Directing Technology Addiction Research in Information Systems: Part II. Understanding Technology Addiction

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Abstract

In this second part of a series of articles to direct technology addiction research in the information systems discipline, we discuss the history, conceptualization, and measurement of technology addiction. We admit that it is possible to label the phenomenon as overuse or excessive use as long as it is defined and measured by the presence and the magnitude of the six core symptoms of behavioral addictions: salience, mood modification, tolerance, withdrawal, conflict, and relapse. The advantage of this terminology is that it does not attribute one's problems to helplessness and does not pathologize the behavior, implying that it may possibly be corrected. Nevertheless, we posit that the term technology addiction is currently the most reasonable choice that may need to be adjusted as we learn more about this phenomenon and its potential similarities to and differences from established behavioral addictions. Dependence, obsessive/compulsive use, and pathological/problem use terms should not be used as synonyms for technology addiction as a form of mental disorder. Researchers should not include the name of the IT artifact as the subject of addiction (e.g., "Facebook addiction"). Instead, they should focus on the activity that is mediated through the IT artifact (e.g., "addiction to Facebook use").

Keywords: Mental Disorder; Behavioral Addictions; Technology Addiction; Information Systems.

Introduction

A stunning newlywed couple accompanied by a group of excited bridesmaids and groomsmen exits a picturesque chapel in fabulous Las Vegas. In this very moment, a random observer may expect the bride and the groom to hold each other's hands, look deeply into each other's eyes, repeat the magic words said a few seconds ago, and make promises while the bridesmaids are enviously whispering, and the groomsmen are silently saying goodbye to their dearest friend. Yet, in this perhaps most precious moment of their lives that should be cherished forever, both of them simply pull out their smartphones and start texting or checking messages while completely ignoring each other and their surroundings. A few bridesmaids and groomsmen follow suit, and others confusingly stare at the unexpected scene. At some point, the procession is told to vacate the premises, and they slowly proceed towards the patiently waiting limo while periodically checking their phones. One can only wonder if the marriage lasted.

(This memorable event was observed by one of the authors of this paper in August 2016.)

The dark side of information technology (IT) has recently become one of the major themes in the information systems (IS) literature (Tarafdar et al., 2015; Turel, 2019). For example, there have been several journal special issues and numerous tracks at major IS conferences on this topic, including the International Conference on Information Systems and the America's Conference on Information System (D'Arcy et al., 2014; Tarafdar et al., 2013, 2015; Turel et al., 2019). A growing interest in the dark side of IT stems from the surprising, typically unanticipated, adverse effects of technologies on people, organizations, and societies – effects which emerged parallel to the positive effects of these technologies (Miranda et al., 2016).

One of the major topics discussed within this research stream is technology addiction, which is a specific instance of behavioral addiction. Behavioral addictions refer to a "specific group of mental and behavioral disorders that do not include the ingestion of psychoactive substances" and are defined as a "psychological dependence on repetitive behaviors that feature the core components of addiction: salience, mood modification, tolerance, withdrawal, conflict, and relapse" (Serenko & Turel, 2020, p. 82). In a previous paper, we discussed the concept, history, and evolution of behavioral addictions, explicated the relevant brain circuitry, and explained how behavioral addictions differ from substance addictions (Serenko & Turel, 2020). In this paper, we continue this line of inquiry and specifically focus on technology addiction, defined as maladaptive psychological dependence on the use of IT to such a degree that the six core symptoms (i.e., salience, mood modification, tolerance, withdrawal, conflict, and relapse – see Griffiths (1996a, 2005, 2018)) of behavioral addictions are present, at least to some degree (Turel, Serenko, & Giles, 2011). This definition implies that technology addiction is a continuous variable, the magnitude of which varies based on the presence and/or severity of typical behavioral addiction symptoms in relation to the use of IT.

On the one hand, technology addiction research has been booming, which is a positive sign given the possible detrimental consequences of this new form of potential mental disorder. On the other hand, technology addiction is an atypical IS construct because its conceptualization and measurement rest on knowledge documented outside the traditional IS domain: mostly in psychology, psychiatry, and neuroscience. This may represent a challenge for some IS researchers who would like to engage in technology addiction research because typical IS training does not entail the study of psychiatric disorders and neuroscience.

In this paper, we aim to help IS researchers become more involved (and involved in a more rigorous fashion) in technology addiction research. To do so, we summarize our understanding of technology addiction research. We intentionally include and use the professional psychology, psychiatry, and neuroscience terminology to ensure the application of consistent terminology in IS research. After all, we borrow from over a century of psychology, psychiatry, and neuroscience research on various forms of addictions. Hence, IS scholars can benefit from building on such works and the corresponding terminology, rather than creating an isolated instance of addiction research. However, we acknowledge that such terminology may be difficult to digest. For this reason, we summarize the key terms and their definitions in the Appendix.

The rest of this paper is structured as follows. First, we cover the history of technology addiction research going back to the 19th century. Second, we elaborate on the terminology that relates to technology addiction research, including the concepts of mental disorder, dependence, obsessive and/or compulsive use, overuse or excessive use, pathological or problem use, and addiction. We also present a framework of technology addiction and discuss its definition and conceptualization. Third, we outline measurement approaches and, fourth, propose future research directions.

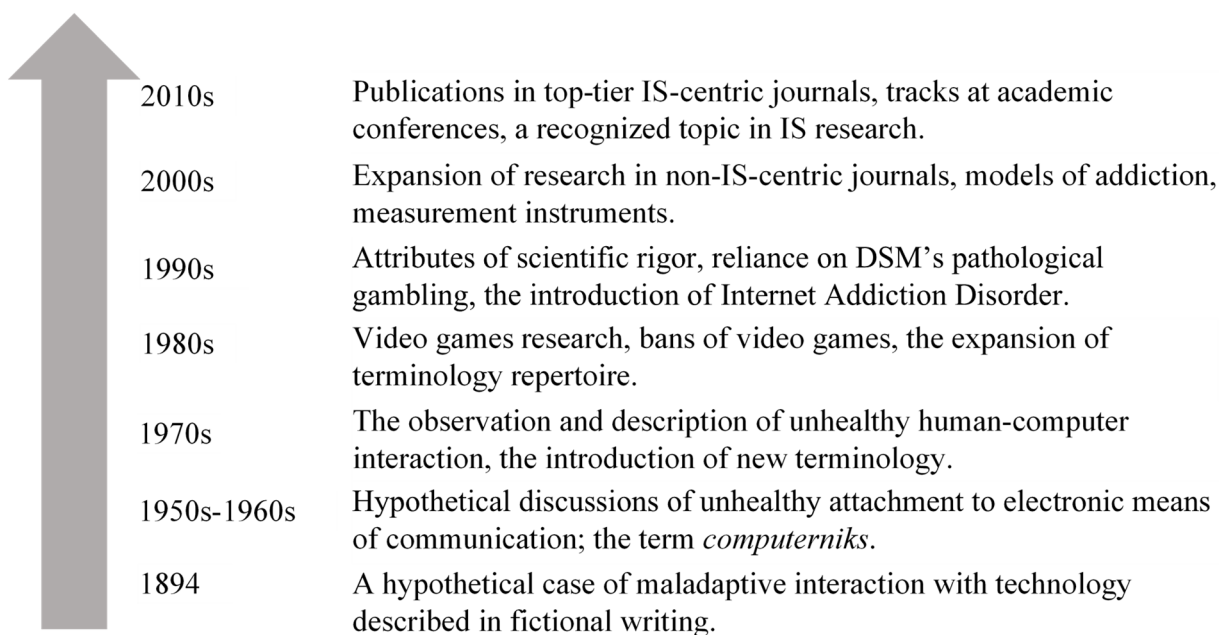## The History of Technology Addiction Research

Concerns about problematic and maladaptive interactions with technology are not new. The first documented attempts to describe them predate the widespread adoption of personal computers (see Figure 1). In 1894, H. G. Wells, a British writer, published a fictional (and somewhat controversial) story of Azuma-zi, a power station worker, who became addicted to the big dynamo machine to such a degree that he started attributing god-like properties to it and engaging in human sacrifice (Wells, 1894/2018). Horton and Wohl (1956) hypothesized that certain characteristics of mass media – radio, television, and movies – may appeal to the psychological needs of vulnerable viewers who may develop *pathological para-social relationships* with real or imaginary characters. Block and Ginsburg (1968) invented the term *computerniks* to describe those who develop unhealthy emotional or even sexual attachment to advanced computer systems. This term was rarely used in the context suggested by Block and Ginsburg, but it was occasionally applied to regular computer professionals (Ilson, 2012).

A more systematic, scientific inquiry into the addictive nature of computer systems commenced in the late

1970s. Leary (1975) used the term *technological addiction* to refer to people's obsession with inventing and employing various technologies and machinery. Weizenbaum (1976) proposed the term *pathologically compulsive programmer* defined as a mental disorder that manifested in the following ways: a tendency to interact with computers for the sake of mere interaction rather than task completion, constant analysis and re-analysis of programming code even when away from a machine, preferences for complex and challenging tasks, an inability to work on non-programming assignments, and striving for perfection. The ultimate goal of a pathologically compulsive programmer was to dominate and control a computing machine – to become its true master. Most importantly, Weizenbaum (1976) considered compulsive programming a form of psychopathology that is similar to compulsive gambling. Thimbleby (1979) emphasized the seductive nature of computers and their ability to mold *compulsive programmers* or *computer freaks* who engage in a neurotic struggle to gain power over the machine. Zimbardo (1980) documented the dark experience of *computer addicts* at Stanford University who spent "their days and nights in the concrete-and-glass computer center playing harmless games and mock-vicious 'wheel wars' on the terminals… [while] losing touch with the human race" (p. 62). Frude (1983) compared *compulsive programmers*, *obsessed programmers*, *computer monomaniacs*, or *computer addicts* to alcoholics who, instead of drinking, may be characterized by their deep affection for the machine, lack of interest in other subject matters, a disturbance of normal habits, and profound social withdrawal.

The 1980s witnessed an emergence of empirical research on the harmful effects of video games. Ross et al. (1982) presented evidence on the *obsessional playing of video games* and accompanying intrapsychic and interpersonal conflicts, and Harry (1983) predicted that more *video game-mania* cases will be observed in the future. Loftus and Loftus (1983) argued that *video game addiction* is a result of a unique aspect of computer technologies that employ the reinforcement of behavior through intrinsic motivation. Video game features – such as an irregular schedule of rewards (i.e., reward uncertainty), a variable magnitude of rewards, a wide selection of rewards, instant gratification upon the completion of behavior, and progressively more difficult levels – alter players' cognition so that they change their priorities to gaming and develop coping strategies to justify their choice and avoid cognitive dissonance. Loftus and Loftus (1983) also proposed and applied three classification criteria to identify *video game addicts*: 1) Is the behavior good for the player? 2) Is the player in touch with reality? and 3) Is the player's behavior significantly different from the norm? In contrast to this focus on addictive behaviors, some researchers emphasized the positive aspects of computer technologies (including video games) as teaching tools and their contribution to children's development (Loftus & Nelson, 1985; Suppes, 1966).

2010s	Publications in top-tier IS-centric journals, tracks at academic conferences, a recognized topic in IS research.
2000s	Expansion of research in non-IS-centric journals, models of addiction, measurement instruments.
1990s	Attributes of scientific rigor, reliance on DSM's pathological gambling, the introduction of Internet Addiction Disorder.
1980s	Video games research, bans of video games, the expansion of terminology repertoire.
1970s	The observation and description of unhealthy human-computer interaction, the introduction of new terminology.
1950s-1960s	Hypothetical discussions of unhealthy attachment to electronic means of communication; the term *computerniks*.
1894	A hypothetical case of maladaptive interaction with technology described in fictional writing.

Figure 1. The History of Technology Addiction

The 1980s also witnessed numerous proposed and realized *bans of video games* because these technologies were considered a source of violence, antisocial behavior, and mental problems. In that sense, researchers and governments created "moral panic" regarding video games (Markey & Ferguson, 2017). In 1981, in the Philippines, President Marcos banned all electronic and electromechanical gaming devices through a presidential decree (Dillon, 2011), and, in 1983, Singapore banned video game arcades (Shotton, 1989). The UK parliament was presented with a bill titled "Control of Space Invaders and Other Electronic Games" to regulate and license the video gaming industry, but the bill was subsequently challenged and defeated by a narrow margin (Ayes 94, Noes 114) (The UK Parliament, 1981). Similar attempts to curb the proliferation of video games were made in the US. For instance, the town of Marshfield, Massachusetts, prohibited the use and possession of all commercial video games except those for home use (Rubin & Sipress, 1982). All such bans were eventually lifted. Nevertheless, in the modern day, many countries still ban particular video games – though usually by claiming that these are misaligned with their political, religious, or social values rather than attributing the bans to these games' addictive potential.

The 1980s research, however, spread far beyond the context of video games. Starker (1983) argued in favor of the existence of *computer mania* as a new category of mental disorder. Solomonides and Levidow (1985) employed the term *compulsive technology* from the perspective of computers rather than individuals by arguing that technology fully submits to the desires of its users, offers total control, and appeals both to people's external and internal cravings. Several researchers extended the concept of *technophilia* to an extreme love of, identification with, unreasonable devotion to, and submission to technology, especially when the symptoms exhibited by technophiles implicitly resembled addiction (BloomBecker, 1987; Drengson, 1982). This concept, however, did not receive due attention in academic circles at the time. Davidson and Walley (1985) discussed the term *computer addiction* as a form of mental disorder in the context of IT. Shotton (1989) favored the term *computer dependency* (rather than compulsive, obsessive, excessive, or addictive use) by arguing that it is more general, is open to interpretation, and avoids social stigma. Nevertheless, Shotton also employed the term *computer addiction* in her publications (e.g., see Shotton, 1991). In addition, many of the works mentioned above also used the term *hackers* to denote computer-dependent or addicted individuals.

In the 1990s, the notion of videogame addiction attracted the attention of the general public after the release of a *Star Trek: The Next Generation* episode in which most of the crew of the Enterprise become addicted to an alien-designed video game which stimulates pleasure centers in the players' brains as they progress through the levels (Allen, 1991). Technology addiction research also showed some attributes of rigor at this time because scholars started to rely on the body of knowledge in reference disciplines, such as medicine and psychology. For example, Mark D. Griffiths embarked on his long-term line of research. First, he consistently employed the term *addiction* and introduced its clear definition and core symptoms (Griffiths, 1996a). Specifically, he popularized and defined the term *technological addictions* as a subset of *non-chemical, behavioral addictions* that occur when a person develops a *psychological dependence* on human-machine interaction (Griffiths, 1995, 1996a). Second, Griffiths relied on prior psychology literature to form a conceptual and methodological foundation for his studies, starting with DSM-III (Griffiths, 1991). Third, he empirically demonstrated the existence of technology addiction in various contexts (Griffiths, 1990; Griffiths, 1992, 1996a; Griffiths, 1996b).

Immediately after the introduction of the World Wide Web, researchers switched their attention to *Internet Addiction Disorder*. Kimberly S. Young was the first to present strong empirical evidence in the form of surveys and case studies documenting the phenomenon (Young, 1996, 1998a). Most importantly, Young (as well as others) relied on the conceptualization and diagnostic criteria of pathological gambling in DSM-IV because it was considered the closest to the pathological nature of Internet addiction. In 1998, the peer-reviewed journal *Cyberpsychology & Behavior* (currently published as *Cyberpsychology, Behavior, and Social Networking*) was launched, and it immediately attracted the attention of technology addiction scholars (Wassenaar et al., 1998; Young, 1998b).

In the early 2000s, there was an exponentially growing interest in the topic, with the phenomenon being referred to as *addiction*, *dependence*, *excessive use*, *problematic use*, *pathological use*, *obsessive use*, *compulsive use*, and *overuse*. Several models of addiction (Davis, 2001; Douglas et al., 2008) and several measurement instruments (Charlton, 2002; Charlton & Danforth, 2010) were also developed. A majority of such works appeared in psychology/cyberpsychology, gambling, and social science journals. At the same time, the mainstream IS journals (except *Computers in Human Behavior*) were somewhat slow at publishing technology addiction papers. For example, an analysis of the Senior AIS Scholars' Basket of Eight Journals (*European Journal of Information Systems*, *Information Systems Journal*,

Information Systems Research, *Journal of Association for Information Systems*, *Journal of Information Technology*, *Journal of Management Information Systems*, *Journal of Strategic Information Systems*, and *MIS Quarterly*) revealed that only one work briefly discussed the issue of online gambling: this was published in *Journal of Information Technology* in 2007 (Laffey, 2007). Major technology addiction papers started appearing in these journals in and after 2011 (James et al., 2017; Kwak et al., 2019; Kwon et al., 2016; Soror et al., 2015; Tarafdar et al., 2020; Turel, 2015; Turel & Serenko, 2012; Turel, Serenko, & Giles, 2011; Vaghefi, Negoita, & Lapointe, 2022; Vaghefi et al., 2017; Venkatesh et al., 2019; Wang & Lee, 2020; Xu et al., 2012).

Soon after that, the concept of technology addiction was explored in numerous IT contexts and in the flagship academic IS meetings: the *International Conference on Information Systems* (ICIS), the *America's Conference on Information Systems* (AMCIS), and the *Hawaii International Conference on System Sciences* (HICSS) have all introduced tracks and mini-tracks devoted to this topic. As a result, technology addiction has formally entered the realm of mainstream research in the IS field. And, since the early 2010s, there has been an explosion in neuroscience studies examining the differences between technology-related and substance addictions. Recently, more medical and psychiatric research has been induced by the call of DSM-5 to further examine *Internet Gaming Disorder* and by the recognition of *Gaming Disorder* by ICD-11. These developments suggest that it is likely that technology addiction research will also persist in the IS domain.

Terminology

The Concept of Mental Disorder

Before discussing the terminology associated with the "dark side of IT," it is imperative to revisit the very concept of mental disorder. Other related terms that are occasionally mentioned in the academic literature are mental illness, mental problems, and mental health, but both the DSM and the ICD have accepted "mental disorder" as a uniform term. The reason for this is that *mental illness* pertains more to medicine and biology and so does not capture the social aspects of a mentally disordered behavior. *Mental problems* refer to the outcome of one's mental condition instead of the underlying cognitive impairment. *Mental health* is too general because it can be both positive and negative, while *mental disorder* captures the exclusively negative aspects of one's mental condition (Cockerham, 2013). Thus, *mental disorder* is the most appropriate term to employ in the context of technology addiction.

Over the years, the concept of mental disorder has undergone various changes ranging from an extremely broad definition, such as any deviation from some ideal standard of highly desirable state of mental health, to a very narrow definition which includes only extremely undesirable and dangerous behaviors (Bolton, 2008; Cockerham, 2013). In addition to changes in the scope of the definition of mental disorder, the very understanding of what constitutes a mental disorder has also been in a state of constant flux, as concepts of "normal" (and deviations from "normal") can be somewhat subjective and temporary. For instance, homosexuality was included in the earlier versions of the DSM, but it is no longer considered a mental disorder. On top of that, there have been frequent changes in the terminology describing specific mental conditions and their classifications – for instance, the terms melancholia and nymphomania no longer appear in the formal medical, psychological, and psychiatric literature. As the body of empirical knowledge accumulates, our understanding of mental disorder will continue to evolve, and such changes will be further reflected in the technology addiction literature.

DSM-5 defines a mental disorder as a "syndrome characterized by clinically significant disturbance in an individual's cognition, emotion regulation, or behavior that reflects a dysfunction in the psychological, biological, or developmental processes underlying mental functioning" and that is generally "associated with significant distress or disability in social, occupational, or other important activities" (APA, 2013, p. 20). Dysfunction refers to "the failure of a mental mechanism to perform a natural function for which it was designed by evolution" (Wakefield, 1992, p. 373). For a mental condition to be considered a mental disorder, it must have a negative impact on one's cognitive, emotional, or behavioral functioning (Wakefield & Conrad, 2020). However, deviations from social norms (e.g., sexual, political, religious) and conflicts arising between a person and a society do not meet the criteria above unless they impair one's functioning.

Therefore, as a potential form of mental disorder, technology addiction must impair a user's cognitive performance, emotional state, and/or behavior by creating some sort of dysfunction, which must be reflected in the definition of technology addiction. This impairment needs to be "clinically significant" – a vague term which leaves room for wide interpretations. At the same time, deviations from social norms (e.g., spending more time on social media than an average user) and disapproval of a user's behavior by others (e.g., playing violent video games at a young age) do not constitute technology addiction.

During the previous decade, various terms have been employed to describe a mental disorder associated with the use of IT. These include 1) dependence; 2) obsessive and/or compulsive use; 3) overuse or excessive use; 4) pathological or problem use; and 5) addiction. Below, we will briefly discuss each of these labels and show how it fits the subject matter in the context of IT. We note that, while these are semantically somewhat similar concepts which are often used as synonyms, they refer to different phenomena.

Dependence

Between 1968 and 2013, the term *dependence* was routinely used in several versions of the DSM (Maddux & Desmon, 2000), including DSM-IV-TR (APA, 2000). It referred to various substance abuse disorders, such as dependence on alcohol, cocaine, hallucinogens, nicotine, opioids, phencyclidine, polysubstances, etc. until it was replaced with the term *addiction* in DSM-5 (APA, 2013). In the academic literature, this term is occasionally used to describe "IT dependence" as a form of mental disorder (e.g., see Bae, 2017; Wolniczak et al., 2013). This practice is rooted in the earlier versions of the DSM when substance dependence diagnostic criteria and definitions were adapted to the context of IT. Currently, however, as a form of mental disorder, the use of the term dependence is not recommended in the context of IT.

First, in the psychiatry and psychology literature, dependence is often considered a pharmacological term which refers to physiological dependence on a particular substance when a person's body has adapted to the intake of this substance, producing tolerance and withdrawal symptoms (Miller & Gold, 1991). However, dependence does not necessarily produce the other core symptoms of addiction as a mental disorder (i.e., salience, mood modification, conflict, and relapse), and such a condition is a common response to many routinely administered drugs (e.g., antidepressants and beta-blockers) and usually goes away without intervention. As such, dependence is an expected, normal response of the body, which is quite different from uncontrolled drug-seeking behavior, which impairs normal functioning (Maddux & Desmon, 2000; O'Brien, 2011; O'Brien et al., 2006).

Second, dependence refers to "the quality or state of being influenced or determined by"[1] the subject, which, in the context of IT, implies that a user depends on the employment of an IT system. However, all users depend on the performance of their IT to complete routine tasks (Ball-Rokeach & DeFleur, 1976), and it can be assumed that being dependent on an IT artifact means that users merely rely on their systems (i.e., task completion depends on system performance),

which is similar to a driver being dependent on a car's performance. To avoid such ambiguity, Park (2019) recommended splitting the IT dependence term into two composites: functional dependence, which refers to the instrumental usefulness of a system, and existential dependence, which refers to an unconscious and obsessive attachment to the system (i.e., addiction), but this division only complicated matters. In some studies, the terms IT dependence and addiction are used interchangeably (e.g., see Ahn & Jung, 2016), resulting in further ambiguity and confusion.

Third, the term dependence may be confused with dependent personality disorder (Maddux & Desmon, 2000), defined in DSM-5 as "a pattern of submissive and clinging behavior related to an excessive need to be taken care of" (APA, 2013, p. 645). For example, one may assume that "Facebook dependence" means that one has become clinically dependent on his or her online friends. Fourth, DSM-5 has abandoned the term dependence in favor of other terminology, and it is recommended that the IS community keep up with recent changes (i.e., "dependence" is a leftover term from DSM-IV-TR). Thus, IS researchers should apply the term dependence only in the context of functional needs, but not as a psychological construct.

Obsessive and/or Compulsive Use

Obsessive-compulsive disorder (OCD) is characterized by the presence of obsessions and compulsions. *Obsessions* are "recurrent and persistent thoughts, urges, or images that are experienced as intrusive and unwanted" that an individual cannot successfully suppress or ignore, and *compulsions* are "repetitive behaviors… or mental acts… that an individual feels driven to perform in response to an obsession" (APA, 2013, p. 235). OCD symptoms have been present throughout the entire human history and were first clearly documented in the 15th century AD (Alvarenga et al., 2007). Initially, OCD causes were believed to be connected to a person's religiosity, spiritual well-being, and morality, and the symptoms were considered signs of possession (Calamari et al., 2011). In the early 1800s, the focus gradually shifted to scientific principles, and OCD was viewed as a disease of one's brain. In 1877, Carl Westphal, a German psychiatrist, developed the term *zwangsvorstellungen* in German (Oberbeck & Steinberg, 2015). In English-speaking countries, it was translated as *obsession* and *compulsion*, and the modern OCD term evolved as a combination of both words (Alvarenga et al., 2007). In 1952, it was included in DSM-I under the label of *obsessive-compulsive reaction* (APA, 1952), and DSM-5 offers a variety of OCD diagnoses and their diagnostic criteria (APA, 2013).

Inspired and guided by DSM-IV-TR (APA, 2000), OCD-related terminology and measurement instruments have also entered the realm of IT under the label of obsessive and/or compulsive use (e.g., see Aladwani & Almarzouq, 2016; Lee, Chang, Lin, & Cheng, 2014; Meerkerk, van den Eijnden, Franken, & Garretsen, 2010; Meerkerk, Van Den Eijnden, Vermulst, & Garretsen, 2009). A key benefit of such studies is that they have expanded our understanding of the dark side of IT and attracted the attention of the public to this issue. However, obsessive-compulsive symptoms pertain to only one of the six core symptoms of behavioral addictions because salience includes both thoughts about (i.e., obsession) and engagement in (i.e., compulsion) the behavior (Griffiths, 1996a, 2005, 2018; Jameel et al., 2019). At the same time, the OCD term does not accurately capture the other five core symptoms (i.e., mood modification, tolerance, withdrawal, conflict, and relapse), which should be present in both the definition and diagnostic criteria of addiction as a mental disorder. Moreover, OCD and behavioral addictions are conceptually and empirically distinct, and DSM-5 clearly differentiates between OCD and behavioral addictions (i.e., gambling disorder) by placing them into different categories (APA, 2013).

Therefore, the OCD term may be employed in the realm of the dark side of IT to denote one's persistent thoughts about the system (i.e., obsession) and a corresponding engagement with the system (i.e., compulsion) as a proxy for an IT-related metal disorder within a particular, narrow context. However, it cannot be considered a form of behavioral addiction, as it only partially captures addiction symptomology, and it should not be referred to, defined, or operationalized as such.

Overuse or Excessive Use

In the medical literature, *overuse* and *excessive* use generally refer to the intake of an excessive amount of medication, which may eventually lead to the development of addiction (Calabresi & Cupini, 2005). However, by themselves, overuse and excessive use are not considered mental disorders, and these terms are not used in the DSM. In contrast, overuse and excessive use are frequently employed to indicate a mental disorder associated with the use of IT. In such cases, the conceptual definitions of the overuse and excessive use constructs include implicit or explicit mental disorder statements (i.e., mostly addiction-related), and their operationalizations focus on the users' mental state, control, and well-being (e.g., see Guedes et al., 2016; Perry & Lee, 2007; Shen & Wang, 2019).

The key issue, however, is that, by their very definitions, overuse and excessive use refer to the length or intensity of human-computer interaction sessions, but they do not imply or hint at the presence of salience, mood modification, tolerance, withdrawal, conflict, and relapse symptoms – all of which are required for the behavior to be classified as a mental disorder (Griffiths, 1996a, 2005, 2018; Jameel et al., 2019). In many cases, users may overindulge with the technology in a healthy way as a form of recreation. For example, during the COVID-19 lockdown, people may have spent a disproportionate amount of time using social media or playing video games (i.e., they overuse or excessively use IT) only to dramatically reduce their use levels when their normal routines resume, and this behavior does not constitute a mental disorder. Some studies (e.g., see Munno et al., 2017) even employ the term problematic or pathological overuse, which implies that, by itself, regular (non-problematic or non-pathological) overuse is quite normal.

Nevertheless, given the disagreement in the medical community about the term addiction, some studies justify the use of the term overuse or excessive use. They often do not define overuse or excessive use in terms of the length or intensity of engagement; instead, they imply that something becomes overused or excessive when behavioral addiction symptoms emerge. Such concepts resemble addiction, and, when defined this way, overuse or excessive use becomes conceptually identical to addiction (He, Turel, & Bechara, 2018; Kuss et al., 2017; Kuss & Griffiths, 2011; Meshi et al., 2019; Turel, Cavagnaro, & Meshi, 2018; Turel & Serenko, 2020).

A key advantage of the overuse and excessive use terms is that they do not attribute one's problems to helplessness and do not pathologize the behavior, indicating that it may possibly be corrected. While the term addiction implies that the behavior is beyond one's control, the term excessive use (or overuse) is not associated with such assumptions and leaves room for self-responsibility, behavioral correction, and improvement (Weinstein & Lejoyeux, 2010). It also does not stigmatize users, as the term addiction does.

Thus, we view the term overuse or excessive use as potentially appropriate for describing technology addiction when excess is defined from the perspective of the core behavioral addiction symptoms. In other words, given their less pathologizing semantics, overuse and excessive use may be employed to denote one's maladaptive technology use – as long as they are defined as such. However, it would be erroneous to focus on the length and intensity of user-system interaction under the label of overuse or excessive use as a form of mental disorder.

Pathological or Problem Use

The line of research which employs the terms of *pathological* or *problem use* of IT emerged when researchers adapted pathological gambling terminology, definitions, and diagnostic criteria from the DSM to understand the dark side of human-computer interaction (Griffiths, 1991; Griffiths, 1996a; Griffiths, 1996b). At that time, this was a logical approach because pathological gambling, as documented in DSM-III, IV, and IV-TR, was the most suitable, formally recognized mental disorder which might have been adapted to the IT environment.

Pathological gambling was first introduced in DSM-III in 1980 (APA, 1980), but the initial criteria had not been empirically tested and validated beforehand – these were based on the personal, clinical experience of a small group of psychologists and psychiatrists (Reilly & Smith, 2013). Pathological gambling was initially categorized as an impulse control disorder and was defined as persistent and recurrent maladaptive gambling behavior leading to a number of negative consequences. The diagnostic criteria were further adjusted in DSM-IV to make them more similar to substance dependence (APA, 1994). At the same time, a related term (not specified in the DSM) of *problem gambling* appeared, defined as a gambling behavior which produces deleterious consequences for the gambler and his or her family but which does not meet all of the diagnostic criteria of pathological gambling (Blaszczynski & Nower, 2002). In other words, problem gambling was considered a mild, sub-clinical form of pathological gambling.

Both terms – pathological gambling and problem gambling – were adapted to the IT context (i.e., pathological use and problem use) and employed as synonyms with no clear differentiation between them. However, we argue that pathological use and problem use should not be used as synonyms for technology addiction as a form of mental disorder. First, DSM-5 has radically changed its terminology and classification. It rescinded the term of pathological gambling and replaced it with *gambling disorder* because the former had been considered too pejorative and had become outdated. DSM-5 also placed gambling disorder in the category of *non-substance-related addictive disorders* because it shares more similarity with substance-use disorders than with impulse-control disorders (Petry et al., 2014), which suggests that the addiction-related terminology may be more appropriate.

Second, the term pathological or problem use has a very negative connotation even for users who exhibit minor symptoms. Third, the term pathological or problem use is so broad that it may include behaviors that are unrelated to mental disorders such as online theft, scams, privacy violations, cyberstalking, cyberbullying, etc. (Sun & Zhang, 2020). Fourth, in the IS literature, only a few studies drew a line between the terms problematic or problem use and addiction, suggesting that all addictions are problematic, but not all problematic-use patterns (e.g., texting while driving) represent an addiction (Turel & Qahri-Saremi, 2016). For instance, Gerlach and Cenfetelli (2020) show that heavy checking of messages does not necessarily result from addiction. Thus, pathological or problem use represents a narrow conceptualization of mental disorder in the IT context: they can be used as standalone concepts, which we agree are important, but should not be confused with addiction as a form of mental disorder.

Addiction

Addiction is a historically and culturally specific term (Room, 2003) that has undergone major changes since its introduction in the legal lexicon of the Roman Republic. The word *addiction* stems from the Latin terms *addictio* and *addicere*, which were used in the Early Roman Republic (5th – mid 3rd centuries BC) to describe the judicial act by which a debtor was legally made the slave of his or her creditor when unable to pay off a debt. *Addictus*, in a similar vein, referred to the helpless individual who was chained, deprived of any remaining possessions, stripped of citizenship, and turned into the perpetual property of his or her debtor. Much of such debt resulted from gambling activities, particularly dice games, and, by the 3rd century BC, a strong association between gambling, indebtedness, and enslavement (i.e., *addicere*) had been formed (Rosenthal & Faris, 2019). However, by the end of the Late Roman Republic (30 BC), the term *addicere* had evolved into an auto-antonym[2] which represented two opposite meanings. On the one hand, it had a negative, stigmatized connotation associated with vice (e.g., gambling, drinking, gluttony). On the other hand, due to a positive, even divine, societal view of gambling, people began to use *addicere* in a positive sense to describe a person devoted to something honorable or useful, including service to the State (Rosenthal & Faris, 2019). The meaning of the term thus depended on the nature of the object of addiction.

This ambiguity remained when *addicere* was introduced into the English lexicon in the 16th century. The earliest documented use of the terms *addict* and *addicted* dates to 1531 in the works of the English reformers William Tyndale and John Frith who used them in a positive sense to describe one's *preference*, *attachment*, or *devotion* (Russell, 1531). In 1603, William Shakespeare mentioned *addiction* in the *Tragedy of Othello* as a synonym for a *choice* (Lemon, 2018). Yet simultaneously, the terms were used to

describe uncontrollable craving for psychoactive substances, predominantly alcohol. For instance, the *Oxford English Dictionary* first mentions addiction in the context of wine or strong drink as being used in 1612 (Room et al., 2015).

Initially, the term addiction was used as an indication of mental consumption or craving. Since the mid-1800s, the meaning evolved into the definition of the condition of a mental disorder: Magnus Huss, a Swedish doctor, clearly established such use of addiction in the medical literature with most attention being paid to the long-term physiological consequences of consumption (Huss, 1849-51; Levine, 1978; Room et al., 2015). By the end of the 19th century, a variety of alternate terms had been proposed, such as alcoholism, inebriety, dipsomania, narcomania, morphinomania, and dependence.

Since the 1980s, the possible objects of addiction have been dramatically expanded to also cover behavioral (non-substance related) mental disorders (Room et al., 2015). Initially, the term addiction was included in DSM-I (APA, 1952) to refer to drug addiction and alcoholism, but it was renounced in subsequent versions (i.e., II, III, and IV) due to conceptual ambiguity, social stigma, and potential misuse (Maddux & Desmon, 2000; Rosenthal & Faris, 2019). It was, however, reinstated in DSM-5 with respect to gambling disorder, but it excluded other behavioral addictions, such as sex, exercise, or shopping addictions due to insufficient evidence in peer-reviewed journals to unambiguously describe and identify them as mental disorders (see APA, 2013, p. 481). Nevertheless, DSM-5 has hinted at the possibility of expanding the formal list of behavioral addictions in the future.

The historical development of the term addiction presented above points to several important conclusions. First, the term addiction has been in a constant state of competition with other terms. Second, its evolution as an auto-antonym is still present in the contemporary addiction research under the label of positive addiction (Glasser, 1976), which implies that not all addictions are negative and so results in further conceptual ambiguity. Third, addiction has been consistently referred to as a mental disorder, and the most recent version of the DSM places addiction under the category of behavioral (non-substance) disorders, which suggests that it may also embrace technology addiction.

Overall, we believe that, out of all terms discussed above, *technology addiction* is the most suitable in the context of mental disorders associated with the use of IT. We acknowledge that overuse and/or excessive use can also be appropriate if excessiveness is defined in term of its ability to produce addiction-like symptoms. However, a major issue with the technology addiction terminology is that both the academic literature and the media tend to include the name of the IT artifact as the subject of addiction, as opposed to including the use of an IT artifact (i.e., an IT-mediated behavior) as the subject of addiction. Examples of incorrect addiction terms that erroneously specify IT systems as the subject of addiction include WeChat addiction, Facebook addiction, eBay addiction, smartphone addiction, PlayStation addiction, Internet addiction, Netflix addiction, Fitbit addiction, etc. As we stated in the previous article (see Part I), "IT users are not addicted to an IT artifact. Instead, they are addicted to a behavior conducted by means of an IT artifact (i.e., IT-mediated behavior)" (Serenko & Turel, 2020, p. 89). Indeed, an individual cannot get addicted to a smartphone as a physical device: instead, one gets addicted to a behavior that is enabled by means of an IT system (i.e., a smartphone). Thus, a smartphone should not be referred to as the subject of addiction.

Most importantly, the addictive behavior may be conducted through a variety of IT artifacts. For instance, someone exhibiting symptoms of behavioral addiction toward electronic messaging – constantly being connected to an instant messaging system and using it to such a degree that the salience, mood modification, tolerance, withdrawal, conflict, and relapse symptoms, as appear in Griffiths (1996a, 2005, 2018) – may employ a variety of tools such as a mobile phone, an iPad, a laptop, a desktop, etc. to satisfy his or her craving for instant messaging. In this case, it is not only erroneous but also impractical to list the names of the IT systems in the term describing one's mental disorder. Another example is *Internet Addiction Disorder*. In the early days of the Internet, it was theoretically possible for someone to get addicted to a general browsing behavior conducted through an Internet-connected computer, which gave rise to this term. At present, however, almost all IT devices are Internet-enabled, and the Internet refers to the computing network to which a person cannot possibly be addicted. Instead, addictive behaviors are conducted on the Internet (Griffiths & Szabo, 2014), and the corresponding addiction term should include the actual behavior instead of the network's name.

Nevertheless, the use of such imprecise terminology is understandable. First, it shifts the blame from the person to the IT system and its provider. Second, a layperson may find it easier to intuitively understand the nature of one's problems. Third, this approach has already become engraved in routine terminology, and it may be difficult to correct it. However, in scientific literature, it is vital to follow the appropriate terminology and properly refer to the nature of one's technology addiction. In other words, we strongly

advocate for the inclusion of *the type of the addictive behavior* as the subject of addiction instead of the *system* that serves as a means for such behavior. By following the same line of reasoning, one may argue that the term *technology-mediated addiction* is more appropriate than technology addiction because addictive behavior is conducted (i.e., mediated) through an IT artifact and people are not addicted to technology per se. Though in this study we employ the term technology addiction, as the research community accumulates more empirical evidence and improves its understanding of the underlying processes associated with addiction to IT-mediated behaviors, future terminology and definitions are likely to change. As we stated in the previous paper (i.e., Part I), "[t]he 'standing on the shoulders of giants' mindset may not fully apply to technology addiction research" (Serenko & Turel, 2020, p. 90).
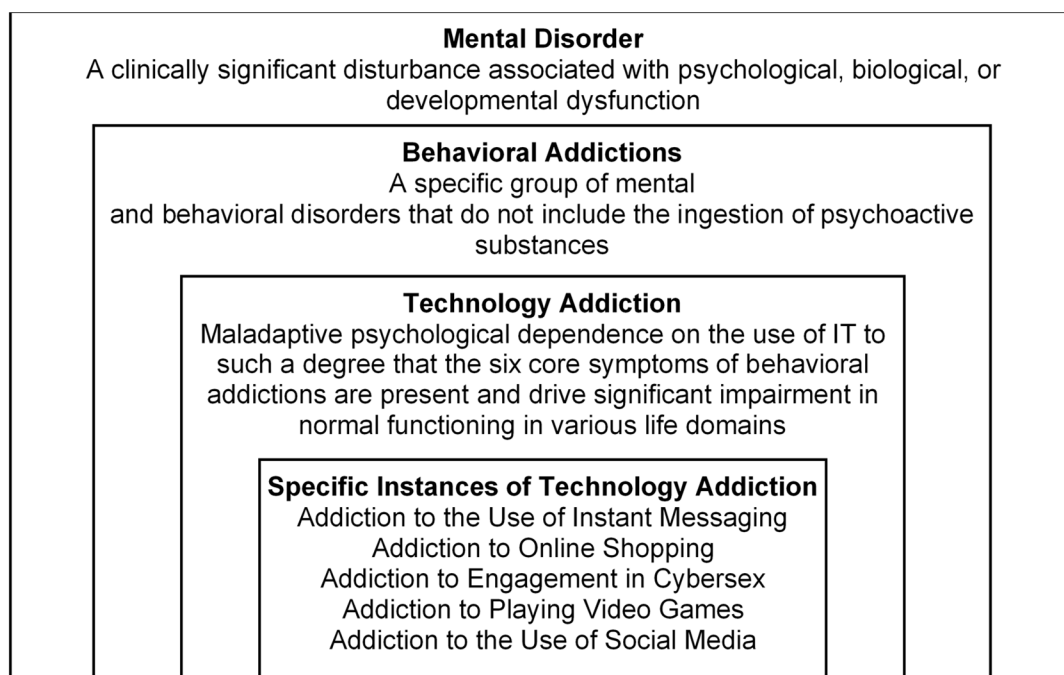
It is also critical to distinguish between the terms of technology addiction and addictive technology use because the former pertains to a mental disorder (i.e., one's maladaptive mental state) while the latter refers to the outcome of this mental disorder (i.e., one's action: the use of an IT under the influence of addiction). Both terms are conceptually distinct, and the former must be present for the latter to occur (i.e., one cannot use an IT addictively unless he or she is addicted to it). However, the former does not have to be accompanied by the latter: it is possible for

someone to experience a mental condition of technology addiction while not being engaged in addictive use. For example, when the IT is unavailable or when one's environment impedes the use of a specific IT (e.g., not being able to play video games on a PlayStation when travelling). Thus, the terms of technology addiction and addictive technology use should not be employed as substitutes.

Figure 2 visualizes our conceptual understanding of technology addiction. It shows that there are many specific instances of technology addiction which should be defined and analyzed by focusing on the behavior rather than on the IT artifact. For a behavior that is mediated through a particular IT system to be classified as addiction, the six core symptoms of behavioral addictions must be present, at least to some degree. The behavior should not include the consumption of psychoactive substances, but it should cause a significant disturbance in a user's psychological, biological, or developmental functioning.

Measurement

In the previous section, we discussed five distinct terms: dependence, obsessive and/or compulsive use, overuse or excessive use, pathological or problem use, and addiction. In this section, we elaborate on their measurement approaches.

Mental Disorder
A clinically significant disturbance associated with psychological, biological, or developmental dysfunction

Behavioral Addictions
A specific group of mental
and behavioral disorders that do not include the ingestion of psychoactive substances

Technology Addiction
Maladaptive psychological dependence on the use of IT to such a degree that the six core symptoms of behavioral addictions are present and drive significant impairment in normal functioning in various life domains

Specific Instances of Technology Addiction
Addiction to the Use of Instant Messaging
Addiction to Online Shopping
Addiction to Engagement in Cybersex
Addiction to Playing Video Games
Addiction to the Use of Social Media

Figure 2. The Technology Addiction Framework

As we explained earlier, the term *IT dependence* should not be defined in the context of a mental disorder, but it may be conceptualized and measured as one's functional dependence when a user actually depends on the system to complete certain IT tasks. For example, most readers of this paper depend on the functional performance of the IT device they use to access this paper, yet they exhibit no maladaptive psychological attachment to it. In this case, the measurement items should pertain to the instrumental usefulness of the IT device rather than to a user's mental state. Consistent with our previous argument against the use of *pathological* or *problem use* under a general label of mental disorder, we believe that it should not be operationalized as such.

To develop measures of *obsessive* and/or *compulsive use*, researchers may consult the definitions and diagnostic features presented in DSM-5 (APA, 2013, pp. 238-239). A very good source is the Yale–Brown Obsessive-Compulsive Scale (Goodman et al., 1989; Storch et al., 2010) and its adaptation to the gambling context (Pallanti et al., 2005). The problem, however, is that OCD-based operationalizations overemphasize the salience symptom at the expense of mood modification, tolerance, withdrawal, conflict, and relapse. For instance, the scale only hints at the presence of tolerance and completely skips mood modification.

One way to conceptualize *overuse* or *excessive use* is in terms of the degree to which the extent and/or intensity of system use exceeds a certain threshold, which is established relative to the user population (e.g., the population average). Using this conceptualization, overuse or excessive use should be measured as the length of time one engages with the system, the degree to which one makes use of the system's features, the effort exerted during use sessions, access frequency, etc. Measures may pertain to the number of hours spent using the system, the number of features employed during a certain time period, a difficulty level (e.g., a video game difficulty level), the number of times one accesses the system, etc., each of which are benchmarked against a certain threshold. Note, however, that the operationalization above is not related to addiction (i.e., the operationalization above cannot be employed in the context of mental disorder). When overuse or excessive use is defined in terms of the addiction-like symptoms it generates (i.e., as a mental disorder), overuse or excessive use may be measured using the typical behavioral addiction symptoms (He et al., 2018; Turel et al., 2018; Turel & Serenko, 2020).

Finally, *technology addiction* should be operationalized consistent with its definition by measuring the degree of the six core symptoms of behavioral addiction – salience, mood modification, tolerance, withdrawal, conflict, and relapse – that emerge due to the use of a particular IT. This may be achieved by separately measuring each of the core symptoms (for an exemplar, see Lee, Cheung, & Chan, 2015) or employing a reflective scale where items systematically tap into the six core addiction symptoms dimensions (see discussion on how typical items maps to the core symptoms of addiction in Turel, Serenko, & Giles, 2011). Scales using this approach can easily be adapted to capture different types of technology addiction because the core symptoms stay the same even though the IT artifact that drives the symptoms changes (see examples of various IT artifact uses in: Serenko & Turel, 2015; Turel & Cavagnaro, 2019; Turel, Serenko, & Bontis, 2011; Xu et al., 2012).

Future Research Directions

Given the embryonic stage of technology addiction research, any type of rigorous and relevant contribution to the body of knowledge would be useful. However, we believe that it is most expedient to direct the effort of the IS research community towards five general objectives: 1) accumulate empirical evidence as to whether technology addiction may be formally recognized as a new category of mental disorder in the DSM and the ICD; 2) document similarities and differences between technology addiction and formally established forms of addiction; 3) study comorbidities and find to what extent technology addiction is a standalone phenomenon or a manifestation of other disorders – for instance, anxiety and depression; 4) understand the effect of technology addiction on various IS-related phenomena in individual, organizational, and societal settings; and 5) develop recommendations, policies, interventions, and guidelines to mitigate the negative effect of technology addiction on individuals, organizations, and society.

First, the research community should accumulate empirical evidence as to whether technology addiction may be formally recognized as a new category of mental disorder in the DSM and the ICD. Both the DSM and the ICD help trained clinicians diagnose and record their patients' mental disorders as well as formulate their case in order to develop an informed treatment plan as part of their mental-health management program. The DSM and the ICD are also used in scientific studies, employed in clinical training, consulted for the development of diagnostic instruments and policies, and used for service reimbursement (e.g., by insurance companies to reimburse psychiatrists' services) (Mezzich, 2002). Because technology addiction (except gaming disorder in ICD-11) has not been officially documented in the DSM and the ICD, it cannot formally be considered a form of mental disorder and so cannot be

treated as such. Thus, it is critical to strive towards informed research that may or may not lead to its formal recognition by the American Psychiatric Association and the World Health Organization (the DSM and the ICD publishers, respectively). We say that it may not lead to such recognition because it is possible that technology addiction is symptomatic of other psychological deficits (Jeong et al., 2019) and that there may be an overarching psychological issue (e.g., addictive tendencies) that should be treated as such, rather than focusing on micro-diagnoses pertaining to specific maladaptive states and behaviors. However, if technology addiction represents a category of mental disorders that significantly impairs one's normal functioning and requires treatment, it is vital to formally recognize it as such in both the DSM and the ICD.

For this, future scholars should demonstrate the clinical relevance, theoretical embedding, and empirical evidence (Brand et al., 2020) of technology addiction. *Clinical relevance* refers to confirming that technology addiction produces psychological and functional impairment, which justifies intervention and treatment. Research that focuses on the *theoretical embeddedness* of technology addiction should be able to explicate the phenomenon by relying on the existing addiction theories, frameworks, and models. The rationale is that, if technology addiction represents a category of behavioral addiction, previous behavioral addiction theories, frameworks, and models should offer explanations for the core psychological and neurobiological processes underlying this novel disorder. Researchers should also accumulate *empirical evidence for underlying the mechanisms* explaining such psychological and neurobiological processes. This body of knowledge should rely on findings obtained by a variety of empirical methods, such as surveys, interviews, case studies, observations, self-assessments, experiments, neuroIS, genetics, etc. For this, a large number of projects relying on each method are required: these may be later summarized by means of meta-analyses and structured literature reviews. Moreover, different working groups must be involved in these investigations (Brand et al., 2020).

Second, it is important to document similarities and differences between technology addiction and formally established forms of addiction. The purpose is to demonstrate the potential clinical significance of technology addiction and to justify the use of the term *addiction*. So far, empirical evidence has been mixed, but this could result from the use of different measurement scales, IT artifacts, and user populations. For example, in some video gaming studies, several key similarities to established addictions, in terms of brain alterations, have been

observed (Palaus et al., 2017). Other studies, conducted in the context of social media, found similarities to established addictions in changes in the reward system of the users' brain (He, Turel, & Bechara, 2017; He et al., 2018; He, Turel, Brevers, & Bechara, 2017) but not in the users' self-control brain systems (Turel, He, Xue, Xiao, & Bechara, 2014). Behaviorally, there can also be some differences between withdrawal from substance use and the effect of abstinence from social media use (Turel et al., 2018; Turel & Vaghefi, 2019). It is possible that such differences may result from the unique features embedded in IT artifacts, which may stimulate neural processes responsible for the development and maintenance of certain forms of behavioral addictions. Hence, there is a need for more systematic research that can establish key similarities to the formally recognized forms of addiction while acknowledging that there can be important differences between technology and substance addictions. This can lead to informed decisions about the proper terminology.

Third, it is critical to study comorbidities, defined as the presence of multiple co-occurring mental disorders in one individual, and find to what extent technology addiction is a standalone phenomenon or a manifestation of other disorders such as anxiety and depression. It is particularly critical to confirm the negative effects of technology addiction in isolation from other variables, including other behavioral addictions and/or mental disorders. Specifically, comorbidity should be studied to establish the possible uniqueness of technology addiction. It appears that technology addiction is often comorbid with other mental disorders such as depression, anxiety, attention deficit hyperactivity disorder (ADHD), and other disorders that adversely affect social interactions (Ha et al., 2006; Ho et al., 2014; Ko et al., 2013; Ko, Yen, Chen, & Yen, 2008; Yen, Ko, Yen, Wu, & Yang, 2007). This may suggest an underlying issue that is manifested in multiple mental disorders. For instance, it is possible that genetic issues that affect receptors in the brain that process dopamine may manifest themselves in difficulties processing enjoyable experiences and may lead to both depression symptoms and technology addiction (Kim et al., 2011). It may also be that technology addiction is a response to underlying depressive symptoms or that technology addiction exacerbates depression (Akin & Iskender, 2011; Banjanin et al., 2015; Özdemir et al., 2014; Younes et al., 2016). Such intricacies should be examined in future research in order to distinguish technology addiction from other conditions and disorders.

Fourth, many IS researchers have already started inquiring into the various unanticipated consequences of IT on individuals, organizations, and societies (Turel,

2021; Serenko, Ruhi, & Cocosila, 2007) and they should further continue exploring the impact of technology addiction on various IS-related phenomena. This may be achieved by including the technology addiction construct in existing and new IS models and testing them in various IS contexts – for example, with respect to a variety of IT artifacts. In this area, the IS research community has already made good progress. For instance, it has been established that addiction to participating in online auctions alters users' belief systems by augmenting their perceptions of enjoyment, usefulness, and ease of use attributed to online auction websites which, in turn, drives their further participation in online auctions (Turel, Serenko, & Giles, 2011).

Fifth, it is vital to understand how to eliminate or mitigate the negative consequences of technology addiction at the individual, organizational, and societal levels and to develop recommendations for IS users, developers, and policymakers. For this, researchers may focus on the biological, psychological, and social antecedents of technology addiction. A fruitful line of research may employ design science to understand how to develop new (or modify existing) IT systems to avoid or minimize the development of addiction symptoms (e.g., see Kloker, 2020). It is also important to study the implementation of effective policies based on sound empirical evidence rather than public opinion. An interesting example of a failed policy is the 2011 South Korean Youth Protection Revision Act (commonly referred to as the Shutdown Law) that legally prohibits online gaming companies from providing service access to users under 16 years of age from midnight to 6 am (Sang et al., 2017). The intention of the law was to increase teenagers' sleep time to mitigate their use of online gaming. However, an assessment of the policy's effectiveness revealed an increase in the average user's sleep time of only 1.5 minutes, which has little practical significance and cannot justify the allocation of public resources (Lee,

Kim, & Hong, 2017). Thus, projects devoted to the study of empirically based policies directed at the mitigation of the impact of technology addiction are of particular importance. At the same time, it is vital not to pathologize regular, non-harmful, human-computer interactions and not to stigmatize heavy IT users (Billieux et al., 2015; Gerlach & Cenfetelli, 2020). Moreover, a majority of behavioral addictions are episodic rather than chronic and tend to be fairly transient for most people (Thege et al., 2015).

Conclusion

For decades, IS researchers have been concerned with the issue of relevance versus rigor in academic research output (Davenport & Markus, 1999; Straub & Ang, 2011). There have been also arguments that it is extremely difficult to ensure scientific rigor yet remain relevant to the broader needs of the non-academic discipline's stakeholders, including practitioners and policymakers (Benbasat & Zmud, 1999). We believe that technology addiction research represents a unique topic that embraces both these aspects. By its very nature, this topic is highly relevant to the needs of individuals, organizations, and entire societies because the preliminary evidence has already identified the negative consequences of technology addiction in various contexts. At the same time, the medical community requires valid empirical evidence obtained by rigorous inquiry methods before it may formally intervene and address the issue on a larger scale. Thus, IS researchers are presented with a unique opportunity to rigorously contribute to another scientific domain and demonstrate the status of IS as a reference discipline (Wade et al., 2006). In this article, we have expressed our understanding of the state of technology addiction research, which is based on our experience in this very important domain, and we hope that these ideas will help IS scholars improve the rigor of their scientific endeavors.

Notes

[1] The Merriam-Webster Dictionary. https://www.merriam-webster.com/dictionary/dependence

[2] Also referred to as an autantonym, contronym, contranym, or Janus word.

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Appendix

Table A.1. Key Terms and Definitions

Term	Definition
Behavioral Addictions	Psychological dependence on repetitive behaviors that feature the core components of addiction: salience, mood modification, tolerance, withdrawal, conflict, and relapse.
Comorbidity	The presence of multiple co-occurring mental disorders in one individual.
Dependence	A pharmacological term which refers to physiological dependence on a particular substance when a person's body has adapted to the intake of this substance, which produces tolerance and withdrawal symptoms. It was used in the earlier versions of the DSM (including DSM-IV-TR), e.g., alcohol dependence or cannabis dependence, but it has been rescinded in DSM-5.
DSM	Diagnostic and Statistical Manual of Mental Disorders (DSM) is the classification of mental disorders which relies on a common language and standard criteria. It is published and regularly updated by the American Psychiatric Association. The latest edition is DSM-5.
ICD	International Classification of Diseases (ICD) is the global standard for coding health information and causes of death. It is published and regularly updated by the World Health Organization. The latest revision is ICD-11.
Mental Disorder	A syndrome characterized by clinically significant disturbance in one's cognition, emotions, and/or behavior that reflects a dysfunction in the psychological, biological, and/or developmental processes underlying mental functioning. It is generally associated with significant impairment in various important activities.
OCD	Obsessive-Compulsive Disorder (OCD) is characterized by the presence of persistent and unwanted thoughts, urges, or images (i.e., obsessions) and repetitive behaviors that an individual feels driven to perform in response to obsessions (i.e., compulsions).
Pathological Gambling	The term classified in DSM-IV-TR under "Impulse-Control Disorders Not Elsewhere Classified" and defined as persistent and recurrent maladaptive gambling behavior disrupting personal, family, or vocational pursuits. In DSM-5, this term has been reclassified as Gambling Disorder under Substance-Related and Addictive Disorders – Non-Substance-Related Disorders (i.e., the term Pathological Gambling has been rescinded in DSM-5).
Problem Gambling	A gambling behavior which produces deleterious consequences for the gambler and his or her family but which does not meet all of the diagnostic criteria of pathological gambling. It is a mild, sub-clinical form of pathological gambling, and it has never been included in the DSM.
Symptoms	The observable manifestations of people's mental states.
Technology Addiction	Maladaptive psychological dependence on the use of IT to such a degree that the six core symptoms (i.e., salience, mood modification, tolerance, withdrawal, conflict, and relapse) of behavioral addictions are present.
Technology-Mediated Addiction	Addictive behavior which is conducted (i.e., mediated) through an IT artifact and which meets behavioral addiction criteria.