the thoughtful control of when and for how long to use Facebook). A growing number of studies have adopted a dual-system perspective that models the antecedents of technology use and negative consequences as a tug-of-war between the (undesirable) reflexive learned habit, on one hand, and the (desirable) reflective self-control, on the other [63, 82, 90]. However, the measures of technology use and habit lack valence [109]; technology use does not make an explicit distinction between addictive and intensive but desirable use, while habits can be bad or good. This is consistent with the findings of an early study by Turel and Serenko [89], which emphasizes that habit per se is not necessarily negative or harmful. More recently, Soror et al. [82] confirm that although both habit and self-control influence usage, only self-control and usage have a significant influence on negative consequences. Similarly, Osatuyi and Turel [63] find that social media usage fully mediates the relationship between habit and addiction-like symptoms. Therefore, whereas self-control seems to have a clear role in restraining usage and subduing addiction-like symptoms, habit only indirectly drives negative consequences through technology use. In the absence of more definitive antecedents, the emergence and severity of addiction-like symptoms have so far been attributed to implicit unobservable elements in the context of use [63, 82]. This presents a gap in our theoretical understanding about the drivers of addiction-like symptoms. To address this gap, we identify a psychological process that is not valence-neutral in driving Facebook addiction-like symptoms. More specifically, we introduce the theory of harmonious and obsessive passion [97] into extant dual-system models of habit and self-control.

The dualistic theory of passions [94, 97] posits that passion for an activity—Facebook use, in this case—is the result of a psychological process of internalization, which makes the activity an integral part of the user's own identity [62, 97]. Thus, this theory offers an explanatory account of intensive personal engagement with an activity and makes the distinction between harmonious and obsessive passion, depending primarily on the extent to which the person exercises volitional control over their engagement [96, 97]. In particular, harmonious passion reflects a volitional engagement that is in harmony with other commitments, whereas obsessive passion reflects an uncontrollable dedication at the expense of other activities. Even though the theory of passions has been applied to a wide range of activities such as sports and online games, its application to social networks is limited but growing [48, 60, 62, 105].

To integrate the dualistic theory of passions with well-established dual-systems theories of habit and self-control, we note that whereas the theory of habit explains the emergence of default behaviors in response to contextual cues, and self-control explains the deliberate pursuit of intentional goals in contrast to habitual automaticity, passions operate at the deeper level of identity; the activities a person loves to engage in (i.e., is passionate about), in part, define the self [97, p. 757]. In this respect, Facebook is often prevalent in users' everyday lives and becomes for them a way of being [46], plays a role in the construction of identity [45, 61, 100], and is a venue for self-formation [74]. Therefore, Facebook is presented as a paradigmatic example of how the extended self is formed in the digital world [8]. For this reason, an integrated examination of harmonious and obsessive passions that

are rooted in identity, on one hand, alongside the well-established dual-system of habit and self-control, on the other, is expected to extend prior literature and shed more light on the emergence of addictive Facebook use.

This paper presents results of a survey of U.S. Facebook users in an attempt to answer the following research questions: (1) What is the role of passions in driving Facebook addiction-like symptoms? (2) How do passions relate to habit and self-control? (3) How well does an integrated model of passions, habit, and self-control explain Facebook use and its addiction-like symptoms? By examining these questions, this study makes the following contributions. First, it contributes to the literature on the negative consequences of social media with a specific focus on Facebook addiction-like symptoms, by distinguishing between desirable (harmonious) and maladaptive (obsessive) user engagement. Second, it contributes an integrated perspective showing the relative roles of self-control, habit, and passions in the use and addiction-like symptoms of Facebook. Third, it brings fresh insight to practitioners (notably social media companies and developers) and policymakers (e.g., regulators) seeking ways to understand and mitigate the undesirable consequences of excessive social media use and prevent addiction-like symptoms.

The paper is organized as follows: First, we present the theoretical background and research hypotheses of this study. These are followed by the methodology, results, implications, and limitations of this research.

Theory and Research Hypotheses

To develop our research model and hypotheses, in the following sections we first review relevant insights from the literature on Facebook addiction-like symptoms, habit, self-control, and passions.

Addiction-like Symptoms of Facebook Use

A growing number of studies attempt to explain the emergence of negative consequences in the use of consumer technologies and, more notably, the use of smartphones and social media [9, 38, 41, 91]. Various potential negative consequences have been examined, such as loss of privacy [27], techno-stress [85], cyberbullying [52], attention-deficit hyperactivity disorder [78], obsessive-compulsive disorder, anxiety, depression [6, 80], and others [93]. Among the diversity of approaches that capture the dimensions of this phenomenon [1, 32, 47], this paper focuses on the negative outcomes of excessive Facebook use, which may end up being deleterious on the user's other personal activities and social commitments; this is consistent with the definition of technology addiction by Turel and Serenko [89]. Even though social media addiction is not a recognized mental disorder [4] and although experts are weary of overpathologizing web, social media, and smartphone use [10, 42], it is widely recognized that even nonpathological forms of engagement can be problematic [82]. Specifically, social media users in general and Facebook users in particular seem to demonstrate symptoms traditionally associated with substance-related addictions [46]. Further, we build on the seminal work by Turel et al. [91] and Serenko and Turel [77], who find significant evidence of addictive symptoms in social network use and argue that different technologies are likely to be associated with different levels of such symptoms. Throughout

this paper, we refer to “addiction-like symptoms” as opposed to “addiction symptoms,” as there is no recognized social media disorder [92].

Facebook’s advertising-driven business model depends on sustained user engagement in the attention economy, and for this purpose, it presents variable psychological rewards in intermittent cycles, among other persuasive design techniques, to coax its users into frequent and repetitive use [53]. Specifically, the variety and continuous streaming of the instantly available content it presents often distracts users from their intended tasks and makes it difficult for them to avoid the habitual Facebook app checking [83, 87]. Finally, prior research has documented the hedonic character of Facebook use [2, 3], which may be implicated in the emergence of impulsive and obsessive use [89]. Among the variety of addiction-related symptoms, we focus on conflict [46, 98, 112]: when the user becomes unable to regulate their Facebook use, there are adverse effects (e.g., neglect) on other personal, professional, and social activities [72], with potential second-order consequences such as on affect or life satisfaction [11].

Habit

It is estimated that between 50 percent and 95 percent of all behavior is habitual [110]. For the most part, habits are desirable and beneficial ways of pursuing everyday goals reliably while economizing on cognitive resources and mitigating adverse conditions such as stress and distraction [64]. On the other hand, bad habits are also common and may emerge if goals pursued in the past are no longer valued, or if behavior yields short-term rewards to the detriment of long-term intentions, or if intended behaviors produce side-effects such as obsession or compulsion [64].

Based on the realization that technology use is not only the result of rational choice and conscious deliberation but also the result of automatic, unreflective habit unmediated by behavioral intention [26], habit has become a prominent factor in technology usage models [35, 43, 49, 68]. More specifically, habits are defined as implicit associations between contextual cues and behavioral responses that develop as representations in memory through repeated learning [108]. When such an association is made, the presence of a relevant cue leads to the automatic retrieval of the appropriate response stored in memory and follows with the impulse to act on it [34]. In our context, habitual Facebook use is the learned automaticity to check Facebook in response to associated contextual cues.

Contextual cues that may elicit habits, especially media habits, can be complex combinations of factors such as space, time, people, events, preceding actions, or emotions, which are similar or analogous to the original cue [75, 108]. Therefore, we may infer that the device that is always on hand (i.e., the smartphone or portable computer) presents the relevant context for habitual social media use in itself: the user interface and the arrangement of application icons on the screen represent a familiar context. For example, a user may turn to their smartphone with the intent of expediting a deliberate action (e.g., send an e-mail, pay a bill, make a phone call) but is habitually drawn to Facebook instead [76].

Self-Control

Self-control is defined as the voluntary regulation of behavior in pursuing deliberate goals that are deemed important and valuable [84]. Extensive research has established

the benefits of self-control in academic performance, higher earnings, physical health, and social relationships [34]. Even though conventional wisdom suggests that self-control is the source of the effort to inhibit impulsive behaviors [82], more recent research has shown that self-control is related to less effortful inhibition. This supports the idea that individuals with high self-control proactively cultivate good habits that are designed to reduce temptations or other contextual cues that might trigger undesirable reflexes [15], so they don't have to actually exert inhibitory effort [34]. Therefore, rather than self-control being like a muscle that is flexed in the heat of the moment [7, 59], recent empirical findings have shown that people with greater self-control report less effort to inhibit undesirable reflexes than those with less self-control [34]; they pursue their intended goals by preemptively avoiding temptation (potentially perilous context cues) rather than by policing their behavior to rein in a habit after it has been activated [15, p. 118]. In other words, whereas high self-control acts preventatively to inoculate a person from bad habits by purposefully cultivating the habitual avoidance of pernicious context cues, low self-control leaves space for bad habits to take root unintentionally and uncontrollably. As we point out in the Discussion section, this is why popular advice for controlling one's social media consumption involves creating a distraction-free environment and a set of desirable habits that prevent the temptation to open up a social media app [66].

Harmonious and Obsessive Passion

The dualistic theory of passions proposes that certain activities that individuals value and intensively engage with are internalized as parts of their identity and become passions that partially define the person [97]. The process of internalization is fueled by the extent to which the activity is highly valued and meaningful for the person and leads to the inclusion of this activity as a constituent part of the person's identity, thus giving rise to passion for the activity [94]. However, passion can be harmonious or obsessive depending on the conditions under which this internalization develops, thus making a significant difference as to the consequences of a passion. In particular, when internalization is voluntary, autonomous, controlled by the person, and without being internally or externally compelled, the passion is harmonious; although it still occupies significant time and energy, it does not overpower other aspects of the person's life. In contrast, when internalization originates from nonautonomous pressures such as social acceptance or fear of missing out, then the activity controls and compels the person in such way that the passion becomes obsessive, consuming a disproportionate amount of time and energy and effectively highjacking other areas of their life [25, 95, 96, 97]. Even though one or the other type of passion usually predominates, the varying salience of social and personal motivational factors at any moment in time may reinforce the simultaneous presence of both passions [94, pp. 114,118].

To the extent that people highly value an activity, those who are able to exercise greater autonomy in controlling how they dedicate their effort and time should be more likely to develop and maintain a harmonious passion for that activity [94]. Thus, because harmonious passion leads to a more flexible task engagement, individuals can avoid conflict with other commitments at work and in life and can derive satisfaction from the experience of immersing in their passionate activity. In contrast, individuals with obsessive passion

engage in the activity without control, and as a result, they experience conflict with other life commitments. This conflict prevents them from fully appreciating participation in their passionate activity, as it may lead them to experience guilt, shame, and anxiety following task engagement [94]. Overall, passions represent the long-term internalization of an activity which becomes anchored at the level of identity, integrating goals that the person values [25, 96].

Research Hypotheses

As argued by Osatuyi and Turel [63], Facebook's mental rewards drive excessive use, which is in conflict with other activities in the user's life—an indication of addiction-like symptoms. Prior studies on social media and smartphones have confirmed that addiction-like symptoms are more likely to occur the more the technology is used [63, 82]. Even though one might think of occasions when lengthy and intensive Facebook usage is justifiable and nonaddictive (e.g., for professional social media marketers), our perspective on addiction-like symptoms implies that engagement with Facebook crowds out the time that the user would have intended to dedicate to other activities, perhaps involving work or family. Furthermore, even though enjoyment is a dominant reason for using Facebook [30, 51], too much enjoyment may become uncontrollable overindulgence [97, 101], confirming the link between the degree of use and the addiction-like symptoms. Finally, in the context of smartphones, as pointed out by Soror et al. [82], a high level of use is a “mandatory and necessary” condition for negative consequences. Therefore, we hypothesize the following:

Hypothesis 1: Higher levels of Facebook use are associated with higher levels of addiction-like symptoms.

Even though earlier research on technology adoption and use focused almost exclusively on deliberate behavioral intention as the main driver, it has increasingly been recognized that ongoing use, especially with personal and hedonic technologies [99], is primarily driven by habit [43, 49, 63, 82]. The more practiced and learned the habit, the more often users will encounter contextual factors that will be tacitly recognized as analogous or similar to the original cues [76, 108]; therefore the habit will be triggered more often [102]. Furthermore, repeated habitual action reinforces the learned habit so that action responses are triggered with greater frequency over a broader variety of contextual cues and even when the initial reward is no longer expected or valued [108]. This is also reflected in the Technology Integration Model [79], which emphasizes the importance of habit in continued technology use. For this reason, we propose the following hypothesis:

Hypothesis 2: A stronger habit for Facebook is associated with higher levels of Facebook use.

Extant research suggests that the effect of habit on addiction-like symptoms is mediated by Facebook use. In particular, in a study of negative consequences of mobile phone use, Soror et al. [82] found that the relationship between habit and negative consequences is always fully mediated by use, whether use is measured as frequency or as duration. A more closely related study of social network addiction by Osatuyi and Turel [63] confirmed the

mediation effect when usage is a composite measure of frequency, duration, and general perception. This evidence is consistent with the general understanding that most behavior is habitual and that only some habits are bad habits [109] that would drive addiction-like symptoms. In particular, Facebook habit is the degree of automaticity (as opposed to the degree of reflection) when checking Facebook in response to contextual cues [110]. However, this automaticity may be either desirable or inappropriate, and therefore the automatic reflex does not carry valence by itself. For these reasons we cannot ascribe Facebook addiction-like symptoms to its habitual use, and we propose the following hypothesis:

Hypothesis 3: Facebook habit does not have a direct influence on addiction-like symptoms.

Recent empirical research on identity and habit has shown that “a particular identity may instigate behavior and thus maintain a habit” [104, p. 2]. At the same time, passions represent the long-term internalization of an activity that becomes anchored at the level of identity, integrating goals that the person values [97] and from which repeated behaviors and learned skills, including habits, emanate [104]. In other words, habitual behavior becomes a manifestation of the person’s identity such that habit activation is a consequence of the identity that the person has cultivated through purposeful choices over time. It follows that passions embedded into one’s identity can instigate the cultivation of habits. Given that a Facebook habit may be desirable or undesirable, we introduce the theory of passions to explore the effects of harmonious and obsessive love for Facebook on habit and use.

Whereas harmonious passion characterizes a commitment under the user’s own volition and control, in harmony with other aspects of the person’s life, obsessive passion characterizes a commitment where the desire to use Facebook overpowers the user’s commitments in other aspects of life [62]. In both cases, the user’s internalization of Facebook as part of their identity is the source that instigates and maintains ongoing Facebook habit [104]. Specifically, harmonious passion reflects the user’s contentment and attribution of positive values and intent to Facebook use, whereas obsessive passion reflects a recognition or even a lament of the user’s surrender to uncontrollable Facebook use. It follows that both passions are expected to promote the development of Facebook habit. Therefore, by drawing on the theory of passions and on research relating identity to habit, we propose the following hypotheses:

Hypothesis 4: The more harmoniously passionate an individual is about Facebook, the higher their levels of Facebook habit.

Hypothesis 5: The more obsessively passionate an individual is about Facebook, the higher their levels of Facebook habit.

Based on the theory of passions, “because there is an intimate person–object link that is rooted in identity, passions should lead people to pursue the object or activity with energy on a long-term basis. Thus, when people are passionate for something, they typically engage regularly in the activity and may do so for several years and sometimes a lifetime” [94, p. 4]. The empirical literature on passions for social media has shown that both obsessive and

harmonious passion fuel persistent use [62, 105]. Similar results have been found in related technology domains, such as gaming [69, 70] and e-commerce [107], and are consistent with a much broader meta-analysis of research on passions [25], even though obsessive passion tends to have a more dominant impact on use than harmonious passion. Therefore, we hypothesize the following:

Hypothesis 6: The more harmoniously passionate an individual is about Facebook, the higher their Facebook use levels.

Hypothesis 7: The more obsessively passionate an individual is about Facebook, the higher their Facebook use levels.

Whereas obsessive passion compels the user to yield to personal or social pressures to use Facebook in ways that hijack great amounts of their time and energy at the expense of other commitments, harmonious passion is defined as enabling free and willing engagement with Facebook in ways that allow a fair and balanced use alongside other demands in life [94]. Based on these distinguishing characteristics of harmonious and obsessive passion, we hypothesize the following:

Hypothesis 8: The more harmoniously passionate an individual is about Facebook, the lesser the Facebook addiction-like symptoms.

Hypothesis 9: The more obsessively passionate an individual is about Facebook, the greater the Facebook addiction-like symptoms.

Recent research on the role of self-control in regulating habitual behavior shows that self-control acts preventively to avoid potentially compromising contextual cues, long before bad habits are triggered [34, 108]. This evidence updates earlier beliefs that the reflective system supervises and corrects the reflexive system during the course of habitual action [82]. In this study, we specifically focus on self-control over Facebook use and not self-control as a trait. Therefore, Facebook self-control corresponds to the strength of the user's Facebook avoidance behavior. It follows that Facebook self-control should reduce both Facebook use (as it works to selectively avoid certain context cues that trigger Facebook checking) and addiction-like symptoms (as it is purposefully oriented toward values and goals that are broader than the gains from Facebook use).

Furthermore, to the extent that higher Facebook self-control represents the deliberate cultivation of Facebook avoidance, whereas lower Facebook self-control allows a Facebook habit to take hold, we expect that Facebook self-control represents the driver that, when successful, prevents Facebook habit from emerging and being activated. Finally, Facebook self-control represents the user's proactive organization of daily life to restrain behavior, thus sustaining a measured engagement that prevents extreme outcomes. In this sense we expect Facebook self-control to promote the volitional, free, and autonomous internalization of the kind of Facebook use they really appreciate (harmonious passion) while "inoculating" themselves from the intrapersonal or interpersonal pressures that may compel an uncontrollable internalization of Facebook use (obsessive passion). For these reasons we propose the following hypotheses:

Hypothesis 10: Higher levels of Facebook self-control are associated with (a) lower levels of Facebook habit, (b) lower levels of obsessive passion, (c) higher levels of harmonious passion, (d) lower levels of Facebook use, and (e) lower levels of addiction-like symptoms.

The integrated research model including our hypothesized relationships is shown in Figure 1.

Research Methodology

To test the preceding hypotheses, we conducted a survey of Facebook users among the general U.S. adult population.

Measurement of Constructs

The measurement items and scales used were adapted from previous studies and are shown in Table 1. The questionnaire was pretested with 100 respondents prior to the main study, which allowed for refinements. This process proved to be critical, as our administration of the survey via smartphones allows only a limited number of questions. Specifically, we introduced a screening question excluding nonusers, which enabled us to add another measurement item.

All measurement items used a 5-point Likert scale with anchors ranging from 1 (strongly disagree) to 5 (strongly agree). We adapted the original scale developed by Vallerand et al. [97] for harmonious passion (e.g., “Facebook allows me to live a variety of experiences”) and obsessive passion (e.g., “The urge is so strong, I can’t help myself from using Facebook”). For habit, we adapted the scale developed by Limayem et al. [50] in the context of Facebook (e.g., “Checking Facebook has become a habit for me”) that has been used by other relevant studies taking a dual-systems approach [82]. Further, for the self-control scale, we adapted items from the scale originally developed by Tangney et al. [84] by maintaining the items identified by Maloney et al. [54] as the restraint factor (e.g., “I am good at resisting the temptation to use Facebook”). It is important to note that in our adaptation we did not

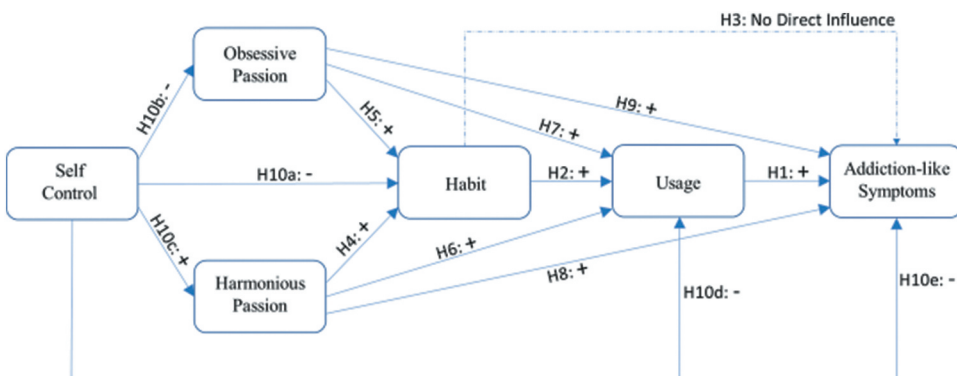


Figure 1. Integrated duality conceptual model

Table 1. Questionnaire measurement scales and internal reliability of the constructs

Construct	Questionnaire items	Loadings	CR	AVE
Harmonious Passion	HP1: Facebook allows me to live a variety of experiences	0.70	0.805	0.508
	HP2: The new things that I discover with Facebook allow me to appreciate it even more	0.75		
	HP3: Using Facebook is in harmony with the other activities in my life	0.72		
	HP4: Using Facebook is for me a passion that I still manage to control	0.68		
Obsessive Passion	OP1: The urge is so strong. I can't help myself from using Facebook	0.83	0.918	0.736
	OP2: I have difficulty imagining my life without using Facebook	0.82		
	OP3: I almost have an obsessive feeling for using Facebook	0.90		
	OP4: I am emotionally dependent on using Facebook	0.88		
Habit	HB1: Checking Facebook has become a habit to me	0.86	0.906	0.763
	HB2: Checking Facebook has become natural to me	0.86		
	HB3: Checking Facebook has become automatic to me	0.90		
Self-Control	SC1: I am good at resisting the temptation to use Facebook	0.72	0.764	0.519
	SC2: I never allow myself to lose control of my Facebook use	0.69		
	SC3: People would say that I have iron self-discipline when using Facebook	0.75		
Facebook Usage	US1: Please estimate how long you spend on average per day on Facebook (7 point scale: Don't use at all, Less than 10 minutes, About 20 minutes, About 40 minutes, About 1 hour, About 1.5 hours, More than 1.5 hours)	0.75	0.855	0.664
	US2: How do you consider the extent of your current Facebook use? (7 point scale: Non use, Very light use, Light use, Moderate use, Somewhat heavy use, Heavy use, Very heavy use)	0.88		
	US3: Please estimate how many times per day on average you access Facebook (7 point scale: Don't use at all, Less than once per day, 1-2 times per day, 3-5 times per day, 6-10 times per day, 11-15 times per day, More than 15 times per day)	0.81		
Addiction-like symptoms	AS1: I sometimes neglected important things because of my interest in Facebook?	0.85	0.907	0.660
	AS2: My social life has sometimes suffered because of me interacting with Facebook	0.84		
	AS3: Using Facebook sometimes interfered with other activities	0.78		
	AS4: When I was not using Facebook, I often felt agitated	0.79		
	AS5: I was sometimes late for engagements because I was using Facebook	0.80		

examine self-control as a generic trait, but we specifically examined self-control in the context of the activity under examination, namely, Facebook use.

For the examination of Facebook addiction-like symptoms, we adapted the scale from Osatuyi and Turel [63] that was itself rooted in the work of Charlton [16]. Facebook usage behavior was measured in terms of frequency, duration, and intensity of use, based on the scales by Wu and Holsapple [111] and Venkatesh et al. [103] as widely adopted in this stream of research (e.g., [63, 82]). Even though the correlation of self-reported smartphone usage questionnaires with objective measures of use is modest [31], it remains the strongest across other measures with which it has been compared [31, p. 91]. The frequency and duration of use were measured using interval scales similar to Wu and Holsapple [111] and informed by an average of approximately 40 minutes of daily reported Facebook use in the United States [19]. We have added demographic control variables as proxy for the fact that Facebook is used for different purposes by different people [24, 55, 88]. Specifically, gender, age, employment status, marital status, income, and educational level were used as control variables, which are also found to play a significant role across a number of studies in social networks or mobile phone use (e.g., [14, 44]). Finally, we also used social desirability as measured by the Hays et al. [37] scale for the purpose of controlling for the fact that individuals may underreport negative behaviors such as addiction-like symptoms and overreport positive behaviors such as self-control [82].

Data Collection

Given that 98.2 percent of active Facebook users access it on their mobile phones [22], we employed the Pollfish survey platform to deliver our survey. This platform delivers online surveys globally through mobile phones and, according to the company, it has access to a panel of more than 700 million consumers worldwide via its in-app survey delivery partnerships. Pollfish has been previously demonstrated to be quite representative of the general population [36, 40] and is especially relevant, as it allowed us to deliver the survey directly to smartphone users. While the Pollfish platform is governed by a strict set of terms and conditions regarding privacy and data protection (<https://www.pollfish.com/terms/respondent>), the research procedure received approval by the research ethics committee of the author's institution. Further, while participants could opt out of the survey at any point, they were also asked to provide informed consent after having been given access to information about the study and the safeguards for anonymity and data protection.

The survey was delivered in a staggered manner across the day, while accounting for the different U.S. time zones to avoid any time-of-day bias. For this purpose, we configured the Pollfish platform to deliver 225 U.S.-based Facebook user responses² in three batches of 75 at different times during the day (10:00, 14:00, and 18:00 PST). The sample contains 46.2 percent female respondents (Table 2). In a manner consistent with the higher penetration of social networking apps at younger ages [81], a considerable number of respondents were between the ages of 18 and 34 (44.4 percent).

Data Analysis

Measurement Model Evaluation

The collected data were analyzed using the structural equation modeling covariance procedure with maximum likelihood estimation available in STATA (version 15.1). All item loadings were found to be significant at the .01 level, the average variance extracted (AVE) values were higher than 0.5, and composite reliabilities (CR) were higher than 0.7 (Table 1), indicating acceptable reliability and convergent validity [33]. Given that the AVE and CR exceed recommended thresholds, there were no low-loading items to remove. Discriminant validity was examined by comparing the square roots of AVE that were greater than the corresponding row and column correlation values (Table 3). This was further confirmed by performing a confirmatory factor analysis that did yield an excellent fit, $\chi^2/df = 285.5/194 = 1.47$ (comparative fit index [CFI] = 0.97, Tucker-Lewis index [TLI] = 0.97, root mean square error of approximation [RMSEA] = 0.046).

Table 2. Demographics of study participants

Measure		N	%
Gender	Male	121	53.8
	Female	104	46.2
Age	18 - 24	30	13.3
	25 - 34	70	31.1
	35 - 44	58	25.8
	45 - 54	36	16.0
	> 54	31	13.8

Because single-source surveys may suffer from common method bias, different tests were conducted [67]. First, Harman's single-factor test demonstrated that no single construct accounted for a majority of the total variance. Second, the correlations between constructs (Table 3) are lower than 0.90, providing additional support that this study does not suffer from common method bias [65]. Third, multicollinearity was also examined; the highest variance inflation factor value at 1.95 is well below the commonly acceptable threshold of 3.3 [29], indicating that this study does not suffer from common method bias [28]. Finally, a single common factor was constructed including all items while they were also loading to their theoretical constructs. Since all items had highly significant loadings on their theoretical constructs, but insignificant on the common method construct, we conclude that common method bias is not a problem in this study [67].

Structural Models

To examine the impact of the introduction of passions in a dual-system model for assessing Facebook usage and addiction-like symptoms, we first constructed a model that does not include passions (Model 1) and another with our complete conceptual model (Model 2). Our Model 1 is a replication of the Soror et al. [82] model with an additional hypothesized path between self-control and habit. The structural equation modeling procedure produced very good fit statistics [39] for both our replication model (Model 1: $\chi^2/df = 244.1/154 = 1.59$, CFI = 0.95, TLI = 0.94, RMSEA = 0.051) and our full conceptual model (Model 2: $\chi^2/df = 373.0/254 = 1.47$, CFI = 0.95, TLI = 0.94, RMSEA = 0.046).

The results of our replication model (Model 1) are completely consistent with the findings of Soror et al. [82]: Facebook usage (H1: $\beta = 0.217$, $p < 0.05$) and self-control (H10e: $\beta = -0.280$, $p < 0.01$) predict addiction-like symptoms as a representative negative consequence, whereas habit is linked with usage (H2: $\beta = 0.544$, $p < 0.01$) and it is not linked (H3: $\beta = 0.062$, $p = 0.496$) with addiction-like symptoms (Table 4). Further, our newly developed hypothesis where self-control is expected to restrain Facebook habit (H10a: $\beta = -0.443$, $p < 0.01$) is also confirmed.

Of interest, our hypothesized model (Model 2) with the introduction of passions does alter previous findings (Table 4, Figure 2). In particular, Facebook usage does not lead to addiction-like symptoms (H1: $\beta = -0.010$, $p = 0.900$), nor is self-control linked with addiction-like symptoms (H10e: $\beta = -0.070$, $p = 0.413$). Nonetheless, the majority of our remaining hypotheses is confirmed: habit does not lead to addiction-like symptoms (H3: $\beta = -0.055$, $p = 0.466$); passions do increase habit levels (H4: $\beta = 0.275$, $p < 0.01$; H5: $\beta = 0.261$, $p < 0.01$) as they also drive Facebook use (H6: $\beta = 0.145$, $p < 0.10$; H7: $\beta = 0.222$, $p < 0.01$). Consistent with previous

Table 3. Measure summary statistics and correlations

Construct	Mean	SD	1	2	3	4	5	6
(1) HP	3.446	0.767	<i>0.713</i>					
(1) OP	2.351	1.054	0.371**	<i>0.858</i>				
(1) HB	3.895	0.942	0.404**	0.462**	<i>0.873</i>			
(1) SC	3.274	0.979	-0.117	-0.467**	-0.340**	<i>0.720</i>		
(1) US	4.437	1.337	0.379**	0.518**	0.596**	-0.403**	<i>0.815</i>	
(1) AS	2.066	0.972	0.186**	0.754**	0.275**	-0.403**	0.339**	<i>0.812</i>

Note: Square roots of the AVE are reported in italics on the diagonal; Pearson Correlations: ** $p < 0.01$; HP: Harmonious Passion, OP: Obsessive Passion; HB: Habit, SC: Self-control; US: Use; AS: Addiction-like symptoms.

Table 4. Results of structural model analysis

Hypothesis	Path	Model 1		Model 2		Model 1	Model 2
		Std β (SE)	p-value	Std β (SE)	p-value	Decision	Decision
H1	US \rightarrow AS	.217* (.104)	.043	-.010 (.083)	.900	Supported	Not Supported
H2	HB \rightarrow US	.544** (.064)	.000	.407** (.073)	.000	Supported	Supported
H3	HB \rightarrow AS	.062 (.096)	.496	-.055 (.074)	.466	Supported	Supported
H4	HP \rightarrow HB	-		.275** (.076)	.000	-	Supported
H5	OP \rightarrow HB	-		.261** (.082)	.001	-	Supported
H6	HP \rightarrow US	-		.145 (.077)	.074	-	Not Supported
H7	OP \rightarrow US	-		.222** (.079)	.005	-	Supported
H8	HP \rightarrow AS	-		-.032 (.066)	.621	-	Not Supported
H9	OP \rightarrow AS	-		.768** (.059)	.000	-	Supported
H10a	SC \rightarrow HB	-.443** (.068)	.000	-.259** (.085)	.002	Supported	Supported
H10b	SC \rightarrow OP	-		-.525** (.058)	.000	-	Supported
H10c	SC \rightarrow HP	-		-.191* (.081)	.018	-	Not Supported
H10d	SC \rightarrow US	-.268** (.078)	.001	-.187* (.092)	.042	Supported	Supported
H10e	SC \rightarrow AS	-.280** (.084)	.001	-.070 (.086)	.413	Supported	Not Supported

Note: ** $p < 0.01$, * $p < 0.05$

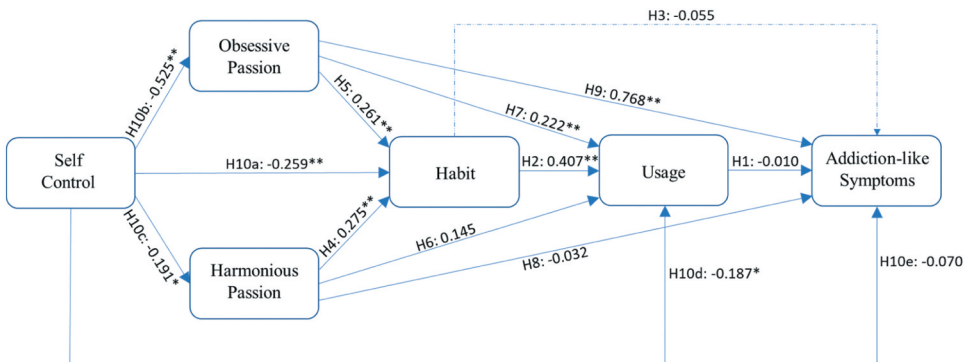


Figure 2. Empirical model results (Model 2, ** $p < 0.01$, * $p < 0.05$)

studies, we find that obsessive passion is strongly related to addiction-like symptoms (H7: $\beta = 0.768$, $p < 0.01$), as in the case of playing online games [106] or problematic series watching [62]. However, harmonious passion does not significantly negatively relate to them as hypothesized (H8: $\beta = -0.032$, $p = 0.621$). Further, we confirm that self-control does restrain habit (H10a: $\beta = -0.259$, $p < 0.01$), obsessive passion (H10b: $\beta = -0.525$, $p < 0.01$), and usage (H10d: $\beta = -0.187$, $p < 0.05$). Nonetheless, contrary to our hypothesis, self-control also restrains harmonious passion (H10c: $\beta = -0.191$, $p < 0.05$). Overall, the total and indirect

Table 5. Hypothesized model (Model 2) total and indirect effects

Model	Total Effect		Indirect Effect	
	Usage	AS	Usage	AS
Habit	0.407**	-0.059	-	-0.004
Self-Control	-0.513**	-0.437**	-0.327**	-0.367**
Harmonious Passion	0.257**	-0.050	0.112**	-0.018
Obsessive Passion	0.328**	0.750**	0.106**	-0.018

Note: ** $p < 0.01$

effects of our hypothesized model (Table 5) reveal that both passions and habit jointly drive Facebook use, with self-control playing a deterring role. The picture becomes even more clear when it comes to the total effects on addiction-like symptoms: obsessive passion becomes the dominant and only driver, while self-control maintains its strong deterring role.

Discussion and Implications

This research set out to examine more closely what drives the emergence of Facebook addiction-like symptoms given that we know only that self-control restrains addiction-like symptoms while neither habit nor usage carry valence; as a result, the emergence of addiction-like symptoms is so far assumed to be contingent on contextual circumstances. By drawing on the theory of passions, we have been able to present an explanatory account involving a psychological process at the level of identity that distinguishes between Facebook use that coexists harmoniously with other activities in life and Facebook use that fights against other activities in life. By extending the dual-system model of habit and self-control with the dualistic theory of passion, we have demonstrated the pivotal role of passions, enabling us to make significant contributions in both theory and practice.

Contribution to Theory

In answering our original research questions, first we find that addiction-like symptoms are directly influenced by obsessive passion (H9). Whereas obsessive passion captures the maladaptive nature of Facebook usage, our measure of addiction-like symptoms focuses on the negative consequences of Facebook on the user's life more broadly [1].

Second, our findings on the relationship between self-control, passions, and habit lend further empirical support to recent theoretical developments on habit and the preemptive functioning of self-control [34, 108]. Specifically, self-control may preemptively inhibit the user from overcommitting to Facebook passions, whether harmonious or obsessive (H10b, H10c). In turn, both passions, harmonious and obsessive, reinforce habit (H4, H5). In other words, as the user commits significant amounts of time and energy to Facebook (the passions), multiple cue-response associations (habits) are learned.

Third, our integrated model confirms prior research while contributing significant extensions and refinements. Specifically, this study begins by replicating and confirming prior research [63, 82] that Facebook use is strongly habitual (H2), that habit is agnostic as to the impacts of Facebook on its users (H3), and that self-control restrains the amount of time

and frequency of use (H10d). Beyond that, our hypothesized conceptual model (Model 2) updates our understanding of the role of Facebook use on addiction-like symptoms. Even though the presence of such symptoms may generally imply that the user tends to use Facebook more intensely, there is consensus that only some kinds of usage in certain inappropriate contexts are likely to lead to the neglect of other personal or social commitments [82]. When we introduce the duality of passions in our full model (Model 2), it becomes clear that addiction-like symptoms are a function of a deeper obsessive internalization of Facebook (H9) and not a direct result of greater levels of use (H1). Specifically, usage is primarily habitual (H2), and habit is associated with both harmonious and obsessive passion in nearly equal proportion (Table 4: H4, H5).

This interpretation is consistent with the notion of passions as a person-defining long-term commitment of time and energy to a particular activity that the person values highly [94]; it is also consistent with our understanding of habit as cue-response associations that are learned when behavior that pursues objectives that are highly valued by the person is repeated in constant or similar contexts [109]. In other words, once the individual internalizes their passion for Facebook as part of who they are, their ongoing engagement produces and reinforces habits of use as a manifestation of either a harmonious and/or an obsessive relationship to Facebook.

Paying closer attention to the beta coefficients in our model (Table 4), it is evident that the dominant and fairly powerful forces are the positive influence of obsessive passion on addiction-like symptoms (H9), the negative influence of self-control on obsessive passion (H10b), and the positive contribution of habit on use (H2). The effect of self-control on harmonious passion (H10c) and use (H10d) are of a size typical of studies in related research [71]. Furthermore, when considering total direct and indirect effects (Table 5), the introduction of passions in the model gives rise to a more refined explanatory narrative where both harmonious and obsessive passions have significant effects on Facebook habit and use. However, our results indicate that while obsessive passion is the driver of addiction-like symptoms (H9), harmonious passion—contrary to our hypothesis based on the theory of passions (H8)—has no influence, direct or indirect, on addiction-like symptoms (Tables 4 and 5). In part, the prevalence of obsessive passion is in line with prior research on passions, indicating the dominance of obsessive passion in the person's identity [94], and with Serenko and Turel [77], who found Facebook to be highly addictive. Therefore, it turns out that harmonious passion neither reinforces nor mitigates Facebook addiction-like symptoms.

Consistently with recent developments in the theory of self-control as it pertains to habit [34], this study contributes a revised perspective on the impact of self-control on addiction-like symptoms. In particular, we find that self-control, understood as proactive prevention rather than real-time correction, does not restrain addiction-like symptoms directly as initially hypothesized (H10e), but its effect is mediated by passions, habit, and use. Having said that, judging by the total effects of self-control on addiction-like symptoms in Model 2 (Table 5), its total (mediated) effect is a powerful counterbalance to obsessive passion, which is the driving force of addiction. In other words, a dual-system that explains Facebook addiction-like symptoms emerges, which comprises obsessive passion as the direct driving force and self-control as the indirect preventative restraining force.

Metaphorically, this explanatory structure alludes to the incident in Homer's *Odyssey*, when the deadly lure of the Siren song was inescapable once it was listened to. The only way

to avoid the seductive force of the Siren was either, as the hero Ulysses did, to have himself tied to the ship's mast or, as he ordered his sailors to do, deny them even the slightest opportunity to sample the beauty and elation of the infamous Siren melody by preventatively sealing their ears with wax before approaching the Sirens' island. Such was the strength of the Siren song's allure. By analogy, to mitigate the peril of addiction, one has to proactively exercise self-control and take measures to avoid the temptation and forego the potential joy of engaging with Facebook. This formulation evokes the notion of commitment devices in game-theoretic studies of behavior³ [13], such as strategic ignorance [12]: the Facebook user makes a credible commitment to abstain from excessive use by choosing to ignore the potential joys of Facebook use [58].

It is noteworthy that although self-control is a significant restraining influence that leads to lower levels of obsessive passion, habit, and use as hypothesized (H10a, 10b, 10d), it has a significant effect on harmonious passion, but in the opposite direction than hypothesized (H10c). The theory of passions suggests that harmonious passion engenders a volitional, autonomous, and measured engagement that maintains a balanced allocation of time and energy between the passionate activity and other domains of life [94, 95], the sort of engagement that self-control would be expected to contribute to. Nonetheless, our results indicate that self-control has a significant negative influence on harmonious passion. Perhaps the key to interpreting this result is that self-control avoids all temptation, without discriminating between harmonious and obsessive engagement. Even though harmonious passion and obsessive passion are very different in their effect on addiction-like symptoms, they coexist: to be passionate is to accept the joy and appreciation alongside the irresistible urge and emotional dependence. Both measure the dedication and love for the activity and tend to develop simultaneously [94, p. 114 and 118], as also indicated by the positive correlation in our results (Table 3). This interpretation suggests that a Facebook user with high levels of self-control might prevent addictive consequences by restraining the development of any kind of passion, ultimately precluding Facebook from becoming a part of their identity.

Implications for Practice

After decades of enthusiasm for the promise of digital technology, public discourse and policy attention have, over the past few years, turned their focus on the dark side of technology [86] and on negative consequences, including symptoms of addiction. For example, there are now tools by Apple, Google, and original equipment manufacturers, as well as third-party applications, hoping to reverse a trend that started with Stanford's Persuasive Technology Lab (<https://captology.stanford.edu/>) and help smartphone users take back control of the frequency of check-ins and the total time they spend on the smartphone, with nearly 50 percent of that time currently spent on social media [21].

Given that we have found Facebook addiction-like symptoms to be the result of an obsessive passion for it, the question is how to prevent that obsession from developing. Based on our model, addiction-like symptoms appear to be mitigated by preventative self-control. Unfortunately our results suggest that self-control cannot selectively isolate and retain the harmonious side of passion while minimizing the obsessive. For example, the popular press regularly presents recommendations to disable notifications or even uninstall the smartphone app (to limit usage to the more fussy browser access only). However, the

insight from our study is that Facebook obsession is deeply ingrained in the identity of the user, which explains why its use is so pervasive in everyday life.

This last point brings to the surface once more the systemic nature of the problem in the attention economy, which is rooted in the advertising-based business model of Facebook and other similar media platforms. As long as such business models depend on performance-based advertising, platforms will continue tweaking the design of their services to maximize user engagement and obsessive passion. The ultimate logical conclusion is that users would have to resort to stop participating altogether by deleting their Facebook accounts either temporarily or until Facebook and others find a way to redesign their services specifically for harmonious engagement (or until regulators force social media companies to do so). Meanwhile, users' efforts at bolstering their self-control should include commitment devices, ways to metaphorically have themselves "tied to the mast" like Ulysses (e.g., keep smartphones and computers at a distance, or have a parent or partner lock them away), as well as the cultivation of replacement passions that are more likely to be harmonious rather than obsessive.

Limitations and Future Research

Notwithstanding the contributions of this paper, the theoretical and empirical scope of the research design imposes certain limitations and creates specific opportunities for promising future research. In particular, even though the statistical criteria for measurement are met, we note the high correlation between obsessive passion and addiction-like symptoms (Table 3). Nonetheless, obsessive passion reflects the manner in which people engage with Facebook, and addiction-like symptoms measure the negative impact of this engagement on other areas of life (Table 1).

Second, our cross-sectional research design identifies antecedents of habit, use, and addiction-like symptoms, but a longitudinal or experimental design could enhance our understanding of the causal process by which passions take their place in the user's identity and lead to habit and addictive consequences.

Third, even though in measuring Facebook usage we employ widely adopted methods and instruments, there is growing concern that self-reported levels of use correlate with actual use modestly at best [31, 32]. Notwithstanding the privacy issues, as objective data on technology use become increasingly accessible, future research should strive to avoid self-reporting biases by collecting objective data where possible. Similarly, we acknowledge the general call for larger sample sizes in this kind of research to provide greater conceptual clarity and interpretative refinement to the findings, such as, in this study, the marginal relationship between harmonious passion and Facebook use (H6).

Further, since we have found that self-control has a restraining effect on both harmonious and obsessive passion, it remains an open question whether there are other psychological mechanisms that could separate harmonious from obsessive passion. Related to this is the question of whether our findings can be replicated beyond Facebook and whether other social media platforms or personal technologies engender similar user behaviors and outcomes.


Notes

1. We thank an anonymous reviewer for highlighting this issue.

2. The Pollfish platform applies a proprietary machine learning algorithm that detects and rejects fraudulent responses (<https://www.pollfish.com/methodology/data-quality/>).
3. We are grateful to an anonymous reviewer for bringing this point to our attention.

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