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The Path to Hedonic Information System Use Addiction: A Process Model in the Context of Social Networking Sites

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Abstract. This study answers the call for a longitudinal view of addiction to hedonic information systems (IS) use by proposing a process model of its development, in the context of social networking site use. Through inductive and iterative analyses of primary data collected via interviews and surveys, and secondary data in the form of narrative accounts, we explain the process of addiction development via three phases associated with nominal, compulsive, and addicted use. In each phase, combinations of salient individual needs, affordances, technology features, IS use behaviors, and control mechanism outcomes (successful or unsuccessful) influence an individual's trajectory toward hedonic IS use addiction. Drawing on cybernetic theory, we explain the role of users' control mechanisms. We show how deficiencies related to the sensing, comparing, or regulating act, in conjunction with salient affordances, influence the development of addiction. The findings extend variance-based research on IS use addiction. They carry implications for research, users, technology providers, and policy makers in relation to hedonic IS use addiction.

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Introduction

Originally, a key focus of information systems (IS) research was to find ways to promote use of information technologies (Venkatesh et al. 2003). However, in recent years, a growing body of evidence speaks to the possible adverse effects of IS use (Tarafdar et al. 2015). Particularly in contexts where IS use is personal and hedonically motivated, such as online games, social media, or smartphone usage (Xu et al. 2012, James et al. 2017, Vaghefi et al. 2017), constant engagement with information technology (IT) may yield adverse outcomes, up to and including addiction (Turel et al. 2011), with negative consequences for individuals, organizations, and societies (Seah and Cairns 2008, Vaghefi et al. 2017). As a result, there is growing concern about the detrimental impacts of hedonic IS use addiction, which previously have been overlooked (Venkatesh et al. 2019).

Addiction to hedonic IS use has been defined as a maladaptive psychological dependency on use of a hedonic system[1] that is associated with significant negative consequences across important life domains (Turel et al. 2011, Venkatesh et al. 2019). As a case in point, recent global surveys showed that individuals spent, on average, 136 minutes per day using social media tools, which constitutes one-third of all internet usage (Clement 2019), with 45% of teens reporting being online "almost constantly" (Anderson and Jiang 2018). Given the significant increase in the market penetration rate of IT innovations and high usage rate of hedonic IS, such as social networking sites (SNSs; Krasnova et al. 2015), understanding the development of addiction-related behaviors constitutes an important focus for IS research. In this vein, multiple studies have focused on the etiology of addiction and, in particular, its drivers (Xu et al. 2012, Soror et al. 2015, Turel and Qahri-Saremi 2016). Much of this research has focused on the role of "self," arguing that addiction is largely a function of specific characteristics of the individual (e.g., personality traits; Charlton and Danforth 2010, Kayiş et al. 2016, Venkatesh et al. 2019). Other studies have portrayed such behaviors as a result of an imbalance between two brain systems (i.e., automatic versus inhibitory reflective system; Turel and Qahri-Saremi 2016), or a byproduct of use and habits (Soror et al. 2015). This body of research also highlights addiction's effects and negative consequences, for instance, biasing perceptions of usefulness and

ease of use, resulting in social problems (Vaghefi et al. 2017), impaired productivity, and job performance (Soror et al. 2015, Turel and Qahri-Saremi 2016, Venkatesh et al. 2019).

Notwithstanding its contributions, the current IS research on addiction has studied primarily the relationships between predictors (i.e., antecedents of addiction) and a dependent variable (addiction) rather than the causal or processual aspect of the phenomenon, which is critical to understanding how hedonic IS use addiction develops. Throughout the variance-based research on IS use addiction conducted to date, researchers assume that the properties of the variables are fixed, unidirectional, and technology agnostic (Paré et al. 2008).

First, research has argued that the effects of the antecedents of hedonic IS use addiction are constant over time (Niemz et al. 2005). Yet, prior findings suggest that *addiction develops gradually* and *evolves over time* (Marlatt et al. 1988, Grover et al. 2011, Martin et al. 2013). Hence, although we increasingly have a better comprehension of the antecedents of hedonic IS use addiction, the underlying perception of addiction as a "static" phenomenon prohibits us from fully understanding its development process and its emergence.

Second, the lack of theorization of the process of hedonic IS use addiction development hinders research aimed at establishing the sequencing of its underlying mechanisms, that is, "entities and activities that produce change from an initial state to observed outcomes" (Avgerou 2013, p. 407). For instance, factors such as depression have been shown to be both antecedents and consequences of addiction (Niemz et al. 2005), and, thus, it is important to clarify the conditions under which they are a cause or a consequence of addiction. To establish the direction of these relationships, a process model is necessary (Van de Ven and Poole 1995, Paré et al. 2008). A better understanding of the sequencing of "entities and activities" would move us away from the cross-sectional identification of antecedents and consequences, in a direction that would help surface differences in individual trajectories toward hedonic IS use addiction—as the pace of developing an addiction can vary from one individual to another—but also commonalities, as they relate to shared characteristics of users and technology.

Third, given the conversation related to regulating technology companies to build ethical and socially responsible business plans and IT artifacts (Martin 2016, Hart 2018), research that shows how technology features and the affordances they enable influence the development of hedonic IS use addiction becomes particularly timely and relevant. Because prior research on addictions has focused primarily on the individual, there is a need to better circumscribe the role of technology vis-à-vis addiction to hedonic IS use. Furthermore, although this literature has shown that addiction to hedonic IS use is shaped by both individual characteristics and technology features (e.g., Xu et al. 2012, Wang et al. 2015), there is a need to better understand how the *interactions between individual users and technology* influence the development of an addiction.

Arguably, the ultimate aim of research on hedonic IS use addiction is to understand the evolution of use and to determine the points in time and interventions necessary to revert an individual's use to healthy levels when (or prior to the time) addiction forms. A process-based approach to studying hedonic IS use addiction will provide a needed complementary perspective to our current knowledge of IS use addiction, by explaining its development and its underlying mechanisms. Thus, the main objective of this research is to contribute to IS research on addiction by providing a process model based on empirical evidence.

Hedonic IS, by definition, refers to any system that is primarily designed to provide self-fulfilling and intrinsic value to the user, as compared with utilitarian IS, which mainly afford instrumental values (Lowry et al. 2012). It includes a variety of *potentially* addictive artifacts such as SNSs (including, for instance, Facebook, Instagram, or Snapchat), massively multiplayer online role-playing games, or online gambling sites. Given that studying all instances of hedonic IS at once would be virtually impossible (Turel et al. 2011), we examine the development of addiction in the context of SNSs, a suitable context for observing manifestations of hedonic IS use addiction (James et al. 2017). An SNS refers to any social site that allows interaction and information sharing between users, based on their association and interests (Kuss and Griffiths 2011, Krasnova et al. 2015). SNSs are considered one of the most pertinent contexts for studying addiction (Kwon et al. 2016) and one that many users "are overly concerned about" (Andreassen 2015, p. 175), given the soaring usage time (Clement 2019), time management difficulties (Polites et al. 2018), and addiction-like symptoms users have reported (James et al. 2017). Accordingly, our context-specific research question is, *how and why does addiction to hedonic IS use develop, particularly in the context of social networking sites?*

Informed by prior views of technology addiction as a *maladaptive relationship* between an individual and a tool (Quiñones-García and Korak-Kakabadse 2014), this research draws on the affordance lens (Markus and Silver 2008, Volkoff and Strong 2017, Karahanna et al. 2018) precisely because it is uniquely suited to offer a relational conceptualization of *user* characteristics and *technology features*. In this study, the affordance lens offers three benefits. First, it informs the identification of specific affordances and the needs motivating them during the process of hedonic IS use development. Second, it enables focusing on the sequencing of affordances' saliency and their

actualization into different types of use, up to and potentially including addicted use. Third, it offers better avenues for the generalization of findings compared with focusing solely on technology features, which may change from one hedonic IS to another.

To answer the research question, we conducted a series of studies involving three rounds of qualitative (85 interviews), one round of quantitative (248 surveys), and one round of secondary data collection (16 case narratives). Based on extant literature and iterative data analyses, a process model of addiction to hedonic IS use was developed. To answer the *how* question, the model highlights three phases, each one characterized by a different type of use, whether nominal, compulsive, or addicted. To answer the *why* question, in each phase, we looked at user needs, affordances, and technology features; type of use; and control mechanisms to explain users' trajectories toward addiction.

In this paper, we make three contributions to IS research. First, we provide a process model of hedonic IS use addiction development, in an SNS context. Insights related to mechanisms underlying the evolution of user behaviors (i.e., those related to one's needs, affordance actualization, types of use, and control deficiency) identified in an SNS context are likely to be applicable to other hedonic IS that are similar in terms of ubiquity and constant access through mobile apps. Indeed, although some differences in terms of drivers for addiction have been reported, for example, between online gaming and SNSs, both have been identified as problematic in terms of their capacity for addiction development (Van Den Eijnden et al. 2016) while showing similar behavior-shaping features and affordances (Andreassen 2015, Griffiths and Kuss 2017). Second, we extend our knowledge of "problematic" types of IS use by conceptualizing nominal, compulsive, and addicted use, while detailing user trajectories toward addiction. In this vein, we complement the Turel et al. (2011) measure of technology addiction by empirically establishing the cutoff points between nominal, compulsive, and addicted use, allowing for more precise and accurate interpretation of technology addiction assessments. Third, informed by cybernetic theory (Ashby 1961, Green and Welsh 1988, Carver and Scheier 2001), we provide a complementary and more detailed account of control over one's use-related behavior and how deficiencies in sensing, comparing, or regulating facilitate the development of hedonic IS use addiction.

Theoretical Background

Addiction to Hedonic IS Use

Traditionally, addiction has referred to a user's dependency on a *substance* (e.g., alcohol, a drug, or nicotine; Goodman 1990, Rachlin 1990). For instance, an addiction to drugs was defined as a state of physiological dependence on a substance to the point at which the lack of substance intake would result in unpleasant feelings and physical dysfunctions (Baler and Volkow 2006). Further theoretical developments extended definitions of addiction to a broader context to describe nonsubstance *behavioral* addictions. Examples of known behavioral addictions include gambling addiction, sex addiction, compulsive shopping, and internet addiction (Potenza 2006).

The term *addiction* in relation to technology, as a behavior that does not include a psychoactive substance, began as an umbrella term for internet addiction (Young 1998). Further research showed that individuals may not develop addiction to the internet (Griffiths and Kuss 2017), but arguably to the hedonic tools they use while on the internet (Van Rooij et al. 2017). Therefore, subsequent studies examined other types of addiction such as online game addiction, smartphone addiction, online auctioning addiction, and online media consumption addiction (Vaghefi et al. 2020, Turel et al. 2021). In fact, prior research indicates that there is no one-size-fits-all approach to developing online addiction types, yet the use of SNSs and online games is particularly addicting (Van Rooij et al. 2017).

With the proliferation of hedonic technologies, more recently, the use of SNSs has become the subject of addiction studies (Turel and Serenko 2012, Andreassen 2015, James et al. 2017). This research has studied maladaptive dependency to platforms such as Facebook and Twitter (Andreassen et al. 2012, Dwyer and Fraser 2016), confirming that addiction to such sites brings out a range of symptoms, including salience, tolerance, mood modification, relapse, withdrawal, and conflict (Turel 2015), and leads to significant impairments on life functions, such as reduced performance (Turel and Qahri-Saremi 2016) and personal well-being (Choi and Lim 2016, Moqbel and Kock 2018). Although there are differences in the use of various SNS platforms (e.g., Facebook or Twitter), in this paper, we focus on generic SNS use behaviors for two main reasons. First, because of the rapid changes of SNS platforms, constant introduction of features and functions, and quick rise and fall of platforms' popularity, theoretical contributions solely based on one platform may become quickly obsolete (Van Den Eijnden et al. 2016). Second, narrowing down the focus of research to a single platform challenges the comparability of research findings and accumulation of knowledge on technology addictions (Van Den Eijnden et al. 2016), and contributes to "further fragmentation of the field" (Van Den Eijnden et al. 2016, p. 479). Hence, focusing on the use of generic SNSs rather than on a specific platform appears appropriate for examining the process of addiction development.

Development of Addiction to Hedonic IS Use. A substantial amount of research on technology addictions has been published over the last two decades. This research has typically extended theories of general addiction to the technology use context (e.g., Young 1998, LaRose et al. 2003). The underlying assumption of this work has been that technology addiction "shares a common underlying etiological framework with other substance-related and behavioral addictions" (Kuss and Griffiths 2011, p. 3530). Two distinct yet relevant streams of research provide insights into the drivers of addiction to hedonic IS use. The first stream of research, mostly in psychology and health disciplines, provides support for the role of the *individual* (i.e., user) as one key component of addiction. The second stream of research, particularly in the human–computer interaction discipline, argues for the key role of *technology* in explaining what drives an addiction (see Online Appendix A for a review of prior research on this topic).

The first stream examines psychological, physiological, and personality factors of users and aims to establish a link between individual differences and problematic and pathological use (Young 1998, Caplan 2002, Davis et al. 2002, Caplan 2006). For instance, depression, which has been associated with dependency on substances (Lysaught and Wodarski 1996), was found to produce a similar effect through increasing dependency on the internet (Young and Rogers 1998). Similar results were reported regarding the role of loneliness, shyness, social anxiety, emotional sensitivity, and reactivity on internet addiction (Morahan-Martin and Schumacher 2000, Caplan 2002, Chak and Leung 2004, Caplan 2006). More recently, similar findings point to the effect of individual differences and use experience, in the context of SNS use and addiction. For instance, prior research has shown the effect of perceived enjoyment, habit (Turel and Serenko 2012), stress (Tarafdar et al. 2020), cognitive emotional preoccupation with SNSs, cognitive behavioral control (Turel and Qahri-Saremi 2016), maladaptive cognition and affect (Wang et al. 2015), SNS belongingness, emotions (envy and anxiety, fear of missing out), SNS gratifications, and personality (James et al. 2017) on SNS addiction. In this research stream, the general assumption about technology is that it provides a medium (Vaghefi et al. 2017) to facilitate communication with others, boosts moods, and allows anonymous interactions, which helps users hide their personalities and disorder symptoms, or escape from negative, unpleasant moods, and feelings.

Despite the dominance of this research focus, a second stream hints that the characteristics of the IT artifact play a role in addiction (King et al. 2010, Turel and Serenko 2010). For instance, the speed and intensity of information flowing through the communication medium were shown to be associated with pathological internet use (Chou and Ting 2003). Similar effects were reported regarding the effect of message characteristics (richness and synchronicity) on augmenting the relation between SNS habit and addiction (Xu and Tan 2012). In the context of SNS use, the interactive capabilities as well as the pervasive access enabled by mobile applications can exacerbate social media dependence and addiction (Wang et al. 2015).

Although considerable evidence on the role of the IT artifact in hedonic IS use addiction is emerging, existing studies focused on technology features make generalization and knowledge building challenging because of the sheer diversity of features studied across a range of hedonic technologies (Turel et al. 2011). In addition, although understanding that individual (i.e., user) characteristics and technology features play important roles in enabling addiction to hedonic IS use, these predominantly variance-based perspectives do not necessarily explain *how* addiction to hedonic IS use develops over time, through interactions between user and technology.

Addiction as a Process. There have been efforts (e.g., in psychology and marketing research) to understand the process underlying the development of an addiction. In psychology research, a handful of models showed that addiction can come about through a combination of biological, psychological, or social processes (Koob and Le Moal 2008). Focusing on smoking behavior, Biglan and Lichtenstein (1984) discussed this process via two stages: (1) acquisition and (2) transition to dependency. They hypothesized, but did not test, that factors contributing to addiction at each stage are likely to be different. In a similar study, Marlatt et al. (1988) discussed the progress of smoking addiction via stages of experimentation and initiation, transition and maintenance of use, and active change and use reduction. In a recent theoretical review, Brand et al. (2016) built upon the existing knowledge on online gaming disorder and modeled the development and maintenance of this behavior based on interactions between a set of predispositions and situational triggers. In this model, situational factors lead to coping responses that form one's decision to use online games, which in turn is followed by an increased sense of gratification and compensation, which finally will bring about online gaming disorders.

In the marketing literature, extant models have focused on the sequence of events occurring during consumption addiction. Grover et al. (2011) proposed a model of everyday consumption behavior and argued that initial consumption begins at a low level that is without any harmful consequence. Depending on physical, environmental, and physiological factors, individuals may increase their consumption to the point at which it causes harm and dependence. Focusing on the same behavior, Martin et al. (2013) developed

a stage-based model that showed how marketing cues help individuals move along four stages of nonconsumption, nonaddictive consumption, near addiction, and addiction. In each phase, a mixture of neurological, biological, psychological, and social factors would trigger consumption and make it progress (or regress) through different stages.

Although grounded in sound theoretical arguments and empirical evidence, an important limitation of prior work is that it does not address addiction to hedonic IS use, nor does it pay attention to the role played by a hedonic IT artifact and the sequence of events leading to such addiction. Compared with other known behavioral addictions, the addictive object in this study, namely, the hedonic and personal IS, is unique in its ubiquity, affordability, and accessibility (Turel and Serenko 2010). Similarly, IS research has shown that in the context of IS use, both the individual and IT artifact may adapt and evolve (Leonardi 2011), which is unlike substance addiction, where the nature of the addictive object usually stays the same. To our knowledge, no study has focused on understanding how hedonic IT artifacts' affordances influence the development of hedonic IS use addiction.

All in all, we argue that to understand the development of hedonic IS use addiction, we must account for both the characteristics of the IT artifact as well as the user's characteristics. We contend that it is critical to include the interaction between these two key elements—the user and the IT artifact—when studying the development process of hedonic IS use addiction. As a result, we leverage the affordance lens (Markus and Silver 2008, Volkoff and Strong 2017), as it is uniquely suited to offer us a relational conceptualization of user characteristics and features of the IT artifact. Because the features of an IT artifact have been shown to offer different affordances to different users (Leonardi 2013), the actualization of affordances (Strong et al. 2014) into different types of IS use could help explain the development of addiction to hedonic IS use stemming from both individual and IT artifact characteristics. This contention is in line with prior views of technology addiction as a maladaptive relationship between an individual and a tool (Quiñones-García and Korak-Kakabadse 2014). In addition, theorizing by focusing on affordances rather than technology features would facilitate the generalization of findings, because multiple applications offer users similar affordances, although their features tend to be application specific for trademark or intellectual property reasons (e.g., the "add friend" button in Facebook, "following" in Twitter, "discover" in Instagram, etc.). Hence, we argue that this theoretical lens allows us to go beyond focusing on either user or IT artifact characteristics, at a higher level of abstraction, when explaining the process of hedonic IS use addiction development.

An Affordance Lens

Originating from ecological psychology and the works of Gibson (1979), the concept of affordance was developed in order to explain an action possibility available to an "animal" in a specific environment. In Gibson's (1979, p. 127) terms, "[the] *affordances* of the environment are what it *offers* the animal, what it *provides* or *furnishes*, either for good or ill". As Gibson (1979) contends, individuals will not interact with an object in their environment unless they know what they can do with it. This perception is formed based on the physical properties of the object, as well as the potential uses the object *affords*, hence, the term "affordance" (Merolli et al. 2013). According to this view, an affordance is determined relative to the action possibilities of goal-directed individuals (i.e., relational). In this way, *affordances* are distinct from *features* and should not be confused with the latter. Whereas an artifact's technical and physical characteristics are embedded in the technology by design, affordances only exist in relation to the individual actor/user (e.g., email features of *sending* and *retrieving messages* afford *communication*; Volkoff and Strong 2017).

The affordance lens has been used by IS researchers who have studied the entanglement (Orlikowski 2007) or imbrication (Leonardi 2011) between user and technology. Whereas for Orlikowski (2007, p. 1437) "the social and the material are considered to be inextricably related," as a whole, whereby "there is no social that is not also material, and no material that is not also social," Leonardi (2011) maintains the separation between the social and the technical while accounting for their mutual reciprocation. To date, IS research adopting either of the two conceptual perspectives on affordances has been conducted at the *macro* (e.g., group; Markus and Silver 2008, Leonardi 2013, Majchrzak et al. 2013, Vaast et al. 2017) and *micro* (e.g., individual) levels of analysis (e.g., Goh et al. 2011, Treem and Leonardi 2012, Majchrzak et al. 2013, Burton-Jones and Volkoff 2017). Particularly, at the individual level of analysis and following Leonardi's (2011) imbrication perspective, affordances were relationally conceptualized to identify "what the user may be able to do with the [technology]" (Markus and Silver 2008, p. 612). In this study, we are using the theoretical lens of affordances to understand the interactions between users and the IT artifact occurring during the development of hedonic IS use addiction. This approach is consistent with recent studies that have examined the IT artifact in relation to specific users' behaviors (e.g., Leonardi 2011, 2013). As we are interested to see which affordances the users actualize and how their actualization helps

explain the process of hedonic IS use addiction development, our focus is at the individual level of analysis. Research has shown that an affordance can be actualized in different ways by different users, giving rise to different patterns of use (Kaptelinin and Nardi 2006). One explanation is that users (e.g., of an SNS) may have various needs and goals when they engage with the IT artifact (e.g., sending a message to a friend, or need for relatedness; Markus and Silver 2008, Leonardi 2013, Karahanna et al. 2018). Even when users have similar needs when using a technology (e.g., connecting to friends using an SNS), it is possible that they use a different set of features or that they have different perceptions with regard to what the technology and its features offer (DeSanctis and Poole 1994, Leonardi 2013).

In this vein, Karahanna et al. (2018) propose a needs–affordances–features (NAF) perspective in relation to social media use. The NAF perspective argues that innate psychological *needs* motivate individuals to leverage *affordances* that are enabled by "specific *features* of the social media application" (Karahanna et al. 2018, p. 738, emphasis added) to satisfy their psychological needs. According to this view, when affordances are being *actualized* through social media use, they in turn *fulfill* the psychological needs that motivated them in the first place.

We follow the approach of Karahanna et al. (2018) by investigating how feature-enabled affordances motivate and, when actualized, fulfill an individual user's needs during hedonic IS use addiction development. For instance, a particularly prominent affordance of SNSs, that of connecting users, is enabled by features, such as the "add friend" (Facebook) or "following" (Twitter) buttons. Although, in this case, the connectivity affordance is motivated by one's psychological need for relatedness, namely, the "individual's innate psychological need to interact, be connected to, and experience caring for others" (Karahanna et al. 2018, p. 740), it will be the actualization of the connectivity affordance into some type of SNS use that helps the individual fulfill her need for relatedness.

Cybernetic Theory

As our data collection, data analysis, and process theory development unfolded, it became clear that the *control mechanism* over use, be it successful or not, plays a key role during the development of hedonic IS use addiction. Hence, we turned to cybernetic theory (Wiener 1948, Ashby 1961) to refine our analysis and theory development. Referred to as "the science of control and communication" (Carver 1979, p. 1253), cybernetics is the study of the way systems, including "the human being as a self-regulatory system" (Carver and Scheier 2012, p. 342), are capable of control based on externally—or internally—defined criteria (Ashby 1961, Klein 1989). A core principle of cybernetic theory is that systems have a natural tendency toward *entropy* (Eagle and Pentland 2006), a state where the system shows a higher degree of disorder, uncertainty, and/or disorganization. To resist entropy, systems apply a control mechanism to rather move toward *negentropy*, which is a state of negative entropy (Wiener 1948).

Cybernetic theory embeds concepts that are helpful in studying control in human beings. First, information, as a perception of reality or signal (Klein 1989), is relayed to an individual through interaction with the environment (e.g., social interaction with others) or gained through self-perception and self-assessment. Any information can be used as an input to the system to reduce uncertainty and disorder. Although the quantity and quality of information may fluctuate at any moment, it is the *information processing* that matters during control (Carver and Scheier 2012). The theory further posits that control occurs through a sequence of "feedback loops" that allow system adjustments based on defined goals, comparison values, or standards. Feedback loops have three subprocesses: *sensing*, where processed information about the state of the system is retrieved; *comparing*, where the state of a system is compared with predefined standards; and *regulating*, where efforts to influence the system are exerted when a discrepancy is observed (Carver and Scheier 2001). Accordingly, two types of feedback loops exist. In the presence of a "negative" feedback loop, the system operates to reduce the discrepancy observed between existing state and standards; in such cases, it is also referred to as "corrective" or "compensating" feedback loop. In contrast, when there is a "positive" feedback loop, the system further deviates from the standards, which likely leads to entropy as the deviations observed become more and more substantial (Carver and Scheier 2012). Ultimately, when the outputs of a given system are not within the range of the reference values (i.e., acceptable values or standards), the system becomes unstable (Carver and Scheier 2012).

Prior literature on control also suggests that whereas the standards are fixed in some systems (e.g., assembly machines), in other instances (e.g., human systems), standards may be flexible and prone to change by becoming either laxer or stricter. Indeed, the goal-directedness or purpose of the system needs to be considered. In autonomous systems, such as a living organism or a human being, given that the system can pursue its own goals, "the system" actually can resist perturbations that would make it deviate from the reference values and hence yield entropy (Heylighen and Joslyn 2001). In such a case, regulating or controlling a system refers to mechanisms that are central to adaptation, which here refer to the processes that allow stability through responsive changes in the states of the system (Rappaport 1971).

To date, several concepts stemming from cybernetic theory have been used to explain IS-related phenomena. For instance, Nevo and Wade (2010) posited that the *entropy* that may exist in terms of IT assets and organizational resources could prove synergistic for an organization, with the ensuing IT-enabled resources capable of positively affecting a firm's competitive stance. In addition, researchers have focused on *control* to explain a range of outcomes, from the dynamics of user resistance to IT implementation, with implementers acting as the control device and the objective being to keep the intensity of user resistance at an acceptable level for the organization (Rivard and Lapointe 2010), to control by the organization over project risk in the context of IT investment decisions (Benaroch et al. 2006), and finally, to individuals' perceptions of control over IT-enabled threats, whether associated with an IT implementation (Beaudry and Pinsonneault 2005), or a security breach enabled by the inadvertent use of malicious IT (Liang and Xue 2009). A common thread of previous work in IS mobilizing the concept of control is that the control is externally focused—control over others' behaviors (Rivard and Lapointe 2010), over project risk (Benaroch et al. 2006), over situations one may find oneself in as a result of an IT implementation (Beaudry and Pinsonneault 2005), or a security breach (Liang and Xue 2009). To the best of our knowledge, no study in IS has yet leveraged the concept of control stemming from cybernetic theory to explain control that is internally focused over one's own behavior, particularly as it relates to IS use.

Methodology

In this paper, we used a primarily qualitative methodology to uncover the mechanisms underlying the development of addiction to hedonic IS use (Langley 1999, Pentland 1999, Burton-Jones et al. 2015). The theory development process in this paper was iterative. As we analyzed these data, our understanding of how hedonic IS use addiction develops was refined constantly. Figure 1 summarizes four rounds of primary data collection. The first round was exploratory and included 14 respondents. The goal was to better circumscribe the use of SNSs and the associated addiction-related behaviors. In the second round, we conducted 26 semistructured interviews with users deemed addicted to SNSs. It allowed us to build upon the results of Round 1 to better understand how use behaviors evolved over time and identify the elements associated with the development of SNS addiction. These first two rounds of data collection revealed a progression toward addiction with time brackets that were marked not only by different affordances but also by different types of use. It became evident that identifying the affordances in each bracket and differentiating between these different types of SNS use was critical. Hence, the third round involved a 10-item data collection instrument that was administered to 248 respondents. Cluster analysis indicated cutoff points that permitted us to differentiate between nominal, compulsive, and addicted use. Finally, in the fourth round, a subset of 45 respondents (out of 167 newly recruited individuals) were contacted for semistructured interviews. These additional interviews, which included users exhibiting all three types of use, as determined using the cutoff points from the third round, provided a finer-grained understanding of SNS use behaviors across time. They also allowed us to identify user trajectories toward addiction and explore the role of control, or lack thereof, in these trajectories. All in all, the data collected generated a final data set of 1,100+ pages of interview transcripts (Online Appendix B details the research participants), in addition to 60+ pages of secondary data (used for internal validation). For each round, we detail next our sampling, data collection, data coding, data analysis, and theorization strategies.

Round 1: Exploration

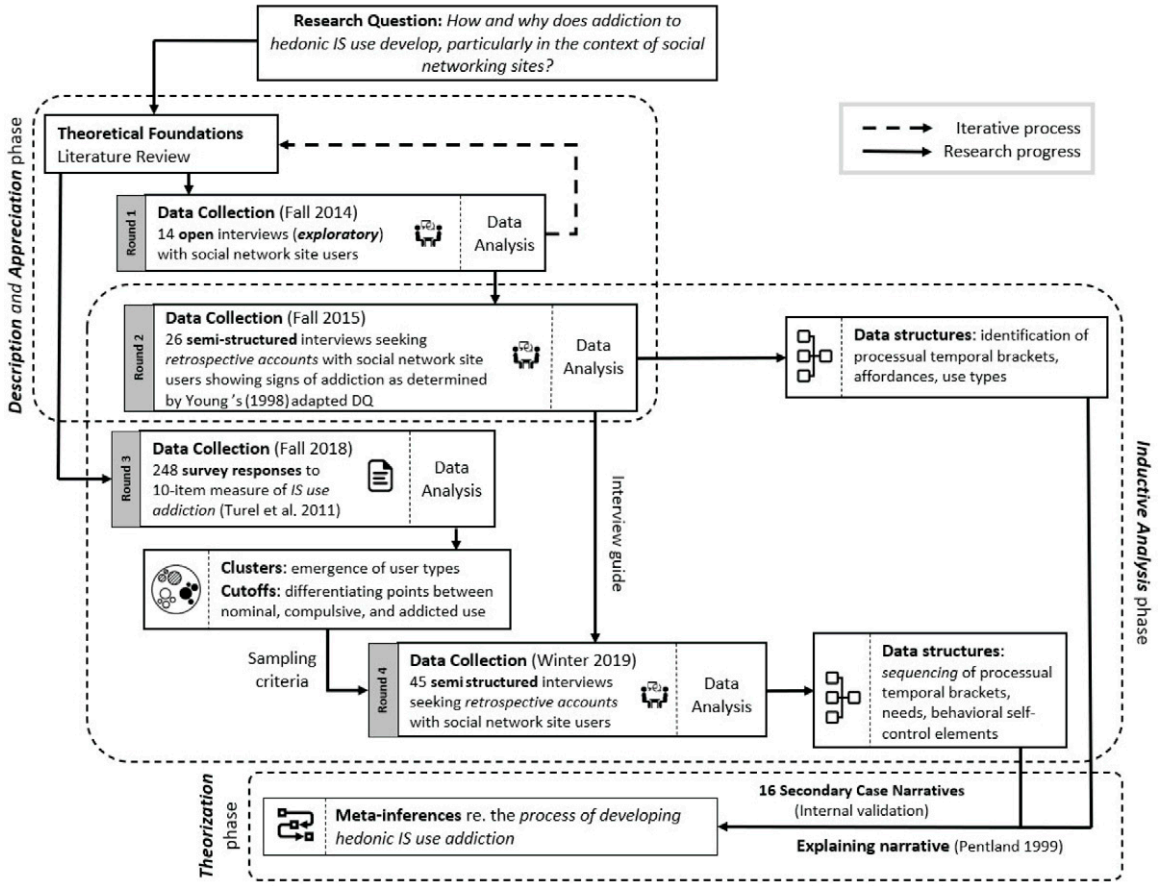
In this exploratory round, we sought to understand better general SNS use and addiction-related behaviors. The interview questions were retrospective in nature,[2] similar to the approach taken in previous seminal IS papers (e.g., Romm and Pliskin 1999, Lapointe and Rivard 2005, Thomas and Bostrom 2010, Leonardi 2011), and focused on initial experience with SNSs and how users' behaviors changed and evolved over time, as well as the outcomes of use.

The interview guide was refined using pilot interviews with two SNS users and an IS professor, expert in qualitative interviews. The final pool included a convenient sample of 14 professors, graduate students, and staff at a large North American university. The interviews used open-ended questions. The analysis began with a round of open coding in NVivo 10, with a list of final codes that included features used, user traits, moods, or feelings, and use-related behaviors. We iteratively went back to the literature to compare extant knowledge with the findings of our analysis to make better sense of the data, and to identify relevant conceptual categories.

Round 2: Patterns of Use

In the second round of data collection, we focused solely on individuals with higher levels of addiction to understand their trajectories toward addiction. We used a theoretical sampling strategy (Patton 2014) and recruited SNS users via an online advertisement posted on classified pages of a large North American university.[3] All prospective respondents were asked to fill out the validated and widely used Young (1998)

Figure 1. Summary of the Research Process



internet addiction diagnostic questionnaire (DQ), adapted to our context (Beard 2005, Byun et al. 2009; see Online Appendix C). The questionnaire included eight questions, each corresponding to a symptom associated with SNS use. Only those who scored five or higher[4] on the questionnaire were invited for an interview. We conducted 26 interviews lasting between 35 and 75 minutes. We followed qualitative data coding techniques (Miles and Huberman 1994, Myers 2013) using NVivo 10. Because our respondents were all exhibiting high levels of addiction, their retrospective narratives provided us with a longitudinal understanding of their use. Indeed, interviews seeking retrospective accounts are considered relevant data sources in process research, where "interviews are temporarily versatile in that respondents can draw on their memories and link phenomena across time" (Langley 2009, p. 411).

Drawing upon the six principles of Volkoff and Strong (2017, p. 4) for identifying affordances as "potential for action" in IS research, we paid close attention to the "user actions" (p. 5) and to mentions of features leveraged during these actions. As such, through interpretation, it became apparent that an individual using the "add account" or "check-in" button of an SNS, for instance, is afforded *visibility* by making her virtual presence visible to others on the platform; another individual, using the Search toolbar is afforded the possibility for *connectivity*, as potential connections are displayed in a list of results; someone else yet, mentioning the use of the "create post" text box is afforded the possibility of *content exchange* with her respective contacts, etc.

All in all, the analysis conducted during Round 2 helped us refine the understanding achieved in Round 1, as we found and coded key elements of a user's trajectory toward hedonic IS use addiction: (1) the temporal brackets; (2) the affordances exhibited, namely, visibility, connectivity, availability, content exchange, and social entertainment; and (3) the types of use emerging from the narratives (nominal, compulsive, and addicted).

Round 3: Classification and Discrimination

Data collected in the next two rounds were used to refine our process model and augment the internal validity of our findings. The analysis of data from Rounds 1 and 2 indicated that the progress toward the

development of hedonic IS use addiction unfolds across three phases, where nominal use (Phase 1), can turn compulsive (Phase 2), and ultimately turn into addicted use (Phase 3). As a result, we wanted the new qualitative data collected to come from respondents evenly distributed across these three types of use. Therefore, to identify respondents, we drew upon a continuous measure of addiction (Turel et al. 2011), adapted to the SNS use context. The measure included 10 items that correspond to the same common symptoms of addiction included in the DQ. Yet, compared with the DQ, which allowed for a dichotomous yes/no answer, this measure allowed for reporting of each symptom from low to high on a seven-point Likert scale. This helped us distinguish between people who show no symptoms of addiction, those who show some symptoms, and those who exhibit the whole range of addiction symptoms, thus giving us a more granular view of their SNS addiction (see Online Appendix E for a review of dichotomous versus continuous measures of addiction).

Although the scale was validated and used in prior research, to our knowledge, there is no study that uses this (or any other similar) scale to distinguish between nominal, compulsive, and addicted use. Hence, we first sought to investigate the cutoff points that can reasonably distinguish between these types of use. This critical step allowed us to identify participants who could add significantly to our data pool. Using a survey, we collected data from 307 SNS users[5] (248 completed; 81% response rate), who had a similar profile to our prospective interviewees (undergraduate or graduate students at another North American university). To examine the cutoff points between nominal, compulsive, and addicted use, we ran a series of analyses (see Online Appendix F for details). First, we started with exploratory cluster analysis, using hierarchical agglomerative clustering (HAC; Norušis 2012) and addiction items as inputs, to identify the number of clusters emerging naturally from our data. Results of HAC analysis confirmed that the optimal number of clusters (i.e., types of behaviors) for classifying these data was indeed three. Second, we performed a *k*-means cluster analysis to assign our data points to the three clusters of use (51% showed nominal, 32% compulsive, and 17% addicted use). The results (see Table F2 in Online Appendix F) were largely consistent with our understanding of these behaviors based on earlier analyses, with rates of technology addiction of approximately 20% of the population (Turel and Serenko 2012). The *k*-means cluster analysis identified cluster means (centroid) and standard deviations, which, however, do not mark the cutoffs between clusters. To identify the cutoffs, we used the receiver operator characteristic (ROC; Hanley and McNeil 1982), a technique common in clinical research to find the optimal point that discriminates between two populations (e.g., patient versus nonpatient; Liu 2012). The technique uses a trade-off between sensitivity criteria (a.k.a. true positive rate) and specificity criteria (a.k.a. true negative rate). Although selecting a higher cutoff increases specificity, it results in lower sensitivity (and lower cutoff equals higher sensitivity and lower specificity). We ran two rounds of ROC analysis (nominal versus compulsive use, and compulsive versus addicted use) in SPSS 24 and plotted two ROC curves. A value that has the highest specificity and sensitivity combined is the optimal value (see Figure F3 in Online Appendix F). The results of this analysis showed that the cutoff points of 2.65 and 4.06 (based on the 10-item scale) could reasonably distinguish between users who exhibit nominal, compulsive, and addicted use.

Round 4: Refinement

Using the cutoff points, we were able to identify a sample of SNS users evenly distributed across phases of nominal, compulsive, and addicted use. SNS users from three large North American universities were invited to participate in the study through posters, class announcements, and emails. To meet the eligibility criteria, each interested individual was required to provide her or his response to the SNS addiction scale (Turel et al. 2011). One hundred and sixty-seven individuals completed this survey.[6] Comparing each survey respondent's addiction score to the cutoff points, everyone's use reflected either nominal, compulsive, or addicted use in the final sampling. To yield a balanced sample, we randomly selected 15 respondents from each type of use (45 interviews, each lasting between 30 and 45 minutes[7]). Before conducting these semistructured interviews seeking retrospective accounts, we revised the interview guide (Table G2 in Online Appendix G), and then tested it via two pilot interviews. In this round, we paid specific attention to the time dimension and thus asked questions regarding users' experience at the initial stage of use, their current use, and how their SNS use has evolved over time.

As we identified key SNS affordances in an earlier analysis (Round 2), in Round 4, to examine their saliency (Volkoff and Strong 2017), namely, the moment and the extent of their actualization across the different phases, we drew on the NAF framework. Following the procedure of Karahanna et al. (2018), we assembled a list of common SNS features for three popular SNSs (Facebook, Instagram, and Snapchat) and associated them with the affordances they enable. Furthermore, we coded our data inductively to reveal the user needs, some that appear unique to the SNS context, that motivate the SNS affordances. This helped us identify nine user needs, including needs for self-expression,

information, belonging, etc. Finally, we mapped these needs onto specific affordances. Comparing our mappings, we found over 90% overlap. Minor discrepancies were resolved through discussion (Larsson 1993, see Table G1 in Online Appendix G). We also asked retrospective questions about features used over time to capture the longitudinal saliency of affordances.

We used NVivo 12 to code interview data. We assessed the reliability of our coding by asking an independent coder (not an expert on this topic) to code 20 pages of transcripts (von Eye and Mun 2005). A comparison of coded excerpts showed a good level of agreement, with interrater reliability of 0.89, superior to the recommended level of 0.70 (Landis and Koch 1977, Boudreau et al. 2001).

While comparing the coded data to existing codes, we kept an open mind for emergent insights. The analysis of the data allowed us to refine our process model of hedonic IS use addiction. For instance, by referring to the extant literature and using cybernetic theory (Wiener 1948, Ashby 1961, Green and Welsh 1988, Carver and Scheier 2001), we revisited our results to provide a finer-grained account of the role of control mechanisms in the development of addiction to hedonic IS use. Overall, no contradictory evidence surfaced, and other than the more granular dimensions of control, no new concepts emerged from the analysis, either structurally or dimensionally, suggesting a state of data saturation (Corbin and Strauss 2014).

Finally, we relied on secondary data collected from published cases in the form of 16 narrative accounts of Facebook addiction (Flores 2014) to strengthen the internal validity (Stone-Romero 2009) of our newly developed process model of hedonic IS use addiction development. In particular, we paid close attention, first, to the temporal precedence (the sequencing of phases of use), second, to the relation between cause and effect (the constituent elements that are adjacent to one another in the process model; Langley 1999), and third, to the lack of possible rival explanations for the relation between cause and effect. Like the analysis of the primary data, we formed detailed trajectories of use from these case narratives (see additional narratives in Online Appendix I). Because the accounts were largely consistent with the key tenets of the process model of hedonic IS use addiction development, we concluded that the evidence supports the theoretical claims of our process model.

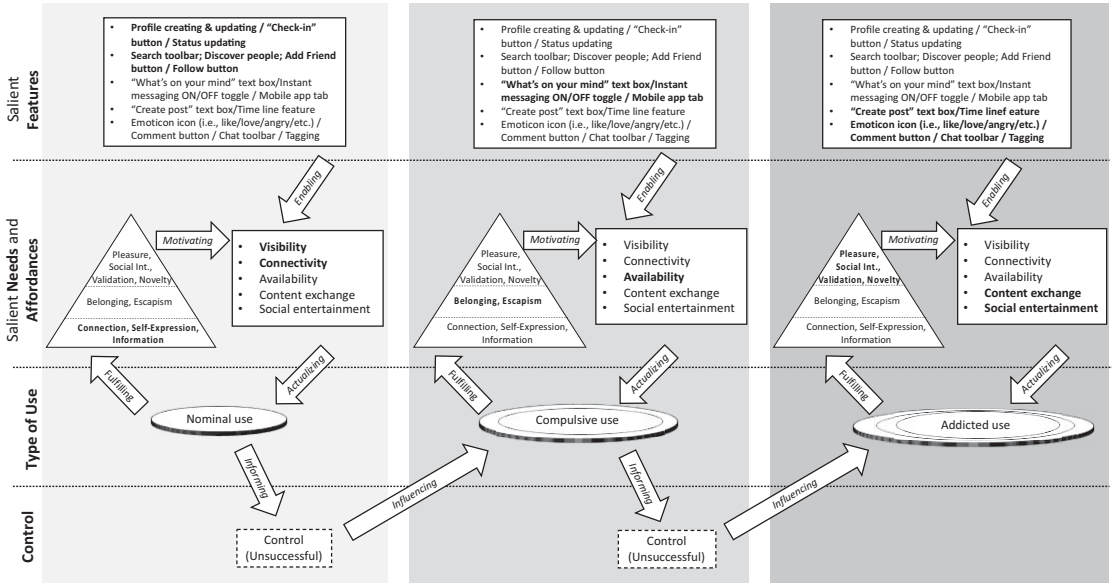
Findings

Enriched inductively by the data analysis, the results revealed key elements of the process of hedonic IS use addiction development. (The data structures mapping the empirical observations to the theoretical observations and constructs are detailed in Online Appendix D.) Overall, the evidence suggests that addicted use emerges because of a progression in an individual's use, beginning with nominal use and evolving into compulsive use and ultimately addicted use. From one type of use to another, changing user needs motivate SNS-specific affordances, such as visibility, connectivity, availability, content exchange, and social entertainment. Although these affordances are always available to users along their eventual trajectories toward addiction, some of the affordances are salient, in that a user most heavily actualizes them,[8] at different points in time. Furthermore, progression from one type of use to another appears to be associated with a compromised control over an individual's use. As such, specific salient affordances *in conjunction with* the lack of control influence the type of use one exhibits. The model shows that, initially, individuals exhibit *nominal use* or use motivated by a context-appropriate purpose and driven primarily by needs for connection, information, and self-expression. While the technology affords users a range of opportunities for action, particularly in relation to visibility and connectivity with others, their use informs a user's ability to control their ongoing interactions with the technology. Should the individual's ability to control his or her use be compromised, the 24/7 availability of the technology, motivated by one's needs for escapism and belonging, is then actualized into *compulsive use*, denoted by an urge to interact with the hedonic IT artifact with frequent repetition. Such IS use, in turn, informs an individual's control mechanism, which may or may not regulate the individual's subsequent use behavior. Again, when the ability to control one's use is again compromised, one sees the emergence of *addicted use*. At this point, needs for social interaction, pleasure, novelty, and validation motivate affordances, such as content exchange and social entertainment, which are actualized in use characterized by an excessive interaction with the technology on an ongoing basis despite negative consequences. These phases characterized by different types of use are shown in Figure 2, and their constituent elements will be detailed next.

Nominal Use Phase

Our data reveal that when the adoption decision is made, individuals begin to use the technology and, through repeated repetition, make sense of how it works and what it affords them. In the context of SNSs, based on the users' descriptions of their early interactions with these technologies, we identified a range of action possibilities that have been actualized by individual users. Although several affordances are presented to individuals early on in their interaction with the technology, two affordances, namely, visibility and connectivity, are salient in the respondents' accounts. Our analysis shows that hedonic IS provides an opportunity for visibility of the user's presence, preference, network, and affiliation with others, something that was not possible (or

Figure 2. Empirically Informed Trajectories Toward Hedonic IS Use Addiction and Their Constituent Elements



Element	Type	Definition	Sample evidence
IS use	Nominal	Purposeful and context-appropriate interaction with the technology	"Twice a day … maybe 15 minutes total per day" , yet "it's definitely not entertainment … rather building a network." (Respondent 51) "[O]nce a day, I get on the platform… [and the duration] hasn't really changed, 30 minutes. … I use the platform a lot for work and communication, like video-conferencing." (Respondent 55)
	Compulsive	Urge-driven interaction with the technology, with frequent repetition	"[I'm accessing the SNS] hundreds of times [per day]. I would walk out of this interview, pick up my phone, check, put it back in my pocket, get to the elevator, check again, leave the building, check again … Totaling, 5-6 hours per day being an active user." (Respondent 52) "Sometimes I'm waiting for something like a notification of a 'like', or something. I'm scrolling up and down and nothing new is happening." (Respondent 13)
	Addicted	Continued excessive and compulsive interaction with the technology, despite negative consequences	"I'd probably open (Snapchat) maybe ten times in one hour… and if I'm up for about 16 hours, I would say maybe even close to 14 hours of it I definitely am using some sort of social media … You check it out and then check it again… I check periodically… it's almost like an instinct now. (…) My performance … took a hit because you're just distracted by it; everything takes much longer to finish." (Respondent 33)
Affordances	Visibility	Action possibilities of being seen and reached effortlessly across a social context	"Creating and updating my profile" (Respondent 51) "The features I use now are the features I always used, [those that allow me to]curate my profile and timeline."(Respondent 50)
	Connectivity	Action possibilities related to using the technology to connect the user to other individuals	"Connecting to other professionals" (Respondent 51) "I was able to connect with my friends back home, while being elsewhere" (Respondent 55)
	Availability	Action possibilities related to the readiness for use of the technology platform	"I started to get a lot of notifications and I would check them almost right away … I mean I have the phone with me and the [SNS] app's right there!" (Respondent 33)
	Content exchange	Action possibilities to produce and consume socially created content across the technology platform	"Because I have so many friends on there that there's never a time where their stories aren't new" (Respondent 33) "The funny videos, memes… seeing other people's pictures that I can't see [elsewhere]… it's mainly the content" (Respondent 44)
	Social entertainment	Action possibilities to leverage the technology platform to provide a pleasant and fun personal experience that is deeply rooted in social interactions	"[P]osting more stories on Instagram you get more reactions from friends that see that story" (Respondent 44)
Need	Connection	Need to establish a social association (James et al. 2017, Karahanna et al. 2018).	"I didn't want to have the sensation that I will be losing touch with these individuals" (Respondent 52)
	Self-Expression	Need to disclose information about self (Pierce et al. 2003)	"I needed to figure out my online brand and see if it was of value to me" (Respondent 51) "[I wanted] to stay in touch… with my followers" (Respondent 50)
	Information	Need to retrieve general or personal details (Hjørland 1997)	"It's definitely not entertainment … maybe a need because it's more information that is available now so everyone's more informed, so I need to be as informed as others." (Respondent 51)
	Belonging	Need to be part of a social group (Baumeister and Leary 1995)	"[One needs] to feel part of something bigger." (Respondent 52)
	Escapism	Need to temporarily forget real-life stress and problems (Hassouneh and Brengman 2014)	"Boredom. When I'm bored, I go on Instagram. … or I have something I have to do but I don't want to do it… First thing I would do is … get on the Instagram." (Respondent 44) "It's a way to occupy my hands and my mind." (Respondent 52)
	Pleasure	Need to maximize feeling good (Epstein 1998)	"To share more… it feels good" (Respondent 44) "I would go on Instagram just to see [something I like]." (Respondent 44)
	Social Interaction	Need to socialize with others (Karahanna et al. 2018)	"We would chat on the [SNS] app, but not to people I would talk to in person." (Respondent 33)

Figure 2. (Continued)

	Validation	Need to receive others' attention, recognition, and acceptance (Marshall et al. 2015)	"[The drive to] show to 'friends' what a good time you're having." (Respondent 33) "[Getting reactions on one's content], that's encouraging actually." (Respondent 44) "Getting 'likes' on facebook was fun, at first, but truthfully now they're necessary. If I post something and I don't get enough 'likes', I freak out -kind of like I just made the worst mistake in the world." (Respondent 31)
	Novelty	Need to seek new experiences that provide higher levels of rewarding stimulation (De Jonge et al. 2018)	"Because I have so many friends on there that there's never a time where their stories aren't new." (Respondent 33) "The content got more and more interesting, the fact that I follow more pages that I have an interest in."(Respondent 44)
Control		Ability to correct one's IS use behavior based on perceived cues, cognitive processes, and contingent consequences	"[Work and studies] are sometimes interrupted by my use, but no impact on productivity … Sometimes when I study, I would use an app blocker [hinting successful control] and I would put my phone in a different room… to cut out the access point." (Respondent 51) "I went on [university] exchange, I took a lot of pictures but then I didn't post them. I think it is important to regulate it, the use. Like not to go in the extremes… you can do Facebook a lot, but not spend a whole day on it."(Respondent 50)
Connectors	Enabling	Providing action possibilities for an individual in relation to one's IS use (Karahanna et al. 2018)	"I start getting all of these Friend Suggestions [SNS feature]: Tony from high school… I haven't seen this guy in 20 years. There was Sarah and Paul. This was like a high school reunion. … Amazing!!!" (Respondent 29)
	Motivating	Prompting action possibilities for an individual in relation to one's IS use (Karahanna et al. 2018)	"The allure of 'likes' gets us posting things to our friends … the ability to post is a powerful thing." (Respondent 97)
	Actualizing	Leveraging an action possibility to enact the IS use behavior (Strong et al. 2014)	"Connect[ing] with existing friends and family …, maintaining my profile [have enabled me] to be in the know … for school and work. It's easier than texting for me." (Respondent 55)
	Fulfilling	Satisfying a need through IS use (Karahanna et al. 2018)	"[P]osting more stories on Instagram you get more reactions from friends that see that story. [It becomes] so easy to get satisfaction!" (Respondent 44)
	Informing	Sensing information in relation to one's IS use (Buckland 1991)	"I compare all the time. I was looking at the activity of other people, other users, in terms of how many connections they had, how active they are… to measure my performance at building my … network. … I was probably evaluating whether I should or not be more active in terms of publishing content." (Respondent 51) "I'm aware my friends use Facebook more… They're more implicated than me. I see how much they post, when."(Respondent 50)
	Influencing	Having an effect on subsequent IS use	"Over time you compare yourself so much, your behavior changes, but gradually… if no one was active on [the SNS], I probably never would've been active. So it had an influence over me but it was not like 'I had to be like them'… there was a general trend of following what the others were doing." (Respondent 51)

was very difficult to do) without SNSs. The visibility affordance, for an individual, represents action possibilities aimed at being seen and reached effortlessly across a social context. Motivated by one's need for connection, information, and self-expression, one's virtual presence is enabled by the ability to create and update an SNS profile via features, such as "profile creating/updating" (for a complete list of features, see Table G1 in Online Appendix G). As one of the respondents put it, "[s]ince I created a profile, I have been continuously curating it with my life and interests, especially my Facebook profile picture is usually a recent photo taken during the past month" (Respondent 25). The actualization of visibility affordance appears particularly prevalent as individuals use technology to establish and enhance their presence in the virtual world.

Several SNS users mentioned that once they were visible in their SNSs, they quickly found colleagues, old classmates, or friends with whom they had lost touch. It is in this context, and motivated by the same need for connection, information, and self-expression, that individuals actualize the connectivity affordance enabled by specific SNS features, such as the "search" toolbar, the "follow" button, etc. The possibility of using the technology to connect the user to other individuals enables users to establish virtual connections, sometimes mirroring offline relationships. Multiple respondents highlight the connectivity affordance in similar ways to Respondent 13, namely, that "I found some of [my relatives] and it was so interesting for me, so I kept searching for people, for relatives that are not in the same country." Thus, our data suggest that the connectivity affordance actualizes into use aimed at establishing and maintaining social connections. As users gain visibility among friends and colleagues or experience a higher degree of connection, their IS use becomes repetitive. Through repeated use, users become increasingly familiar with additional action possibilities aimed at enhancing visibility and connectivity. This spiraling use emerged in a number of accounts, with one respondent recognizing that "I was using it less early on than I do now, because there was nothing to do and … less people … then, I use it a lot more and … I started adding more people, there are so many different things to do" (Respondent 17).

The actualization of visibility and connectivity affordances does not appear problematic or associated with negative consequences per se. Many individuals characterize their use of the technology as purposeful in that they use the technology when necessary (e.g., posting or responding to a message, scheduling an event, etc.) A qualitative assessment of users' behaviors at this phase reveals *nominal* use:

> [Facebook] is a commodity; it's practical to have [it]. It's not a source of pleasure. It's a communication device, like the telephone. … [As an international student], it's

> my way to keep in touch with family and friends back home, to link up with colleagues here. (Respondent 50)

Our observation of nominal use is consistent with the prior view of *healthy* hedonic IS use for an expressed goal that takes a reasonable amount of time and is free of cognitive or behavioral discomfort (Vaghefi et al. 2017). Although nominal use does not appear to be problematic, we found that users' *ability to control* their use helps distinguish between individuals who progress toward eventual addiction and those who continue nominal use behaviors. Our data suggest that when users interact with an SNS platform, they sense information about their use by implicitly or explicitly monitoring their behavior. Such information is self-perceived and relates to the extent and frequency of one's use, for instance, an average of 62.7 minutes and 8.2 times per day, as per Round 3 data on users exhibiting nominal use. As one of the respondents put it, "I was using it … maybe an hour a day. I … had less access and the usage was limited to when I needed to do something. … I'd go days without checking Facebook, and there would be no problem" (Respondent 14). Given an awareness of the nature of their use, individual users seem to compare it against certain criteria, whether they are related to internal (e.g., personal beliefs) or external measures (e.g., peers' usage or society values), in order to assess the appropriateness of their behavior. The assessment of their behavior against said criteria helps users gauge whether their behavior is in line with their perception of nominal use, and whether a problem exists as a result of their use. As Respondent 26 indicates, "[w]e all started using it. It was socially accepted to spend this much time on Facebook. I was using it less, probably because I didn't have a smartphone."

Where a discrepancy was observed, our evidence suggests that some users exhibit behaviors aimed at moderating one's subsequent use behavior and keeping it within perceived boundaries for control; we label such efforts *successful control*. Nonetheless, in several instances, users failed to regulate their use behavior; we label such efforts *unsuccessful control*. In the case of respondents that show nominal use initially and continue to do so, their use of SNSs has been and continues to be purposeful and context appropriate. They are individuals who, regardless of the platform used, report frequencies of use and time spent on the platforms to similar levels between the present and when they started using. Their accounts do not reflect an urge or dependency on technology use, and there is no evidence of frequent repetition or excessive use in their interaction with the SNS. They are mindful of their use and how it aligns with the purpose of using the SNS, and they consider how their use compares with that of others.

The chains of evidence included in Vignette H1 of Online Appendix H provide complete narrative accounts of users exhibiting and, most importantly, maintaining nominal use, over time. The quotes speak to specific needs "to connect" (Respondent 55); "to stay in touch … with my followees" (Respondent 50), motivating salient affordances aimed at updating, enhancing, or maintaining one's profile (Respondents 50 and 55), and "[connecting] with friends back home, while being elsewhere" (Respondent 55). The actualization of these salient affordances into nominal use helps fulfill the expressed needs without the users reporting a higher frequency of use, even after many years of use (Respondent 50) or "negative impacts" in relation to use (Respondent 55). Interestingly, these complete narratives underline conscious efforts at curbing one's nominal use by comparing with others (Respondent 55) and purposefully "tak[ing] a distance with social media … to be in the *real* [respondent's emphasis], to be present" (Respondent 50).

As opposed to Respondents 50 and 55, it is the inability of certain individual users to regulate their IS use that, in conjunction with next phase's salient affordance, influences the type of use an individual exhibits next, namely, compulsive use. Our observations resonate with empirical observations showing that deficient self-control promotes compulsive behaviors (LaRose et al. 2003), with respondents also underscoring the role of the technology's availability in facilitating the high frequency and repetitive nature of their behaviors.

Compulsive Use Phase

Once again, although a range of affordances are available to users, the affordance of *availability* emerges as the salient action possibility for those individuals unable to regulate their IS use during their nominal use phase. Motivated by needs for escapism and belonging, this affordance reflects the action possibilities related to the readiness for use of the technology platform. We found that users get a sense of continuous and uninterrupted presence in a virtual world enabled by applications running on a multitude of devices, ranging from desktops and laptops to smartphones and tablets, leading to an increase in the extent and frequency of use. Interviewees point out that such real-time access to SNSs shapes their use, so that ready access paves the way for longer and more frequent interactions with the technology. As respondents indicated,

> Facebook is the ultimate time suck; I was on it all the time … this was especially easy since I got the app installed on my smartphone. (Respondent 93)

> I had limited computer access when I was younger [but later] I lost myself through spending too much time with this Facebook crap! I had it on my phone, on my iPad and my laptop and could access it anytime, anywhere. (Respondent 87)

By frequently actualizing the affordance of availability, users' behaviors go through a substantial change

that differentiates them from nominal use. Our analysis shows that these behaviors can be described as *compulsive*, which is when users experience an urge to use the technology (James et al. 2017). In such a situation, users tend to interact frequently with the technology by repeatedly and needlessly checking their SNS. We label this behavior compulsive use:[9]

> I am like some people, who just *really* enjoy surfing it, seeing those photos and seeing what people are doing on Facebook. (Respondent 17; respondent's emphasis)

> The moment I feel bored, or uncomfortable, I … check my feed or play a quick game. Sometimes, it gets too much, like I may check … 20 times [in one hour], every few minutes! (Respondent 4)

This was consistent with recent conceptualizations of compulsive behaviors as highly repetitive, chronic behaviors that are stimulus oriented (Wang and Lee 2020). Users exhibiting compulsive use showed the need to escape reality by responding immediately to a received message or notification. Others pointed out that they tend to check their SNS platform even when there is no notification of a relevant event happening. As one of the respondents pointed out, "I have to check Facebook, because I receive the notifications on my cell phone. It's always near me then I hear the notification … for instance, I'd check … and see that there is no message although I thought there is one!" (Respondent 14). In other cases, users experienced a feeling of missing out or even anxiety when not interacting with and being away from technology, with some echoing that "I will go crazy, if I … can't check my Facebook … I feel uneasy without it" (Respondent 3).

There is evidence that throughout the enactment of compulsive use, with the drive to respond immediately as well as the fear of missing out and anxiety, individual users are nonetheless aware of the nature of the use. In the words of one of the respondents exhibiting compulsive use, SNS use took up "too much time at some point" (Respondent 34). This reflection on the nature of their use at a moment in time indicates the ability of some individual users to be aware of the extent and frequency of their use with some self-reporting usage of an average of 85 minutes and 12 times per day, as per Round 3 data on users exhibiting compulsive use. However, what can be interpreted as deficient awareness of the nature of their use has also emerged in the interviews, with individuals failing to provide an accurate assessment of their compulsive use.

> I am always on Facebook … I can't go more than 20 minutes without picking up my phone. I have to keep checking it. I may spend half of my workday on Facebook. (Respondent 53)

> I was staring down at my phone so much that I caused myself a neck pain. I had forgotten what it felt like to look up and around. People had to tell me to put it [Facebook] away and every time they did, I'd get angry! (Respondent 13)

Among individuals that were able to assess the extent and frequency of their compulsive use, there was evidence of some who assessed their use of the technology vis-à-vis the behavior of their peers, such as classmates and friends, or with their perception of acceptable social norms and standards for use, in a bid to control their behavior. In such cases, although they became aware of the compulsive nature of their use, they considered the behavior to be in line with nominal use by denying the urge aspect of their use behavior:

> I can see all my friends that are online through mobile at all times. I cannot judge, because I'm no different than them. … Most of them use it the exact same amount. … I don't know if they check it on their phone or Facebook at other times, but I know when I'm with them. It is how it is now. (Respondent 15)

Finally, evidence suggests that even when individuals adequately look at the nature of their use and assess it against a certain threshold that suggests compulsive use, some users fail to exert the necessary efforts to modify use and to control their compulsive use behavior:

> I tried to make conscious efforts not to let [SNS use] take over my life, but I slipped. (Respondent 24)

> I feel I should cut back, it's like it's become too much of a distraction and I just find myself going back to it time and time again although I can't imagine not using it or use it less! (Respondent 16)

> I tried cutting it, but it's impossible not to be part of this and not checking it [SNS]. (Respondent 34)

In the case of respondents that show compulsive use, although their motivation may have initially had a purposeful basis, for instance, to connect with others, it was often mixed with more hedonic use elements. They are individuals who, regardless of the platform used, report increased levels in their frequencies of use and time spent on the platforms when compared with their earlier interactions. Their accounts sometimes reflect a behavioral automatism or "the automatic performance of well-practiced actions" (Wigley 2007, p. 209) accompanied by the frequent repetition of their interaction with the SNS. Nonetheless, there appear not to be significant negative impacts of their use with respect to their productivity, well-being, or social life. In their progression from how they used the SNS initially to how they are using it at the present time, they have compared their use with that of others. And interestingly, in some cases, there is evidence of certain individuals exhibiting compulsive use that adjust their use to limit the types of activities they engage in.

The chains of evidence included in Vignette H2 of Online Appendix H provide complete narrative accounts of users exhibiting and, most importantly, maintaining compulsive use over time. The quotes reflect specific needs for belonging, "to feel part of something bigger" (Respondent 52), or to escape reality and occupy one's mind (Respondents 46 and 52), which are fulfilled through the actualization of the salient affordance of availability of the technology platform. As "[i]t's easier [to access], because you have [the app] on your smartphone" (Respondent 52), and "there is always something to do [on the respective SNS]" (Respondent 46), use becomes repetitive, up to "hundreds of times [per day]" (Respondent 52), as "you don't really have to put a lot of energy or thought into it" (Respondent 46). Notably, the actualization of the salient affordance of availability into compulsive use helps fulfill the expressed needs without the users reporting particularly negative impacts, or, as Respondent 52 put it, "I know I use [SNS] a lot, but I know when it's important to cut it off and I actually do it when I want to." The complete narratives underline conscious efforts at curbing one's compulsive use by assessing one's use (Respondents 46 and 52) and turning off notifications and locking up the smartphone (Respondent 46) or physically going to places where smartphone use is prohibited (i.e., libraries; Respondent 52).

Thus, to avoid progressing toward addiction, an individual's awareness of their compulsive use and their capacity to assess it adequately and to keep it within certain boundaries in terms of frequency is critical. Failure at self-control, whether because of unawareness of one's compulsive use or inability to compare it against accepted social norms and standards for use or to adjust one's behavior, will influence one's future use. This observation resonates with extant literature showing a lack of self-control influences subsequent addicted behaviors (Lalande and Ladouceur 2011). In conjunction with lacking self-control, our data show that respondents point to the technology's social entertainment and content exchange affordances as key enablers of continued and excessive interaction with the technology, despite emerging negative consequences, a sign of addicted use.

Addicted Use Phase

Associated with individual users' failure to successfully control their compulsive use, their needs for social interaction, pleasure, novelty, and validation act to motivate two affordances that are salient for those exhibiting addicted use, namely, content exchange and social entertainment. Content exchange reflects the action possibility to produce and consume socially created content across an SNS, by taking advantage of features that enable users to exchange status updates, media files, and individual or group messages in order to meet their needs for social interaction and novelty. In the words of Respondent 15, "I now use it as a source of information on and by friends. … Facebook is more informative in its daily use. People share articles or updates about their life."

In addition to the generation and consumption of social content, social entertainment is another affordance identified by respondents as salient during this phase. This affordance reflects the action possibility for the technology to meet one's needs for pleasure and validation by providing a pleasant and fun personal experience rooted in social interactions. Social entertainment is made possible by built-in applications for online social games, music, and video streaming with social feedback, as well as chat services. Because the entertainment experience provided by SNS platforms happens through interactions with other users, the experience is intrinsically social and interactive. As Respondent 87 indicated, "[t]here's comfort in knowing that friends are entertained by status updates, that they appreciate my views on society and life and that they 'like' and endorse our way of thinking."

In the case of SNSs, the technology offers near limitless opportunities for content exchange and social entertainment. Our interviewees mentioned that they engage with technology excessively to catch up with what is being posted on their feeds, which, by design, provide a near-infinite stream of content to the user. This nonexhaustible source of novelty is reinforced by interactive features enabled by synchronous communication and time-limited content, such as stories. As stated by Respondent 18, "I usually go to bed with it. I keep checking my emails and Facebook or playing games with friends who are up and online on the network. … I just play till I'm really tired."

When users actualize content exchange and social entertainment affordances, evidence suggests that their use can often be described as addicted use, whereby there is a need to use the technology, excessively and compulsively, for instance, for an average of 95.6 minutes and 17 times per day (as per Round 3 data on users exhibiting addicted use), despite negative consequences. Adverse outcomes, whether immediate or longer term, include, as mentioned by several individuals, that hedonic IS use takes priority over other tasks, involving loss of productivity or lower physical and psychological well-being:

> It [Facebook] distracts me from studying and sometimes a simple assignment can take twice as long because of that. I look at the notes and I'm thinking I have to check my inbox right now. … I go to check the messages, I end up playing a game, reading news and I totally forget I had to study for class. (Respondent 5)

> I think that it definitely kind of takes away from their experiences in the real world. I think that spending a lot of time kind of in a virtual world takes away from actual personal development and ability to deal with things in the real world. (Respondent 25)

Respondents that show addicted use, although they exhibit some similarities with those showing compulsive use, are nonetheless differentiated by the negative impacts that their use has on their work/study performance, well-being, and social life. Their initial, purposeful motivation behind their use of the social networking site has evolved into a use driven by urge. Their frequencies of use and time spent on the platforms when compared with their earlier interactions are higher. In progressing toward addicted use, the respondents account for certain episodes where they compared their SNS use with others' use. The results of these comparisons, however, were generally dismissed and otherwise not acted upon in a way to adjust and control one's use.

These observations are reflected in the chains of evidence included in Vignette H3 of Online Appendix H, which provide complete narrative accounts of users exhibiting addicted use. The quotes reflect needs for validation, "showing to 'friends' what a good time you're having" (Respondent 33); pleasure, as "[sharing content] feels good … so easy to get satisfaction" (Respondent 44), or novelty, as "there's never a time when [the contacts'] stories aren't new" (Respondent 33). These needs are fulfilled through the actualization of salient affordances related to content exchange ("the funny videos, memes … seeing other people's pictures that I can't see elsewhere" (Respondent 44)) and social entertainment ("posting more stories … you get more reactions" (Respondent 44)) into addicted use. Notably, with addicted use, as opposed to compulsive use, one notices an inability to halt the behavior as it becomes "almost like an instinct" (Respondent 33), "like a reflex I can't control, I don't think about it, I just do it" (Respondent 44), despite negative consequences, such as insomnia and lower academic performance (Respondent 33) or anxiety and lack of concentration (Respondent 44).

All in all, the process of developing an addiction to hedonic IS use unfolds across three phases, each corresponding to a type of use. Although a whole range of affordances (e.g., visibility, connectivity, availability, content exchange, and social entertainment) is always available to users, salient affordances are actualized at different times into nominal use, and in conjunction with failed self-control, into compulsive use and addicted use. Thus, faced with different types of use, the individual's successful—or unsuccessful—control mechanism helps explain the individual trajectories toward addiction. For instance, evidence suggests that a user will have a self-perceived awareness of the extent and frequency of one's use. Given this awareness, the individual evaluates it against internal (e.g., personal beliefs) or external (e.g., peers' usage) benchmarks to ascertain the appropriateness of one's IS use. Considering this assessment, behaviors aimed at moderating one's subsequent use may be taken.

Discussion and Conclusion

Prior research has recognized the importance of individual needs (e.g., extrinsic or intrinsic) to enact IS use (Agarwal and Karahanna 2000, Van der Heijden 2004). The findings have, for instance, shown that use of a hedonic system could be driven by individuals' needs for enjoyment, pleasure (Wu and Du 2012), efficacy, having a place, or self-identity (Karahanna et al. 2015). Moreover, satisfying psychological needs, for example, for social interaction (Zhang et al. 2014, Yang et al. 2016), escapism (Xu et al. 2012), or belonging (Zhu et al. 2015), was linked to addiction in several contexts such as internet browsing (Hawi 2012), smartphone use (Chen et al. 2017), online gaming (Xu et al. 2012, Zhu et al. 2015), and SNS use (James et al. 2017; see Online Appendix A). Our examination of individual needs during one's trajectory toward addiction was consistent with these findings. Although we did not intend to provide a comprehensive treatment of all individual factors or to replicate these results, an effort best left for variance-based research, our model showed how different individual needs influence hedonic IS use addiction development. We extended the knowledge of individual factors underlying addictions by illustrating how needs motivate different salient affordances, which were actualized into nominal, compulsive, and ultimately, addicted use. Once actualized, hedonic IS use fulfills the specific needs that triggered those behaviors.

The findings also provided a contextualized view of affordances, in relation to their evolution over time and type of IT artifact, during hedonic IS use addiction development. The affordance lens and the NAF perspective facilitated our theory development related to the interaction between individual-related (i.e., needs) and technology-related (i.e., features) factors during the development of hedonic IS use addiction. Whereas research has shown how specific affordances shape, at a moment in time, individual behaviors such as social media use (Karahanna et al. 2015), socialization (Treem and Leonardi 2012), knowledge sharing (Majchrzak et al. 2013), or media choice (Jung and Lyytinen 2014), our findings speak to the evolution over time of salient affordances of a particular type of IT artifact, namely, SNS. We showed that although a whole range of SNS-specific affordances (e.g., visibility, connectivity, availability, content exchange, and social entertainment) are available to users at all times,

only certain of these affordances become salient at different phases of the process model, as they are actualized into nominal, compulsive, and addicted use behaviors.

With affordances being relational constructs, accounting for the features that enable the SNS salient affordances helped us provide a granular view of a specific class of IT artifact (SNSs). Whereas the empirical approach to observing how certain features enable affordances has previously been detailed by Karahanna et al. (2018) for social media platforms, our study has done so *specifically* for SNSs. Our view of features was consistent with Markus and Silver's (2008) notion of technical objects, which refers to the material, technical, and physical properties of an IT artifact and its component parts, including input, output, and the overall user interface. Although features serve to enable affordances, it is the individual needs that motivate the technology's action possibilities, as "an affordance arises from the relation between an object and a goal-directed actor" (Volkoff and Strong 2013, p. 824).

By paying close attention to the interplay between needs, affordances, and features, we help clarify the distinction between hedonic IS use addiction (in an SNS context) and other behavioral addictions, such as gambling or shopping. Despite some similarities and common symptoms like withdrawal and relapse (e.g., Young 1998, Serenko and Turel 2020), hedonic IS use addiction is distinct from other behavioral addictions due, in part, to the ubiquity, affordability, and accessibility of the IT artifact (Turel and Serenko 2010). The presence of the IT artifact is why prior process-based findings are limited in their ability to provide insight into the process of hedonic IS use addiction development. By explicitly accounting for the role of affordances, as enabled by technology features, our findings thus underline the distinct role of the IT artifact in the development of addiction and complement the extant literature.

Toward a Process Model of Hedonic IS Use Addiction

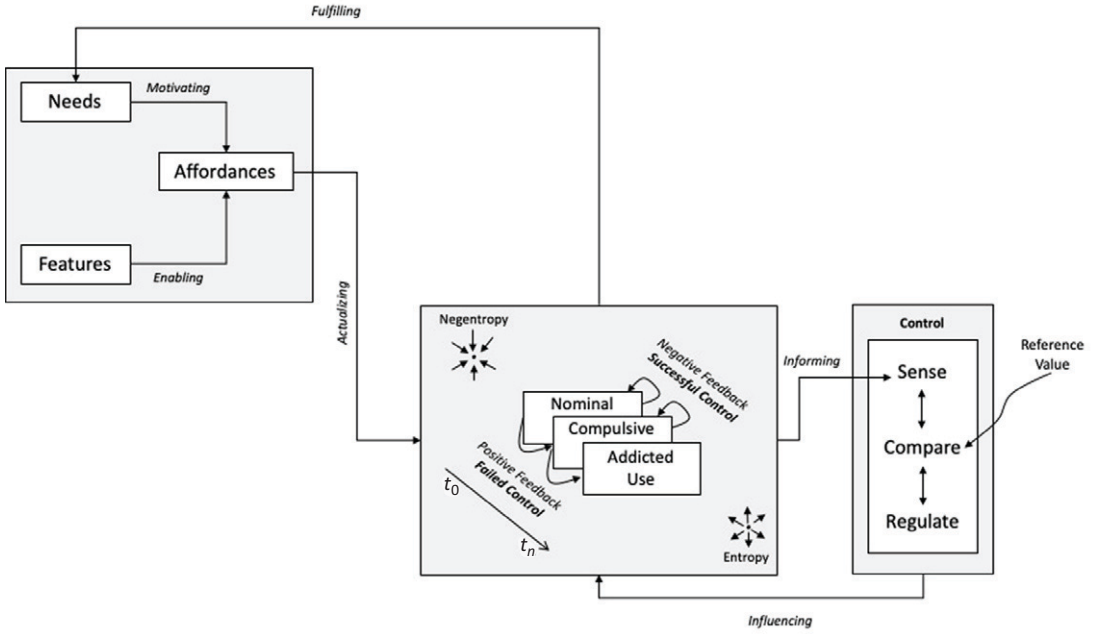
The process model we propose in Figure 3 offers a synthesis of previously discussed theoretical observations related to needs, affordances, features, use behaviors, and behavioral control that are consistent with our findings reported earlier and helps explain the path to hedonic IS use addiction. In light of the observation that for a theoretical contribution, the *why* criterion addressing the "dynamics that justify … the proposed causal relationships" (Whetten 1989, p. 491) is particularly important, our model offers a generalized view of hedonic IS use addiction development.

To begin with, the process model reflects how the interaction between needs, affordances, and features plays a role in relation to the use behaviors exhibited by certain individuals on their trajectory toward addicted use. The process model particularly points out that it is not entirely the hedonic technology and its features that determine the type of use being exhibited, but it is the way in which individual users leverage the action possibilities afforded to them by the technology to satisfy needs that motivated their hedonic use in the first place. The directions in which our original findings extend prior research relate to, first, the specificity and, second, the saliency of needs, affordances, and features over time, as individual use behaviors evolve toward addiction, in an SNS context.

The central role played by the individual user in the development of addicted use is highlighted by our results related to one's *control over use*. Defined as the ability to correct one's IS use behavior based on perceived cues, cognitive processes, and contingent consequences, control grants an individual the opportunity (but not the certainty) of moderating one's IS use behavior. Based on the findings, we argue that it is in conjunction with specific salient affordances that unsuccessful control plays an important role in developing hedonic IS use addiction, whereas successful control inhibits its development. The process model thus shows that underlying the development of hedonic IS use addiction is an increasingly compromised control mechanism. Failure to interpret accurately the nature of one's use and its impact on oneself (sense), to benchmark one's use against an internal or external benchmark of use serving as a reference value (compare), and/or to adjust one's behavior in response to the benchmarking effort (regulate) hampers an individual's effort to control one's subsequent behaviors. Alternatively, when considering the progression through the various phases toward addiction, we had examples where individuals described their use in ways that could be categorized as nominal use over extended periods of time given successful awareness of one's use, assessment of the appropriateness of one's use, and regulation of one's subsequent use. Although SNS affordances like availability, content exchange, and social entertainment are available to these individuals, they are not salient when it comes to their actualization into use. Such control over one's use, as our findings suggest, indicates that there are users who will not progress to the later phases of addiction development. Indeed, prior studies show that only about 20% of users show symptoms of addicted use (Turel and Serenko 2010, Vaghefi et al. 2017).

Extant literature on cybernetic theory (Ashby 1961, Carver and Scheier 2001) that has studied the role of control in regulating human behavior provides conceptual support for our empirically driven insights. Although, arguably, regulating human behavior is more complex than regulating ambient temperature via a thermostat,[10] the logical sequence of the elements

Figure 3. Process Model of Hedonic IS Use Addiction Development



Control	Sense	Awareness regarding the extent and frequency of one's technology use
	Compare	Evaluation against a reference value to ascertain the appropriateness of one's technology use
	Regulate	Behaviors aimed at moderating one's subsequent technology use
	Reference Value	Self-perceived standard of use (e.g., when to use, for how long, social circumstances of use, etc.)
Feedback	Positive	(Unsuccessful) or no interventions aimed at reducing the discrepancies observed between one's use and the reference value.
	Negative	(Successful) Interventions that reduce the discrepancies observed between one's use and the reference value
Entropy	User trajectory that tends towards addiction	
Negentropy	User trajectory that tends towards normalcy[a]	

Note. Certain elements appearing in the process model, such as the needs, affordances, features, types of use, and connectors have been conceptually defined and detailed earlier, along with empirical support, in Figure 2.

[a]Normalcy (noun) is the state of being within certain limits that define the range of normal functioning (https://www.vocabulary.com/dictionary/normalcy).

of control is similar. First, self-perceived or objective information related to the enacted use behavior is relayed to an individual through one's environment of use (e.g., observing others' use, receiving feedback from other users and peers, reading an iOS Screen Time report, etc.). Second, if one's extent or type of use departs from a reference value, often a self-perceived standard of use (e.g., when to use, for how long, social circumstances of use, etc.), by a discriminable amount, it makes one aware of a discrepancy between one's use and the standard of use. Third, because of such discrepancies, regulatory interventions may be enacted (e.g., muting alerts, delimiting a specific time of use, uninstalling the SNS app, etc.), which would act to diminish or eliminate the separation between one's extent or type of use and the standard of use. Such regulatory interventions effectively act as negative feedback loops (Carver and Scheier 2012), keeping one's use behavior on a trajectory that, over time, tends toward normalcy (i.e., negentropy). The corollary to this explanation is that in the case of individual users that experience deficiencies in either sensing, comparing, or regulating, this will entail a failure of control acting as a positive feedback loop (Carver and Scheier 2012) in relation to one's use. Acting in conjunction with salient affordances, such as availability, content exchange, and social entertainment, the lack of control over one's use will shape an individual's progression toward addiction (i.e., entropy), where use can be considered out of control.

Last, it should be noted that the relationship between sense, compare, and regulate is not sequential, but rather reciprocal and simultaneous (as shown in Figure 3 via the double-headed arrows). One does not stop sensing as one undertakes regulatory action to delimit a specific time of use, for instance, to control one's technology use. Control is thus continuously cycled among its three components so that sensing, comparison, and regulatory interventions are enacted in an ongoing fashion.

Contribution to Research

This study contributes to extant research in three ways. First, our primary contribution is a three-phased process-based view of hedonic IS use addiction development. Building on the NAF perspective (Karahanna et al. 2018), our findings reveal that, in the first phase, driven by needs for connection, self-expression, and information, which motivate salient affordances of visibility and connectivity, users initiate their interaction with the SNS in ways that could be characterized as nominal use. In the second phase, as needs evolve to include belonging and escapism, the salient affordance of availability in conjunction with one's failure to control his or her nominal use is actualized into compulsive use. Finally, in the third phase, having failed to control one's compulsive use, needs for pleasure, social interaction, validation, and novelty motivate salient affordances of content exchange and social entertainment, which are then actualized into addicted use, with evidence of negative consequences. Whereas our model used the tenets of NAF for theorizing about hedonic IS use, our process model provides a unique longitudinal overview of the temporal importance of varying needs, features, and affordances during the process of addiction development. Overall, these findings resonate with process models of addiction development from psychology and marketing research (Koob and Le Moal 2008, Brand et al. 2016), depicting a gradual emergence of individual behaviors via phases (or stages) and showing how everyday nonproblematic behaviors can morph into addictions with harmful consequences. Our findings also support the implication of these process models that various physiological, psychological, or contextual factors (e.g., genetic comorbidity or marketing cues) can contribute to behaviors forming and evolving across phases (Grover et al. 2011, Martin et al. 2013). Yet, our results extend the process-based understanding of addiction development to the context of hedonic IS use. Our study shows how interactions between individual-related (e.g., needs) and technology-related (e.g., features) factors enabling affordances, which are unique to our context, explain the eventual evolution from nominal to compulsive to addicted use.

In line with our research question, our process model provides complementary but important insights into the dynamics of hedonic IS use addiction development, which extends current IS research (Turel et al. 2011, Kwon et al. 2016, Venkatesh et al. 2019). Based on robust analyses of primary and secondary data gathered through multiple rounds of data collection and analysis, our model provides a longitudinal perspective of the mechanisms involved in hedonic IS use addiction development. It establishes the temporal changes in the key elements' (i.e., needs, features, affordances, type of IS use, and control) saliency and interactions that influence addiction development. This adds critical insight to extant knowledge, given that, until now, the existing variance models have provided snapshot views of addiction by establishing associations between predictors (i.e., antecedents of addiction) and dependent variables (addiction behavior; e.g., James et al. 2017, Venkatesh et al. 2019). Assuming that variables and their properties do not change over time, these studies typically utilized cross-sectional surveys to test the hypothesized associations empirically. In this way, variance-based studies have limited ability to confirm the sequence and the direction of these associations (Paré et al. 2008). Accordingly, there have been recent calls to provide a longitudinal and processual view of IS use addictions (Venkatesh et al. 2019). From this perspective, our study provides a response to such calls. In addition, our process model provides a detailed account of the relationship between *user* and *technology* characteristics, which have been shown to be two key components of addiction (Quiñones-García and Korak-Kakabadse 2014). This was important given that most of the previous studies considered these components independently and in isolation (see Online Appendix A). By considering both the user (through needs, behaviors, and deficient control) and the technology (through features) and their relationship (through affordances), our process model integrates these two streams of research and shows how addiction develops through the interactions between a user and a technology (e.g., an SNS).

Second, our qualitative and quantitative analyses provide a detailed conceptualization of three types of use, that is, nominal, compulsive, and addicted use. Our results, in this way, showcase earlier contentions stating that various groups of people may show different interactions with an artifact, which lead to distinct behaviors and experiences (Leonardi 2013). This view is in contrast with the treatment used in many variance-based theories that typically consider users' interactions with an IT artifact without making a distinction about the type of use (DeSanctis and Poole 1994, Leonardi 2013). These results add to our understanding of behaviors in the realm of the dark side of

use (Turel and Qahri-Saremi 2016, Vaghefi et al. 2017, Venkatraman et al. 2018, Gerlach and Cenfetelli 2020). For instance, recent results have highlighted use behaviors, such as high engagement (i.e., frequent use of IT with a low to medium level of dependency and self-regulation; Turel 2015, Vaghefi et al. 2017), problematic use (i.e., impulsive, inappropriate, sometimes risky use of IT; Turel and Qahri-Saremi 2016), and IT-mediated state tracking (i.e., constant checking for information to fill a perceived knowledge gap; Gerlach and Cenfetelli 2020), that are distinct from addiction behaviors. Through our analyses, we extend this knowledge by distinguishing between nominal (a purposeful and context-appropriate use of hedonic IS), compulsive (frequent use that is urge driven), and addicted use (excessive and compulsive interaction with the technology despite negative consequences). Beyond the added conceptual clarity (Suddaby 2010) brought forth in relation to nominal, compulsive, and addicted use, we have also established empirically the cutoff points between nominal, compulsive, and addicted use based on the Turel et al. (2011) measure of technology addiction. This contribution will allow for a more precise and accurate interpretation of future quantitative data on technology addiction collected via this instrument.

Third, our results add to the domain's understanding of the role of control in explaining the development of hedonic IS use addiction. The role of self-control or self-regulation as an important driver of hedonic IS use addiction has received attention in prior research (LaRose et al. 2003, Mehroof and Griffiths 2010, Soror et al. 2015). We complement that extant literature in two ways. First, we show that there are different points in time when control can prevent one's progression toward hedonic IS use addiction. This control can be *preexisting*, as seen in the case of individuals that exhibit nominal use and maintain it over time, or *can be developed*, as evidenced by those users going from nominal use to compulsive use but then maintaining their compulsive use without progressing to addicted use. We thus show how successful control exhibited during nominal use or compulsive use prevents the development of addicted use. Second, we show that control explains only partially the addiction development, or lack thereof. Our evidence shows that it is unsuccessful control *in conjunction with* salient affordances related to availability, content exchange, and social entertainment that will see an individual continue on a trajectory toward addiction, because it is those affordances that are actualized into compulsive and, ultimately, addicted use.

Our conceptualization of control thus goes beyond the relatively static extant view of control, with continuous measurements ranging from low to high, that has been used in research on technology addiction (e.g., see LaRose et al. 2003, Soror et al. 2015). Leveraging principles of cybernetic theory (Wiener 1948, Ashby 1961), we have detailed the constituent elements of control, namely, sensing, comparing, and regulating. We have provided evidence that shows how individuals alter their usage based on a perceived reference value and how regulatory behaviors enacted in response to observed deviations from it may promote or inhibit one's progression toward addiction. By drawing on key concepts from cybernetics, we help develop an even finer-grained understanding of the role of control in the development of addiction, which helps us see previous work from a more nuanced perspective. For instance, recent research has shown that low (or sometimes referred to as *impaired*) self-control can enable technology addictions (e.g., to smartphones or SNSs; Chen and Roberts 2019, Chou and Chou 2019), excessive use behaviors (e.g., to gaming; Yang and Tung 2007), and higher levels of mobile phone use leading to negative consequences (Soror et al. 2015). Yet, as shown in our model, low self-control may be the result of a lack of self-awareness in relation to one's use, a higher threshold for acceptable use, and/or a lack of ability to correct an out-of-control use behavior. Therefore, treating self-control as a black box may not be an ideal approach, given that each scenario of low self-control is distinct in nature and may require a unique corrective strategy.

Limitations and Future Research

We must acknowledge that this paper has limitations, which provide opportunities for future research. First, our data represent users' perceptions about their behaviors and retrospective accounts of their SNS use. Although this is a common methodological approach and has been used in prior addiction (e.g., Turel et al. 2011, James et al. 2017, Vaghefi et al. 2017) and process-based research (e.g., Beaudry and Pinsonneault 2005, Stein et al. 2015), responses could have been limited by social desirability or recall biases. To minimize these biases, we followed the guidelines suggested in prior studies (Coughlin 1990). For instance, our interviewees were selected based on relevant and appropriate criteria, and their anonymity and the confidentiality of the data provided were safeguarded in accordance with research ethics rules and regulations. Nonetheless, and considering recent research (Gerlach and Cenfetelli 2020) arguing that *constant checking* is not to be construed as addiction and thus implicitly echoing our distinction between compulsive use and addicted use, future work on the development of hedonic IS use addiction would benefit from the use of objective data. Direct observation or the parsing of system logs showing individual use patterns would bypass self-reported assessments by users in relation to the suitability of their own use behaviors and would enhance the internal validity of our findings and process model.

Second, although our findings provide the sequencing of the various phases of hedonic IS use addiction, we do not provide a specific timeframe for each phase. A comparison between the individual narrative accounts suggests that users progress toward addiction at different rates. Additional factors that are beyond the scope of this study may influence this process. For example, the extant literature points to a number of individual and technology-related antecedents of addiction, such as personality traits (e.g., shyness and self-esteem; Caplan 2002, Chak and Leung 2004), the user's moods and emotions (e.g., anxiety and envy; James et al. 2017), physiological factors (e.g., genetic comorbidity; Koob and Le Moal 2008), and sociodemographic factors (Venkatesh et al. 2019). Although our process model captured some of the interplays between individual and technology-related factors by way of needs, affordances, features, and control in shaping one's trajectory toward addiction, we expect that additional factors may contribute to the pace at which an individual may develop an addiction to hedonic IS use. For instance, an individual with a history of depression, when interacting with a social technology or an interactive game with a rapid span of play, might develop an addiction faster than individuals lacking this condition. From this perspective, three promising avenues could be pursued by future research. First, additional individual and technology-related factors (including other needs or hedonic IS features) could be integrated into the process models of hedonic IS use addiction. Second, our findings related to the influence of needs, affordances, and features could provide a basis for developing variance-based models of hedonic IS use addiction that account for the maladaptive relationship between user and technology and help establish an individual's propensity to develop a hedonic IS use addiction. Third, identifying specific conditions that contribute to the pace of the hedonic IS use addiction development requires further research.

Third, in line with our research questions, our data collection, data analyses, and theory development were focused on how user behaviors progress from a healthy state of use toward addiction. Nonetheless, it is quite likely that some individuals may be able to go back to a prior state of use, as recent IS research has considered the existence of behaviors such as discontinuance (i.e., quitting; Turel 2015), regressive discontinuance (Soliman and Rinta-Kahila 2019), reduction of use (Osatuyi and Turel 2020), and temporary cessation (Schoenebeck 2014). Although the focus of this paper was not on addiction coping and recovery, an important avenue for future research would rest in understanding how out-of-control addicted use behavior can revert toward nominal use (as a possible desired state), through increased self-control or, as we have shown, a combination of ongoing sensing, comparing, and regulating mechanisms. The implications of such future research could be considerable from a theoretical perspective but also practical, as they would be highly relevant to the treatment and recovery from addiction to hedonic IS use.

Finally, our process model emerged from 101 individual narrative accounts of SNS use. Given that we examined the most common features associated with SNSs and in light of the arguments by Van Den Eijnden et al. (2016) related to the theoretical and practical need to study *families of technologies* (rather than focusing on a particular technology), we believe that our proposed theoretical model and insights are, to some extent, generalizable to other hedonic IS. Yet, further examination of elements unique to each hedonic use context might add to extant knowledge. For instance, addiction to online games or online shopping is likely to develop in a comparable fashion. In all these cases, the interplay between needs (such as escapism, pleasure, or social interaction) and affordances (such as social entertainment), in conjunction with deficient control, enables the progression from nominal to compulsive and then addicted use. We acknowledge, however, that other *context-specific* features, affordances, or needs might become salient during the process. For example, needs for advancement in a game's hierarchy (Xu et al. 2012) or affordances of multiple identities (Jiow and Lim 2012) could be of particular importance to online game addictions. Investigating other types of hedonic IS use addiction provides interesting opportunities for expanding current IS research on addiction.

Contributions to Practice

Overall, from a managerial standpoint, the goal of research on technology addiction is to improve healthy interaction with technology (Turel et al. 2011). Our findings emphasize the understanding of hedonic IS use addiction as the result of a development process. Depending on the phase of development and the types of use being exhibited, various preventive or intervening strategies may prove to be effective at enhancing users' control of their behavior. To enhance the individuals' ability to sense, compare, and regulate their use, these strategies should focus on increasing awareness about use (sense), help evaluate one's use (compare), and nudge users in the direction of corrective action (regulate). As such, our results can inform the IT artifact's design. We showed that features purposefully embedded in technology enable the affordances that play a role in developing hedonic IS use addiction. To reduce the likelihood of addiction development, designers can integrate features that facilitate one's control mechanism, such as easy-to-access usage statistics and monitoring systems (e.g., parental control), to send warnings or to limit actively the amount of daily or weekly time spent on the technology (e.g., setting screen

time limits or daily downtime[11]). Nevertheless, there are recent reports hinting that for-profit technology providers are not necessarily concerned about users' addiction and the likely consequences for their well-being or productivity and may even make it harder for users to control use or quit (Ohlheiser 2018). For instance, Facebook, Google, and Apple have been criticized recently for designing technologies that require maximized attention (Spangler 2018). Although compulsive and addicted behaviors generally translate into more revenue for the technology product and service providers, due in part to the enhanced opportunity for advertising, it is nonetheless important that they provide socially responsible solutions that help users control their use and prevent the development of addiction. Our findings could inform policy makers to regulate the IT industry toward developing more ethical and less addictive technology products and services that consider the welfare of the user.

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Endnotes

[1] Prior research shows that addiction to a system that primarily provides utilitarian benefits (e.g., enterprise systems or Microsoft Word) is not very probable, because users are less likely to develop a psychological dependency to use, a required component of an addiction (Vaghefi et al. 2017). Hence, our scope in this paper includes use of hedonic system or a utilitarian system that also provides hedonic benefits, such as online auctioning systems (Turel et al. 2011). Using a fully utilitarian system thus falls outside of the scope of this paper.

[2] Given the nature of the phenomenon studied, there was the uncertainty associated with the eventual outcome of the users' trajectories (leading to some level of addiction or lack thereof), as well as variations in the pace of the process (as some users may become addicted faster than others). Hence, it would have been difficult—if not impossible—to establish specific and regular time intervals for sequential or longitudinal data collection with our respondents.

[3] College students are shown to be among the most vulnerable group in society to develop IS use addictions because of their specific psychological and developmental dynamics, openness toward technology, ready access to the internet and smartphones, lack of external supervision (e.g., by parents), and available free time (Byun et al. 2009, Vaghefi et al. 2017).

[4] This was consistent with the threshold recommended by the *Diagnostic and Statistical Manual of Mental Disorders* (5th edition) for pathological gambling disorder.

[5] We asked respondents to focus on the SNS they use most frequently (Facebook, 38%; Instagram, 21%; (5th edition) Snapchat, 17%; Others, 24%).

[6] Using multivariate analysis of variance, we assessed the similarities between the independent samples in Rounds 3 and 4. Based on the analysis, no statistically significant differences were observed between the two samples when considering age, gender, type of SNS, extent of use (minutes spent on SNSs per day), frequency of use (number of times per day), and addiction score.

[7] The interviewees consisted of users of Facebook (42%), Instagram (29%), Snapchat (22%), and other platforms (7%).

[8] We emphasize that by focusing on "what is salient?" in each phase, we do not imply that only these affordances are being actualized or only these needs are being fulfilled. Instead, we highlight the affordances (or needs) that emerged from our data analysis as core to a specific type of use (e.g., see Burton-Jones and Volkoff 2017). This allowed us to advance our theorizing of the addiction development process while maintaining parsimony.

[9] Not all individuals who follow nominal SNS use will proceed to develop compulsive use. If, over time, SNS use occurs more frequently and at the same time *is driven by urge*, rather than a reasonable need for use (e.g., to reach a friend), it can be considered compulsive use.

[10] See Carver and Scheier (2001) for such a theory building metaphor (Jaccard and Jacoby 2019).

[11] For example, Apple introduced, via the Screen Time app, control features in the iOS 12 operating system (released September 2018).

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