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RESEARCH ARTICLE

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A Dual-Identity Perspective of Obsessive Online Social Gaming

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Abstract

Obsessive online social gaming has become a worldwide societal challenge that deserves more scholarly investigation. However, this issue has not received much attention in the information systems (IS) research community. Guided by dual-system theory, we theoretically derive a typology of obsessive technology use and contextually adapt it to conceptualize obsessive online social gaming. We also build upon identity theory to develop a dual-identity perspective (i.e., IT identity and social identity) of obsessive online social gaming. We test our research model using a longitudinal survey of 627 online social game users. Our results demonstrate that the typology of obsessive technology use comprises four interrelated types: impulsive use, compulsive use, excessive use, and addictive use. IT identity positively affects the four obsessive online social gaming archetypes and fully mediates the effect of social identity on obsessive online social gaming. The results also show that IT identity is predicted by embeddedness, self-efficacy, and instant gratification, whereas social identity is determined by group similarity, group familiarity, and intragroup communication. Our study contributes to the IS literature by proposing a typology of obsessive technology use, incorporating identity theory to provide a contextualized explanation of obsessive online social gaming and offering implications for addressing the societal challenge.

Keywords: Obsessive Online Social Gaming, Obsessive Technology Use, Dual-System Theory, Typology, IT Identity, Social Identity, Longitudinal Study, Contextualization, Identity Theory

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1 Introduction

With the widespread popularity of online social networks, online social games have become the dominant online game genre and have gradually become integrated into users' daily lives (Fang et al., 2019). Online social games allow competitive, cooperative, or competitive-cooperative social interaction between users in online social game communities (Liu et al., 2013). Although online social games yield benefits, medical professionals and scholars have become increasingly concerned about obsessive online social gaming, which refers to an obsessive pattern of playing online social games that typically results in a series of negative consequences and threatens the well-being of users (James et al., 2017).

The World Health Organization (WHO) officially defined obsessive online gaming in the 11th edition of the *International Classification of Diseases* as a psychiatric disorder (WHO, 2018). Several recent obsessive online social gaming cases illustrate the severity of this worldwide societal challenge. In April 2017, a Chinese

17-year-old was diagnosed with a cerebral infarction after playing online social games for 40 hours nonstop (China Daily, 2017). Similarly, a 16-year-old in India died by suicide in April 2019 after being scolded by his parents for his obsession with online social gaming, and a 17-year-old in Thailand died of a stroke in November 2019 after indulging in marathon gaming sessions for several nights (Setupgamers, 2020). Obsessive adolescents often experience depression, social isolation, and aggressive behaviors, which ultimately drive them to drop out of society as they become adults (Lee et al., 2019; Seok & DaCosta, 2012). Obsessive online social gaming is not only a vexing societal challenge affecting adolescents but also a serious phenomenon among adults. For example, 55.2 million adults in the U.S. are online social game users, with 21% devoting over 10 hours a week to playing games (Statista, 2019b). Some adults even interrupt their sleep to play online social games for 24 hours nonstop, resulting in harmful consequences in the workplace, such as job burnout and work exhaustion (Chen et al., 2020).

The information systems (IS) discipline has established a valuable research program on obsessive technology use. However, studies have described the concept using various terms, such as "addiction," "impulsive use," "compulsive use," "excessive use," "problematic use," "dependence," and "obsessive-compulsive disorder" (Kwon et al., 2016; Turel et al., 2011; Wang & Lee, 2020). These terms are sometimes used interchangeably, yet they have different conceptualizations and measures (Gerlach & Cenfetelli, 2020) and are not equivalent. Although inconsistencies between conceptualizations and measures of obsessive technology use are expected at the early research stage, they challenge the rigor of the obsessive technology use literature.

Furthermore, the majority of studies have focused on identifying the antecedents of obsessive technology use pertaining to general sociopsychological factors, such as demographics (Kwon et al., 2016), self-regulation (Turel & Osatuyi, 2018), perceived enjoyment (Turel & Serenko, 2012), and habit (Turel, 2015). We found limited theoretical explanations for the contextual antecedents and psychological mechanisms that shape obsessive technology use. More recently, scholars have highlighted the value of contextualization in theory development (Johns, 2006, 2017) and called for contextual theorizing in obsessive technology use research (James et al., 2017). In online social game communities, users engage in social interactions in two types of groups, namely, guilds and friends (Gong et al., 2019). Guilds are formal social game groups in which a group of users are linked and have specified names and norms. Guild members usually play together with common goals, such as completing collective missions and enjoying team achievements. Friends are informal social game groups without specific names and norms. Users can request to add other users to their friends list, which enables social interaction through a chat function. These contextualized social features contribute to the formation of users' IT identity and social identity, which are important contextual antecedents that shape obsessive online social gaming.

Against this backdrop, our primary research objective is to advance the understanding of obsessive technology use in the context of online social gaming. Guided by dual-system theory (Hofmann et al., 2009), we derive a typology of obsessive technology use with four archetypes: impulsive use, compulsive use, excessive use, and addictive use. We also draw on identity theory (Stryker & Burke, 2000) to construct a contextual nomological network of obsessive online social gaming. Studies have suggested two types of identity: a material-based identity that focuses on self-identification with material objects, and a human-based identity that arises from membership in human groups (You & Robert, 2018). Applying these concepts to the IS literature, we operationalize material-based identity as IT identity and human-based identity as social identity and explain how they shape obsessive online social gaming.

Our research contributes to the IS literature on the dark side of IS and deviant IS use in several ways. We derive a typology of obsessive technology use and offer clear definitions and conceptualizations of the four archetypes (i.e., impulsive use, compulsive use, excessive use, and addictive use) of obsessive technology use. We also incorporate contextualization into our theory development. By considering the online social gaming context, we develop boundary conditions and incorporate identity theory to explain how contextual antecedents (i.e., IT identity and social identity) shape obsessive online social gaming. Furthermore, we follow a rigorous instrument development approach to generate measurement items for IT identity. The concept of IT identity has recently been introduced (Carter & Grover, 2015; Carter et al., 2020), and research into this important concept has been encouraged.

2 Typology of Obsessive Technology Use

Obsessive technology use refers to an obsessive pattern of technology use typically leading to a series of negative consequences that may threaten the well-being of users (James et al., 2017). Various terms have been used interchangeably to describe obsessive technology use, such as "excessive use" (Kwon et al., 2016), "problematic use" (Chen et al., 2020), "compulsive use" (Wang & Lee, 2020), and "obsessive-compulsive disorder" (James et al., 2017), with the term "technology addiction" (Turel et al., 2011) being the most widely used by researchers. The inconsistent definitions and conceptualizations of obsessive technology use in IS studies challenge the rigor of this line of the literature. In this study, we use

dual-system theory to theoretically derive a typology of obsessive technology use. A typology allows phenomena to be clustered into categories without losing sight of the underlying richness and diversity (Rich, 1992). It also allows us to understand a phenomenon with varying degrees of orientation and organization (Venkatraman et al., 2018).

Dual-system theory suggests that technology use may be attributable to two structurally different systems: reflexive and reflective (Soror et al., 2015). Studies generally agree on three key principles of dual-system theory. The first principle explains the distinctive nature of the two systems. The reflexive system is habitual, impulsive, and largely automatic, whereas the reflective system is inhibitory, controlled, and self-regulatory (Gong et al., 2019). The second principle demonstrates the sequence of occurrence of the two systems. Initially, the reflexive system generates short-term behavioral urges in a user's brain and attempts to activate behavior without thinking about its consequences (Soror et al., 2015). Users evaluate the behavior, determine whether it is associated with negative consequences, and ultimately decide whether the reflective system should be activated to inhibit the behavior (Turel & Qahri-Saremi, 2016). When users become aware of a behavior that has potential negative consequences, they will activate the reflective system and generate self-regulation to control behavioral urges and align behavior with their long-term goals (Turel & Qahri-Saremi, 2018). The third principle denotes the distinctive engagement of the two systems in fostering technology usage. Technology use can take place either during the reflexive stage, in which users are unaware of negative consequences and unconsciously indulge in the behavior, or the reflective stage, in which users have sufficient awareness of negative consequences and activate self-regulation to control their behavior but fail to do so (Kwon et al., 2016). For example, impulsive buying is reflexive and nonreflective as it is characterized by "a tendency to buy spontaneously or reflexively in response to physical product stimulus" (DeSarbo & Edwards, 1996, p. 233).

Following dual-system theory (Hofmann et al., 2009), we organize obsessive technology use along two dimensions: the state of obsessive technology use (behavioral urge versus usage behavior) and the awareness of negative consequences (unawareness versus awareness). The juxtaposition of the two dimensions produces four obsessive technology use archetypes (see Figure 1): (I) impulsive use, (II) compulsive use, (III) excessive use, and (IV) addictive use. In our literature review (see Appendix A), we found that studies have referred to impulsive use and compulsive use as behavioral urges and to excessive use and addictive use as usage behaviors. We also found that impulsive use and excessive use have been defined without considering users' awareness of negative consequences, whereas compulsive use and addictive use emphasize users' awareness of negative consequences.

Impulsive use refers to the use of a technology in response to a behavioral urge in which users use the technology spontaneously and are unaware of the negative consequences of its usage (Parboteeah, et al., 2009). This type of obsessive technology use has been labeled as impulsive purchase, impulsive sharing, urge to buy impulsively, and urge to check impulsively (Chan et al., 2017; Ho & Lim, 2018). Further, impulsive use is reflexive and users are unaware of potential negative consequences of their technology use. The reflective system that controls obsessive technology use is usually not activated. For instance, Liu et al. (2013, p. 831) emphasized online impulsive buying as the tendency "(1) to experience immediate and sudden urges to make on-the-spot purchases and (2) to act on these felt urges with little conscious deliberation or evaluation of consequences." Likewise, Wang et al. (2017) suggested that impulsive information sharing is driven by a sudden and spontaneous urge to share personal information immediately without thoughtful consideration.

Compulsive use refers to the use of a technology in response to a behavioral urge in which users use the technology repetitively and have sufficient awareness of the negative consequences of its usage (James et al., 2017). This type of obsessive technology use subsumes the concepts of compulsive buying, compulsive use, and obsessive-compulsive disorder (Turel et al., 2011; Wang & Lee, 2020). Further, compulsive use is reflective, and users are aware of the potential negative consequences of their technology use. Although the reflective system to control obsessive technology use is activated, it usually fails (Turel & Qahri-Saremi, 2016; Wang & Lee, 2020). For instance, Haagsma et al. (2013) highlighted compulsive game use as the inability to resist and control the urge to play online games, resulting in harmful consequences. Similarly, Wang and Lee (2020) described compulsive smartphone use as a form of impulse control disorder in which users are preoccupied by a powerful urge to use their smartphone and by the lack of impulse control over such use. Therefore, when users experience irresistible and uncontrollable impulsive urges with sufficient awareness of the negative consequences, they have transitioned from impulsive use to compulsive use.

Excessive use refers to an obsessive pattern of technology usage behavior in which users spend a considerably larger amount of time than originally planned and are unaware of the negative consequences of its usage (Cao et al., 2018). This type of obsessive technology use includes excessive dependence, excessive use, IT-mediated state-tracking, and constant-checking behaviors (Gerlach & Cenfetelli, 2020; Kwon et al., 2016; Zheng & Lee, 2016).

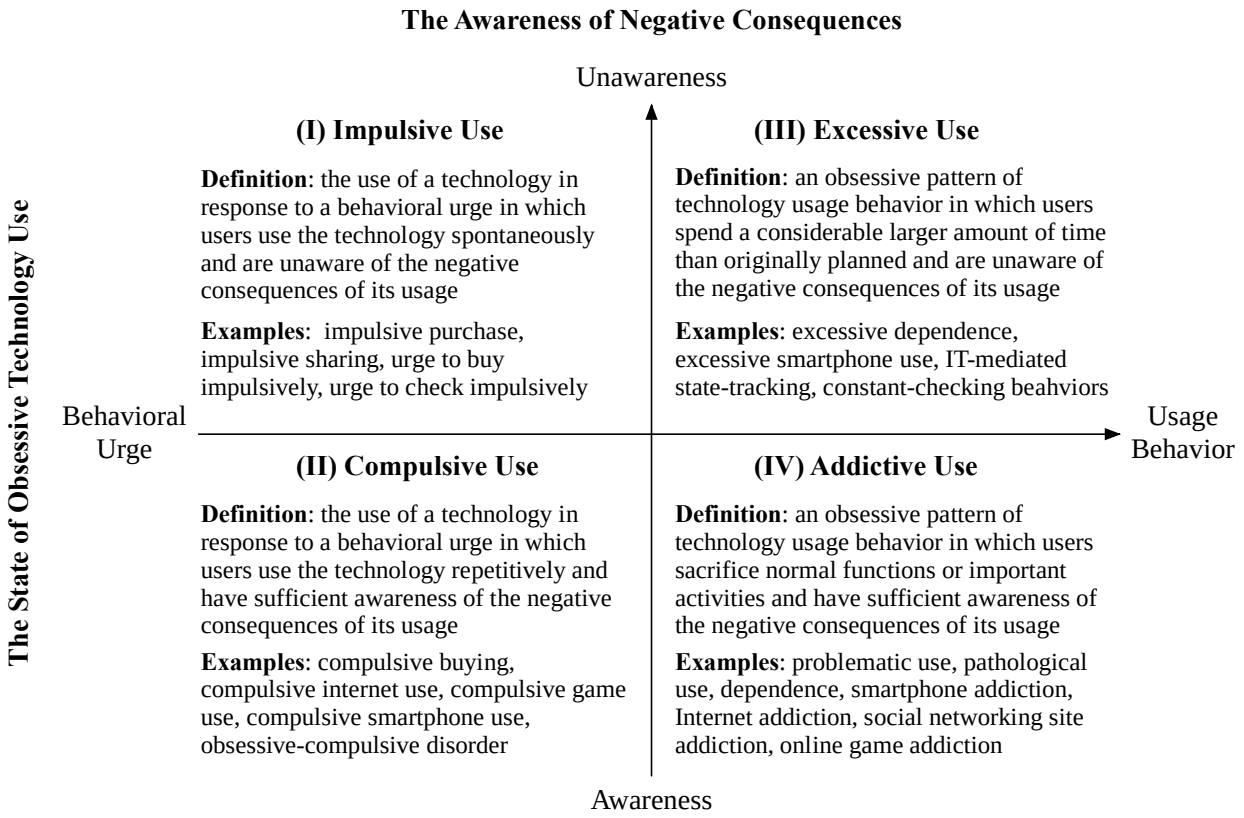


Figure 1. Typology of Obsessive Technology Use

Further, excessive use is reflexive, and users are unaware of its potential negative consequences and thus have not activated the reflective system to control such obsessive technology use. In fact, studies have mostly conceptualized and measured excessive use in terms of frequency, extent, and duration of technology use (Gerlach & Cenfetelli, 2020). For instance, Zheng and Lee (2016) found that when the duration, extent, and frequency of using social networking sites become more substantial than originally planned, users experience excessive social networking site use. Gerlach and Cenfetelli (2020) emphasized that the automatic or unconscious constant checking of digital devices is a widely observed excessive use phenomenon.

Addictive use is an obsessive pattern of technology use in which users sacrifice normal functioning or important activities and have sufficient awareness of the negative consequences of its usage (Turel et al., 2011). This type of obsessive technology use has been identified by studies as technology addiction, dependence, problematic use, and pathological use (Chen et al., 2020; Venkatesh et al., 2019; Wang et al., 2015). Further, addictive use is reflective, and users are aware of its potential negative consequences and have activated the reflective system to control such obsessive technology use but usually fail to do so. For instance, Turel et al. (2011, p. 1044) suggest that "(1) addicted users are unable to voluntarily reduce the use of a technology" even when they are aware that "(2) the use of the technology conflicts with other tasks and impairs normal functioning." Similarly, Tarafdar et al. (2020) report that technology addiction is an uncontrollable pattern of technology use typically associated with harmful negative consequences. Some IS researchers have framed addictive use as problematic excessive use, a state in which users lose control over the use of a technology and keep using it excessively despite experiencing significant intrapersonal, interpersonal, and academic-professional problems (Chen et al., 2020; Lee et al., 2021; Vaghefi et al., 2017). Therefore, when users experience uncontrollable excessive use with sufficient awareness of the negative consequences, they have transitioned from excessive use to addictive use (Wang et al., 2015).

3 Identity Theory

By considering the online social gaming context, we develop boundary conditions and incorporate identity theory (Stryker & Burke, 2000) to explain how contextual antecedents (i.e., IT identity and social identity) shape obsessive online social gaming. Figure 2 depicts the conceptual framework of identity theory. The theory suggests that individuals are motivated to act in ways that are congruent with their identities.

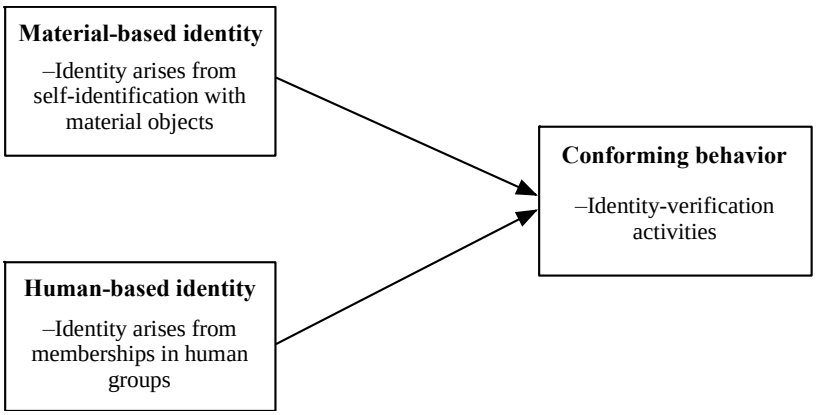


Figure 2. Conceptual Framework of Identity Theory

After forming an identity, individuals tend to engage in verification activities that conform to their formed identities, collectively known as conforming behavior (Carter & Grover, 2015), which can be either normal or deviant. When individuals identify with deviant social categories, they engage with a social environment in which they are exposed to deviant role models (Lowry et al., 2016). To reinforce their formed identities, users are likely to engage in deviant conforming behaviors, such as unregulated and obsessive technology use (Gong et al., 2020; Polites et al., 2018). Our literature review (see Appendix B) shows that identity can be broadly divided into two types: material- and human-based identities.

Material-based identity is when users self-identify with material objects, such as avatars, robots, and technologies (You & Robert, 2018). As a typical form of material-based identity in the IS discipline, IT identity refers to the extent to which users view the use of a technology as integral to their sense of self (Carter & Grover, 2015). IT identity comprises relatedness, emotional energy, and dependence dimensions (Carter et al., 2020). Relatedness captures users' feelings of connectedness with a technology, thereby blurring the boundaries between the technology and the self and acting as a stepping stone to identifying with the technology (Schmalz et al., 2019). Users who feel a strong sense of relatedness with a technology will view the technology as integral to their sense of self across different situations. Emotional energy denotes users' feelings of enthusiasm and passion in relation to a technology (Carter et al., 2019). This factor represents the enduring feeling of affective attachment and enthusiasm that arises as a long-term consequence of satisfactory interactions between users and technologies. Dependence refers to users' feelings of reliance upon a technology. In today's digital world, technology has become an indispensable part of our personal and social routines. Strong dependence on the use of a technology corresponds to a strong tendency to view the technology as integral to one's sense of self.

Human-based identity focuses on how one's identity arises from membership in human groups (You & Robert, 2018). As a typical form of human-based identity in the IS discipline, social identity refers to the extent to which users identify with their small friendship group in online communities (Tsai & Bagozzi, 2014). Social identity has affective, cognitive, and evaluative elements (Bagozzi & Dholakia, 2006; Tsai & Bagozzi, 2014). Cognitive social identity captures users' cognitive awareness of themselves as representative of their small online friendship group (Shen et al., 2010). Such group-based cognitive awareness results from a depersonalization process through which users shape cognitions about their similarities with ingroup members and their dissimilarities with outgroup members. Affective social identity denotes users' affective commitment and attachment to their small online friendship group (Pan et al., 2017). The development of kinship and affect between group members is important to identification in online communities. Evaluative social identity focuses on the value connoted by group membership (Cheung & Lee, 2010). At this stage, users may form group-based self-esteem, which makes them feel proud of being a group member.

4 Research Model and Hypotheses

Figure 3 presents our dual-identity model of obsessive online social gaming. We use identity theory (Stryker & Burke, 2000) as the underlying framework to develop our research model and hypotheses. Building upon prior identity studies in the IS literature (Carter & Grover, 2015; Tsai & Bagozzi, 2014), we examine how the two types of identity, human- and material-based, affect conforming behavior. Specifically, we argue that IT identity and social identity lead to obsessive online social gaming, including impulsive use, compulsive use, excessive use, and addictive use.

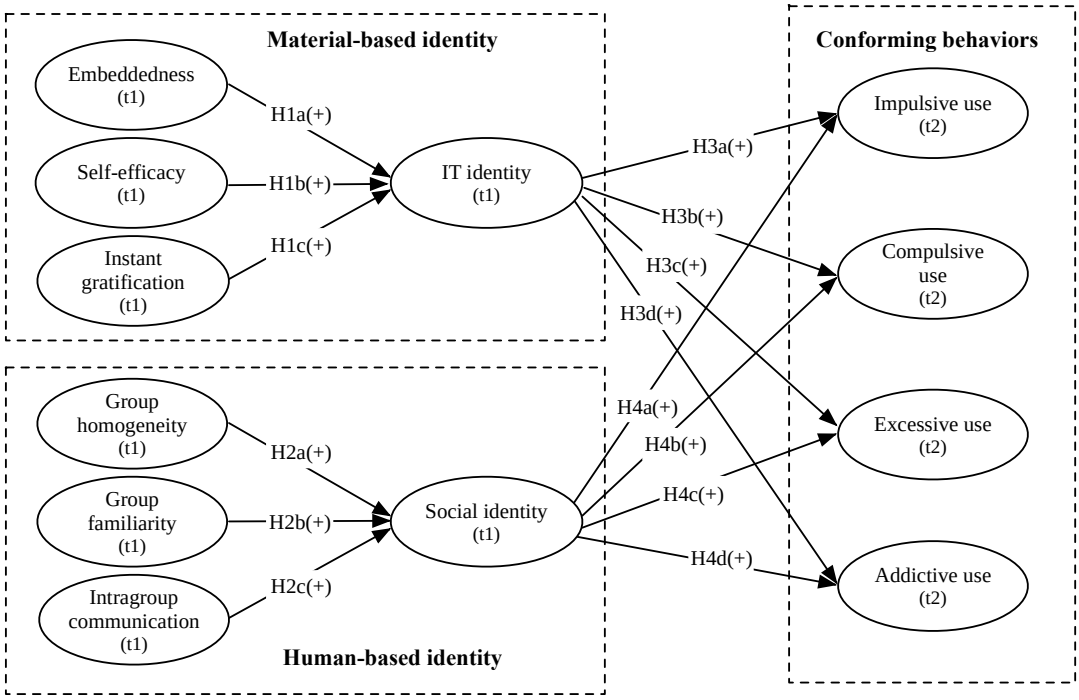


Figure 3. Research Model

4.1 Antecedents of IT Identity

IT identity refers to the extent to which users view the use of IT as integral to their sense of self (Carter & Grover, 2015). Identity theory suggests that IT identity is an outcome of identity verification experiences, including (1) past investment in identity, (2) self-efficacy at verifying identity, and (3) actualized rewards of maintaining identity (Carter & Grover, 2015). We follow Carter and Grover's (2015) arguments and operationalize these antecedents of IT identity as follows: past investment in identity as embeddedness, self-efficacy at verifying identity as self-efficacy, and actualized rewards of maintaining identity as instant gratification.

Embeddedness refers to users' perception of the time and effort invested in playing online social games (Zhang, Lee, Cheung, & Chen, 2009). Studies have suggested that users' investment in using IT is the most important determinant of their formed IT identity (Polites et al., 2018). In the context of online social games, a high degree of embeddedness means that users have dedicated a considerable amount of time and energy to playing online social games. Such investments contribute gradually to users' feeling of relatedness, emotional energy, and reliance toward online social games, thereby generating a sense of IT identity (Reychav et al., 2019; Teng, 2017). Thus, we hypothesize the following:

H1a: Embeddedness is positively related to IT identity.

Self-efficacy refers to users' beliefs about their capabilities in playing online social games (Keith et al., 2015). As mentioned earlier, IT identity is typically verified when users identify with a technology with which they interact (Craig et al., 2019). In the context of online social games, a high degree of self-efficacy suggests that users have the confidence and expertise to play online social games, even if they have only online instructions for reference. These beliefs enable users to successfully play the game, satisfy their needs for self-esteem, and receive self-confirming feedback, further verifying their self-identification with online social games (Santhanam et al., 2016; Suh et al., 2017). Users with strong self-efficacy tend to view playing games as integral to their sense of self. Thus, we hypothesize the following:

H1b: Self-efficacy is positively related to IT identity.

Instant gratification refers to the degree of immediate enjoyment and satisfaction derived from playing online social games (Liu et al., 2013). Online social games allow users to interact with others in a fantastic virtual gaming world (Huang et al., 2019). Such an experience can satisfy users' emotional needs and provide stimulation, such as enjoyment, arousal, and the thrill of victory (Guo et al., 2019). With accumulated gaming experience and gratification, users tend to formulate feelings of relatedness, emotional attachment, and dependence in relation to the act of playing online social games (Liu et al., 2017). As suggested by Carter and Grover (2015, p. 947), "ITs that have materially benefitted individuals or have

provided some intrinsic gratifications are more likely to become integral to the self than those that gain a person little or nothing." Thus, we hypothesize the following:

H1c: Instant gratification is positively related to IT identity.

4.2 Antecedents of Social Identity

Social identity refers to the extent to which users identify with their small friendship group in online social game communities and view themselves as group members (Tsai & Bagozzi, 2014). Identity theory proposes three major factors that contribute to social identity: (1) homogeneity of ingroup members, (2) familiarity of ingroup members, and (3) intragroup communication between ingroup members (Ren et al., 2012). We follow Ren et al. (2012) and operationalize the three antecedents of social identity—namely, homogeneity of ingroup members as group homogeneity, familiarity of ingroup members as group familiarity, and intragroup communication between ingroup members as intragroup communication.

Group homogeneity refers to users' subjective perceptions regarding similarity to other ingroup members in online social game communities (Shen et al., 2010). Homogeneity is the primary criterion applied by users to categorize themselves as ingroup members (Mueller et al., 2019). In online social game communities, a high degree of group homogeneity means that users perceive they have many things in common (e.g., personalities, hobbies, or values) with other ingroup members, enabling a sense of social identity with their small friendship group (Carras et al., 2017; Kaye et al., 2017). Thus, we hypothesize the following:

H2a: Group similarity is positively related to social identity.

Group familiarity refers to users' subjective perceptions of their knowledge of other ingroup members in online social game communities (Shen et al., 2010). Familiarity not only facilitates interpersonal trust, affective commitment, and feelings of belongingness among ingroup members but also allows users to accumulate knowledge about other ingroup members (Ren et al., 2012). These knowledge cues serve as the basis for mitigating uncertainties and risks in group membership. Users with a high degree of group familiarity can show favoritism, emotional attachment, and positive value connotation toward their group membership, thereby generating a sense of social identity with their small friendship group (Bagozzi & Dholakia, 2006). Thus, we hypothesize the following:

H2b: Group familiarity is positively related to social identity.

Intragroup communication refers to the frequency and quality of IT-enabled communications between ingroup members in online social game communities (Moon et al., 2013). The identity literature has suggested that intragroup communication can provide shared language and mutual understanding between ingroup members, thereby playing a key role in forming users' identity in online communities (Ren et al., 2012). In online social game communities, users typically interact with other ingroup members through diverse IT-enabled communication features, such as in-game messaging, boards, and chatrooms (Domahidi et al., 2018). A high degree of intragroup communication indicates that users can easily express their ideas, feelings, and emotions to other members through IT-enabled communication features (Kwak et al., 2019; Silic & Lowry, 2020). Frequent intragroup communication helps users establish a sense of social identity with their small friendship group. Thus, we hypothesize the following:

H2c: Intragroup communication is positively related to social identity.

4.3 Obsessive Online Social Gaming

Obsessive online social gaming refers to a maladaptive psychological dependency on playing online social games that typically results in a series of negative consequences and threatens the well-being of users (James et al., 2017). In this study, we argue that IT identity and social identity affect the four obsessive online social gaming archetypes, namely, impulsive use, compulsive use, excessive use, and addictive use. This idea is consistent with identity theory, which states that users are motivated to act in ways that are congruent with their identities (Stryker & Burke, 2000). Given the hedonic nature of online social games, users often feel highly excited and delighted when playing them (Lowry et al., 2013). To conform their identities to obtain the intrinsic rewards of online social games, users with high IT identity and social identity may spend considerable time playing online social games. The positive reinforcement process of reward seeking is a vicious cycle of hedonic IS use in which users' self-regulation is gradually distorted and ultimately fosters obsessive online social gaming (Hou et al., 2019; Ma et al., 2014).

4.3.1 Effect of IT Identity on Obsessive Online Social Gaming

The psychology literature posits that users' substance identity can lead to obsessive substance use. For instance, Lindgren et al. (2016) argue that drink identity—referring to the strength of self-identification with alcohol—promotes obsessive alcohol consumption. This argument is consistent with early neuroscience research, which found that obsessive substance use is usually an intrinsic reward-oriented outcome derived from the release of midbrain

dopamine neurons (Koob & Moal, 1997). Midbrain dopamine neurons generate positive feelings, such as pleasure, excitement, and arousal (Berridge & Robinson, 2016), that act as desirable outcome expectations stored in the memory. However, such feelings can distort users' self-regulation cycles and urge them to behave impulsively, compulsively, excessively, or even addictively (Chen et al., 2017; Lee & LaRose, 2007). When users engage in identity verification activities, a high degree of substance identity provides favorable intrinsic rewards, such as social acceptance, peer approval, and consumption pleasure. Consequently, identity verification increases the tendency of such users to indulge in obsessive substance use, especially when such behaviors are intrinsically rewarding.

The IS literature shows that the intrinsic rewards from user-to-technology interactions may foster users' obsessive technology use. For instance, Wang et al. (2017) found that users' positive feelings toward microblogs can motivate impulsive information sharing on such platforms. Chan et al. (2017) contend that intrinsic rewards, such as enjoyment, flow, and other positive feelings, can drive users' urges to buy impulsively. Regarding compulsive use, Klobas et al. (2018) argue that intrinsic reinforcement motives, such as instant gratification and perceived enjoyment, can push users to engage in compulsive smartphone use. James et al. (2017) identified feelings of entertainment, excitement, and belongingness as important determinants of compulsive social networking site use. Excessive use is when users spend relatively more time engaged with technology than they originally planned. Prior studies on excessive use have revealed that the perceived enjoyment and excitement of using a technology can increase the likelihood of users engaging in excessive behaviors (Ho et al., 2017; Shen & Wang, 2019). Addictive use is characterized by an obsessive pattern of technology use, which leads to a series of harmful consequences, such as intrapersonal, interpersonal, and academic/professional problems. Prior studies have proposed that technology addiction can be driven by the desire to obtain intrinsic rewards, such as a sense of achievement (Xu et al., 2012) and perceived enjoyment (Turel, 2015; Turel & Serenko, 2012; Wang et al., 2015).

In the context of online social games, a strong IT identity means that users develop intense feelings of relatedness, emotional energy, and dependence on online social games (Carter & Grover, 2015). Users may also feel a sense of reliance on the game or feel highly delighted when playing the game (Polites et al., 2018). These intrinsic reward factors further drive users' impulsive or even compulsive online social gaming. When IT identity is strengthened, users tend to spend a large amount of time on identity verification activities, which may eventually manifest as excessive or even addictive online social gaming. Users with a strong IT identity have a high likelihood of playing impulsively, compulsively, excessively, or even addictively. Thus, we hypothesize the following:

H3a: IT identity is positively related to impulsive use.

H3b: IT identity is positively related to compulsive use.

H3c: IT identity is positively related to excessive use.

H3d: IT identity is positively related to addictive use.

4.3.2 Effect of Social Identity on Obsessive Online Social Gaming

The psychology literature proposes that users' social identity can promote obsessive substance use. For instance, Foster et al. (2014) contend that users identifying with students who gamble frequently tend to foster obsessive gambling tendencies. Neighbors et al. (2010) show that users are likely to develop obsessive alcohol consumption when establishing their social identity with a reference group that drinks. Early sociology studies have suggested that social identity fosters obsessive substance use through an underlying deindividuation effect (Reicher et al., 1995). Deindividuation refers to "the loss of one's sense of individuality through submergence in a social group" (Postmes & Spears, 1998, p. 239). When deindividuated within a social group, users' self-awareness will transform from the individual to the group level (Lowry et al., 2017; Lowry et al., 2016). Users tend to behave on the basis of group norms rather than in accordance with their internal standards and values (Lowry et al., 2013). Therefore, the public perception of an obsessive behavior as unacceptable may be neutralized as acceptable based on ingroup norms and standards (Vance et al., 2013).

The IS literature also shows that intrinsic rewards from user-to-user interactions may foster obsessive technology use. For example, Chen et al. (2016) show that social interaction with ingroup members provides comfort to users in social commerce communities and urges them to buy impulsively. Wang et al. (2017) report that social interaction between microblog users can encourage impulsive information sharing. Caplan (2010) and Haagsma et al. (2013) argue that a preference for online social interaction is a key motivation for users' compulsive online gaming. Lee et al. (2014) argue that the need for social connections can increase the tendency for users to develop compulsive smartphone use. Likewise, Zhu et al. (2015) and Li et al. (2016) maintain that users who affiliate with addicted internet peers tend to develop excessive and addictive internet use. Gong et al. (2019) and Xu et al. (2012) report that users' social identity and need for relationship maintenance with online game community members contribute to their online game addiction.

In the case of online social games, a high degree of social identity indicates that users have a sense of belonging, emotional attachment, and group self-esteem to a small friendship group in online social game communities (Gong et al., 2019). To maintain a positive and self-defining relationship with fellow game community members, users tend to develop behavioral desires to play games with their ingroup members (Tsai & Bagozzi, 2014). These accumulated behavioral desires gradually transform into impulsive, compulsive, excessive, and addictive online social gaming. Thus, we hypothesize the following:

H4a: Social identity is positively related to impulsive use.

H4b: Social identity is positively related to compulsive use.

H4c: Social identity is positively related to excessive use.

H4d: Social identity is positively related to addictive use.

5 Research Method

We conducted a longitudinal field survey of current users of *Honor of Kings*[1] to empirically validate our research model. A longitudinal survey is one of the most commonly used data collection methods in obsessive technology use studies in the IS literature (Tarafdar et al., 2020; Turel & Qahri-Saremi, 2016), and it can establish causality and reduce common method bias (Podsakoff, MacKenzie et al., 2003).

5.1 Sample and Data Collection

Honor of Kings is a popular massive multiplayer online social game in China. As of February 2019, the game had more than 200 million registered users and 151 million active monthly users (Statista, 2019a). Users typically log into *Honor of Kings* using their Tencent WeChat accounts. Upon logging in, users can invite their guild or friends group members who are also playing the game to form a team and enter a battle (see Appendix C). The basic gaming structure of *Honor of Kings* is that (1) two opposing teams of five users have a collective goal to destroy each other's bases, (2) each user controls a single avatar called a "hero," and (3) users must kill enemy units continuously to level up their heroes and accumulate advantages (Gong et al., 2019). These contextual socialization mechanisms encourage users to play the game repeatedly and obsessively with other users.

The survey questionnaires were randomly distributed to *Honor of Kings* users through a popular online survey website called Sojump. At the pilot study stage, we piloted online questionnaires with 33 users to clarify the instructions and terms. In the follow-up phase of the first survey, we used a questionnaire to measure embeddedness, self-efficacy, instant gratification, group homogeneity, group familiarity, intragroup communication, IT identity, and social identity. The respondents were asked to identify up to five group members from their friendship lists with whom they regularly interacted. The respondents were then asked to picture the images of each group member and recall their previous social gaming experiences. They answered the questions by following the recall information specific to their online social gaming experiences. Six weeks later, at the second survey stage, the respondents who completed the first questionnaire were invited to complete a second questionnaire, and their responses were used to assess impulsive use, compulsive use, excessive use, addictive use, age, gender, education, income, usage experience, usage frequency, habits, and social desirability bias.

To encourage participation, we offered US$5.00 to respondents who completed both the first and second questionnaires. Tencent WeChat accounts were used to match the respondents' answers to the two questionnaires. The first survey yielded 931 usable questionnaires, and 627 respondents completed both the first and second surveys. Of the 627 respondents, 31.6% were female, 98.9% were aged 30 or younger, and 72.2% held a bachelor's degree. In terms of usage experience and frequency, 92.5% of respondents had been playing *Honor of Kings* for more than three months, and 85.1% reported playing the game at least three times a week.

5.2 Instrument Development

Most constructs were measured by adapting previously validated scales. All constructs were measured on a 7-point scale with the exception of social desirability bias, which was measured on a 2-point scale. To determine which constructs were reflective and which were formative, we followed the five-step decision guidelines of Polites et al. (2012) and operationalized all of the variables as reflective first-order constructs except for IT identity and social identity (see Appendix D). IT identity was treated as a formative second-order construct with relatedness, emotional energy, and dependence dimensions, as defined in the IT identity literature (Carter & Grover, 2015; Carter et al., 2020). Social identity was also treated as a formative second-order construct with affective, cognitive, and evaluative elements, as conceptualized in the social identity literature (Bagozzi & Dholakia, 2006; Tsai & Bagozzi, 2014).

[1] *Honor of Kings* is officially known in Chinese as *Wangzhe Rongyao* and alternatively translated in English as *Kings of Glory* or *Arena of Valor*.

The scales for embeddedness, self-efficacy, and instant gratification were adapted from Zhang et al. (2009), Brown and Venkatesh (2005), and Chen et al. (2017), respectively. The scales for group homogeneity, familiarity, and communication were adapted from Tuškej et al. (2013), Chiu et al. (2006), and Moon et al. (2013), respectively. The new scales for IT identity were developed by following rigorous IS instrument development procedures (see Appendix E). The scales for affective social identity, cognitive social identity, and evaluative social identity were adapted from Tsai and Bagozzi (2014). The scales for impulsive use, compulsive use, excessive use, addictive use, social desirability bias, and habit were adapted from Parboteeah et al. (2009), Haagsma et al. (2013), Zheng and Lee (2016), Turel et al. (2011), Reynold (1982), and Limayem et al. (2007), respectively.

5.3 Common Method Bias and Social Desirability Bias

To alleviate common method bias, we used a longitudinal design to collect data at two different points in time. Compared with cross-sectional data, longitudinal data are less susceptible to common method bias because of the use of a time-matched sample (Boss et al., 2015; D'Arcy & Lowry, 2019). We also adopted the marker variable technique and collected fashion consciousness as a marker variable in our survey (Malhotra et al., 2006). As expected, the average correlation between fashion consciousness and the other principal variables was nonsignificant ($\beta = 0.03$, $p > 0.05$), indicating minimal concern for common method bias.

To prevent social desirability bias, we offered the respondents a certain degree of anonymity by publishing the anonymous questionnaires on Sojump, a third-party survey website with millions of registered respondents from different demographic backgrounds. The use of a third-party platform for data collection can guarantee a high degree of anonymity, thereby effectively restraining social desirability bias (e.g., Burns et al., 2019; Lowry et al., 2013; Posey et al., 2015; Silic & Lowry, 2020). Moreover, we included social desirability bias as a control variable in our study (Kwak et al., 2019). The results show that social desirability bias was slightly associated with impulsive use ($\beta = -0.11$, $p < 0.001$), compulsive use ($\beta = -0.16$, $p < 0.001$), excessive use ($\beta = -0.18$, $p < 0.001$), and addictive use ($\beta = -0.20$, $p < 0.001$). Thus, since we controlled for its effects, social desirability bias is unlikely to be a critical issue for this study.

6 Data Analysis and Results

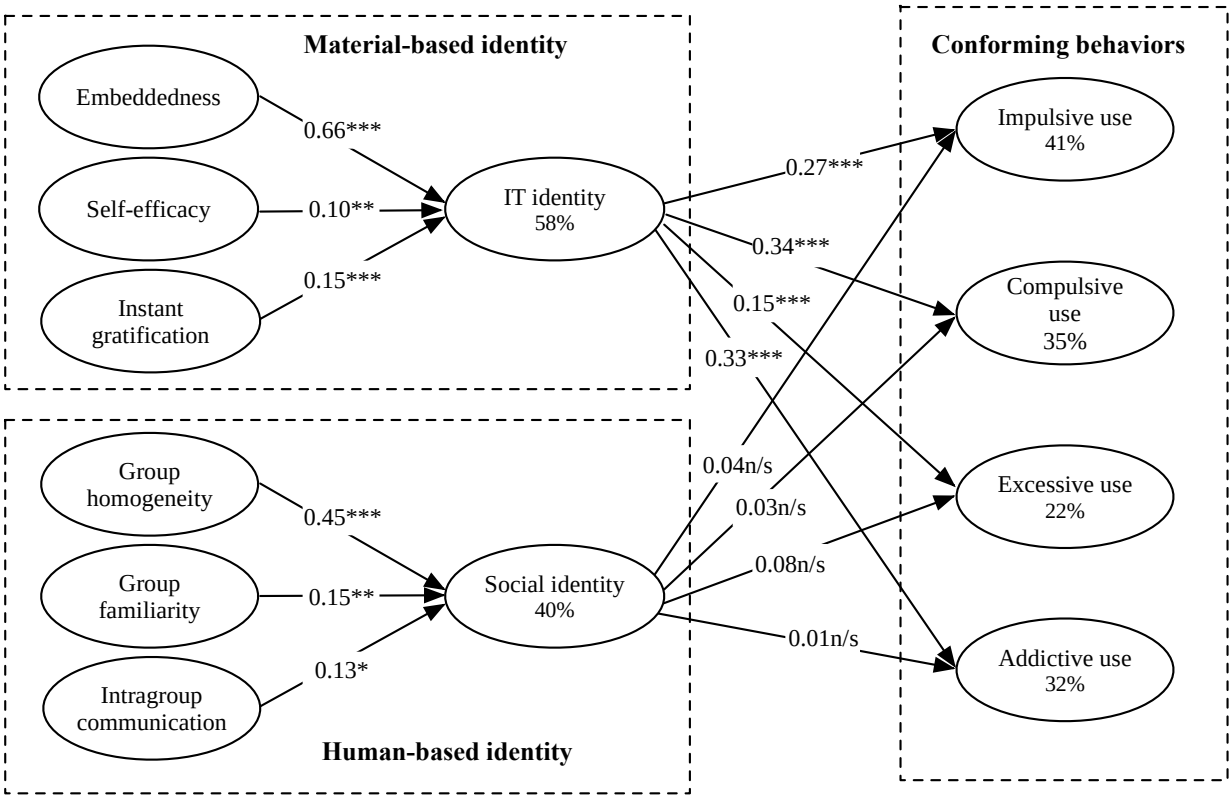
The research model was empirically validated using partial least squares (PLS), a component-based structural equation modeling (SEM) approach. PLS has advantages in developing theories in exploratory research and focuses on maximizing the explained variance of endogenous variables (Hsu et al., 2015; Lowry & Moody, 2015). In addition, PLS is particularly suitable for modeling complex models with both reflective and formative constructs, and it does not produce inadmissible solutions or the factor indeterminacy problems that can occur with a covariance-based SEM approach (Lowry & Gaskin, 2014; Sharma et al., 2019). The specific software used was SmartPLS 2.0 using the standard bootstrapping setting with 5,000 resamples. Following two-step analytical procedures, we reported the measurement and structural models.

6.1 Measurement Model

We assessed convergent and discriminant validity to validate the measurement model of the reflective first-order constructs (see Appendix F). The results showed that (1) the item loadings of all constructs were higher than 0.7, (2) their average variance extracted (AVE) values were higher than 0.5, (3) their composite reliability (CR) scores were 0.7 or above, (4) their Cronbach's alpha (CA) values were greater than 0.7, and (5) the square root of the AVE for each construct was greater than its correlations with the other constructs. We evaluated the weights, variance inflation factors (VIFs), and loadings to validate the measurement model of the formative second-order constructs (see Appendix F). The results indicate that the VIFs of all of the indicators were below the recommended 3.3 threshold, suggesting no evidence of multicollinearity (Petter et al., 2007). Moreover, all of the indicators demonstrated highly significant weights, except for evaluative social identity. All of the indicators loaded well on their intended constructs. Evaluative social identity is a theoretically integral part of social identity, and it obtained statistically significant loadings. Hence, we followed the suggestion of Hair et al. (2016) and included this factor in our analyses.

6.2 Structural Model

We assessed the significance of the path coefficients and the R-square of the endogenous variables to validate the structural model. Figure 4 presents the PLS results of the structural model. The results show that embeddedness ($\beta = 0.66$, $p < 0.001$), self-efficacy ($\beta = 0.10$, $p < 0.01$), and instant gratification ($\beta = 0.15$, $p < 0.001$) exhibited significant effects on IT identity, thereby supporting H1a, H1b, and H1c. Group homogeneity ($\beta = 0.45$, $p < 0.001$), group familiarity ($\beta = 0.15$, $p < 0.01$), and intragroup communication ($\beta = 0.13$, $p < 0.05$) positively influenced social identity, thereby supporting H2a, H2b, and H2c. Finally, IT identity was positively associated with impulsive use ($\beta = 0.27$, $p < 0.001$), compulsive use ($\beta = 0.34$, $p < 0.001$), excessive use ($\beta = 0.15$, $p < 0.001$), and addictive use ($\beta = 0.33$, $p < 0.001$), thereby confirming H3a, H3b, H3c, and H3d.



Note: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Figure 4. Structural Model.

Contrary to our expectations, social identity had nonsignificant effects on impulsive use (β = 0.04, $p > 0.05$), compulsive use (β = 0.03, $p > 0.05$), excessive use (β = 0.08, $p > 0.05$), and addictive use (β = 0.01, $p > 0.05$), thereby rejecting H4a, H4b, H4c, and H4d.

In terms of the control variables, only usage frequency, habit, and social desirability bias had effects on the four obsessive online social gaming archetypes. Usage frequency positively affected impulsive use (β = 0.22, $p < 0.001$) and compulsive use (β = 0.14, $p < 0.01$). Habit positively influenced impulsive use (β = 0.29, $p < 0.001$), compulsive use (β = 0.20, $p < 0.001$), excessive use (β = 0.24, $p < 0.001$), and addictive use (β = 0.18, $p < 0.001$). Social desirability bias was negatively associated with impulsive use (β = −0.11, $p < 0.001$), compulsive use (β = −0.16, $p < 0.001$), excessive use (β = −0.18, $p < 0.001$), and addictive use (β = −0.20, $p < 0.001$). Overall, the model explained 58%, 40%, 41%, 35%, 22%, and 32% of the variances in IT identity, social identity, impulsive use, compulsive use, excessive use, and addictive use, respectively. We also performed post hoc analyses of the effects size test, mediation effect test, and the influence of social identity on IT identity and its dimensions to confirm the model's validity (see Appendix G).

7 Discussion and Conclusion

Obsessive online social gaming has become a societal challenge worldwide and is receiving increasing attention from the public, governments, and the academic community. To address this societal problem and the research gaps in the literature, our primary objective was to develop a dual-identity perspective of obsessive online social gaming. Guided by dual-system theory (Hofmann et al., 2009), we theoretically derived a typology of four obsessive technology use archetypes: impulsive use, compulsive use, excessive use, and addictive use.

These four types can be organized along two dimensions: the state of obsessive technology use (behavioral urge versus usage behavior) and the awareness of negative consequences (unawareness versus awareness) (see Figure 1). We further used identity theory (Stryker & Burke, 2000) to examine the formation of obsessive online social gaming. Specifically, we theoretically explained and empirically examined the effects of IT identity and social identity on obsessive online social gaming. Our empirical results provide several key findings.

First, embeddedness, self-efficacy, and instant gratification are important determinants of IT identity, whereas group homogeneity, group familiarity, and intragroup communication are key predictors of social identity. Numerous IS studies have examined the antecedents of social identity pertaining to the homogeneity of ingroup members, familiarity of ingroup members, and intragroup communication between ingroup members in online communities (Ren et al., 2012; Tsai & Bagozzi, 2014). Our work confirms that group homogeneity, group familiarity, and intragroup communities collectively determine users' identification with other members in the online social game community. However, IT identity is a relatively new concept in the IS discipline. Carter and Grover (2015) have theoretically justified that past investment in an identity, self-efficacy at verifying the identity, and actualized rewards of maintaining that identity are three key sources of IT identity in a general IT context. In complementarity with Carter and Grover (2015), our work empirically validates embeddedness, self-efficacy, and instant gratification as the contextual antecedents of IT identity in the online social game context.

Second, IT identity not only significantly and positively influences the four obsessive online social gaming archetypes but also fully mediates the effects of social identity on obsessive online social gaming. Over the past decade, IS scholars have widely used human-based identity perspective to explain the nature of users' conforming behaviors (Kim et al., 2012; Ray et al., 2014; Tsai & Bagozzi, 2014). A prevalent assumption in the IS literature is that human-based identity is the primary motivation for users' normal and desirable conforming behaviors (Carter & Grover, 2015; Carter et al., 2020). Our empirical findings move this assumption a step further and indicate that human- and material-based identities both play important roles in the formation of users' deviant and undesirable conforming behaviors. Specifically, IT identity exerts a more significant influence than social identity on users' obsessive online social gaming.

Third, social identity has nonsignificant effects on the four obsessive online social gaming archetypes. The results of our mediation test further suggest that IT identity fully mediates the effects of social identity on impulsive use, compulsive use, excessive use, and addictive use. That is, users' identification with social game groups does not foster obsessive online social gaming without the formation of an IT identity toward online social games. There are two plausible explanations for these surprising and unexpected results. First, IT identity theory suggests that the actualized rewards of maintaining identity are a key determinant of IT identity (Carter & Grover, 2015; Carter et al., 2020). In a study of the deep structure use of smartwatch, Ogbanufe and Gerhart (2020) found that a sense of belonging and social interaction are important actualized social rewards that determine IT identity. That is, social identity may serve as an actualized reward that determines IT identity, which in turn fosters obsessive online social gaming. Future studies should further evaluate the relationship between IT identity and social identity in the context of obsessive technology use. Second, 75.1% of the users in our research sample had been playing *Honor of Kings* for 12 months or less.[2] Social identity theory posits that the effects of social identity on technology conforming behaviors may depend on potential situational and temporal boundary conditions (Shen et al., 2010; Tsai & Pai, 2012). Tsai and Bagozzi (2014) further found that usage experience may moderate the effect of social identity on technology conforming behaviors such that the positive relationship becomes weaker for inexperienced than for experienced users in online communities. Therefore, it is likely that the relationship between social identity and obsessive online social gaming became statistically nonsignificant in our research sample. Future studies should seek to identify potential contextual boundary conditions that influence the relationship between social identity and obsessive technology use.

7.1 Theoretical Implications

This work has several key theoretical implications. First, the obsessive technology use literature is complex and disparate. Limited information has been presented to link the various interrelated types of obsessive technology use. Our work advances the literature by developing a typology of obsessive technology use with two dimensions: the state of obsessive technology use (behavioral urge versus usage behavior) and the awareness of negative consequences (unawareness versus awareness). This two-dimensional typology further produces four interrelated types of obsessive technology use—namely, impulsive use, compulsive use, excessive use, and addictive use (see Figure 1). Prior studies describe the phenomena using various terminologies interchangeably (see Appendix A). These inconsistent terminologies have been severely criticized because they challenge the rigor of the obsessive technology use literature (Gerlach & Cenfetelli, 2020). Our two-dimensional typology can help researchers characterize and distinguish between the different types of obsessive technology use and serve as a guide for future obsessive technology use research.

[2]*Honor of Kings* is a relatively new online social game that was delivered to the market in November 2015. Our longitudinal survey data was collected from April 2017 to June 2017. Therefore, it is reasonable that 75.1% of users had less than 12 months of gaming experience in *Honor of Kings*.

Second, our work advances the obsessive technology use literature by incorporating contextualization into theory development. There are two primary contextual theorizing practices: (1) antecedent contextualization that focuses on incorporating contextual factors as antecedents of endogenous variables, and (2) boundary condition contextualization that centers on examining contextual factors as moderators of relationships or replicating theoretical models in different research contexts (Avgerou, 2019; Hong et al., 2014; Zhang, 2017). Our work extends the boundary conditions of obsessive technology use by contextually replicating its typology to conceptualize obsessive online social gaming. Moreover, our work focuses on the effects of contextual antecedents (i.e., IT identity and social identity) on obsessive online social gaming. The majority of the antecedents that have been validated focused on general sociopsychological motives, such as self-regulation (Turel & Osatuyi, 2018) and perceived enjoyment (Turel & Serenko, 2012). However, the effects of contextual antecedents on obsessive technology use have been largely overlooked. Our work bridges this knowledge gap by investigating the effects of IT identity and social identity on obsessive online social gaming. Thus, our work shifts the focus of research on the antecedents of obsessive technology use from general sociopsychological motives to contextual factors.

Third, our work enriches identity theory by developing instruments for measuring IT identity and for empirically validating its antecedents and outcomes. Although the relationship between IT and identity is receiving increased attention in the IS research community, most studies have only examined identity as it pertains to human-based identity, such as social identity, team identification, community identification, and perceived identity verification (see Appendix B). As a typical material-based identity, IT identity has not received adequate research attention. One possible explanation is that IT identity is an emerging construct proposed by Carter and Grover (2015) without readily available instruments. In this study, we develop the instruments of IT identity and conduct a longitudinal study to empirically test its determinants and outcomes. Thus, our work complements the IT identity literature, such as Carter and Grover (2015), and provides empirical evidence supporting the role of IT identity in explaining deviant behavior.

Fourth, our work contributes to identity theory by extending the theory to obsessive technology use. The IS discipline has primarily focused on the relationship between identity and desirable conforming behaviors, such as persistent use, feature use, and enhanced use (Carter & Grover, 2015; Carter et al., 2020; Suh et al., 2011). However, the effect of identity on undesirable conforming behaviors has rarely been addressed in the IS research community (Polites et al., 2018). The psychology literature has recently begun to apply identity theory to investigate user obsessive substance use related to physical commodities, such as alcohol, drugs, and cigarettes (Hertel et al.,2018; Montes et al., 2018). In this work, we extend identity theory to investigate obsessive technology use induced by nonphysical, nonsubstance, and IT commodities.

7.2 Practical Implications

This work offers several important practical implications. First, obsessive online social gaming can be effectively managed based on the two-dimensional typology. Although the literature proposes effective information- and capability-enhancing measures to address obsessive online social gaming (Gong et al., 2019), the roles of these strategies may vary in controlling the different forms of obsessive online social gaming. Specifically, information-enhancing measures focus on users who are unaware of the harmful consequences of obsessive gaming (Kwon et al., 2016). Conversely, capability-enhancing measures center on users who are incapable of resisting obsessive gaming despite having sufficient awareness of its potential harm (Kwon et al., 2016). Information-enhancing measures may be highly effective in curbing impulsive and excessive online social gaming, whereas capability-enhancing measures may play a dominant role in reducing compulsive and addictive online social gaming. To address the societal challenge posed by obsessive online social gaming, family members should speak with users about the four obsessive online social gaming archetypes. Educational institutions and governments should launch nonprofit websites that provide users with information and resources on obsessive online social gaming. Such resources could help users determine the stage of obsessive online social gaming they are in and help them inhibit their obsessive online social gaming while the behavior is in its infancy.

Second, altering the formation of IT identity and social identity could help users recover from obsessive online social gaming. By reflecting on the antecedents and conceptualization of these two identities, game providers can curb obsessive online social gaming by monitoring user-to-technology and user-to-user interactions. For instance, game providers could present users with easy-to-observe usage statistics and warnings (e.g., total playing time) in a conspicuous location on the game interface. For users who play online social games at a level that exceeds the normal baseline, game providers should offer strategies for limiting their gaming time until it returns to a normal

level. These strategies could decrease users' embeddedness, which is the most influential determinant of IT identity, and ultimately inhibit their obsessive online social gaming. Game providers should also use their game databases to automatically identify the members of obsessive users' ingroups. They could send these group members reminders and advise them to decrease their social group gaming. Game providers could also restrict deviant users from excessively communicating, forming relationships, or grouping with other members in their social game groups. This approach could reduce obsessive online social gaming by managing the formation of social identity within small friendship groups.

7.3 Limitations and Future Research

This work has several limitations that provide directions for future research. First, we only focused on a specific type of IT deviance and derived four obsessive technology use archetypes. Similar to the typology of IT deviance in the organizational setting (Venkatraman et al., 2018), future research could enrich the IS literature by developing a typology of IT deviance that deals with a broader scope of deviant behaviors in the online environment. For instance, IT deviant behaviors could be differentiated based on deviant IT use and deviant IT-enabled behaviors. The four deviant IT behaviors in this work are all related to deviant patterns of IT use, whereas other deviant IT behaviors are enabled by using IT, such as cyberbullying and cyberloafing. Future research could also focus on a specific type of IT deviance to derive a typology. For instance, researchers could develop a typology of the phenomenon of cyberbullying. As mentioned by Lowry et al. (2016), researchers have described "cyberbullying" using terms such as "cyberstalking," "cyberharassment," "cyberaggression," and "cyberswearing" (Lowry et al., 2019; Ptaszynski et al., 2019). Indeed, understanding the characteristics of these forms of cyberbullying and advancing theories by developing a typology of cyberbullying are important research tasks that require further consideration.

Second, our work focuses on the effect of identity on obsessive online social gaming. Specifically, we used identity theory (Stryker & Burke, 2000) as a theoretical lens to hypothesize the relationship between the two types of identity and obsessive online social gaming. This relationship was empirically validated in a longitudinal survey in which we collected data at different time points. The measures of IT identity and social identity were collected at t1. Six weeks later, the measures of impulsive use, compulsive use, excessive use, and addictive use were gathered at t2. Although we demonstrate the effects of the types of identity on obsessive online social gaming, we expect that the relationship between identities and obsessive technology use is iterative. For instance, identities can also be viewed as outcomes of obsessive online social gaming. Prior studies on coping theory have explained "positive framing" as a plausible coping mechanism for stressful events (e.g., technology addiction) when such events cannot be controlled or avoided (Tarafdar et al., 2020). Future research could use a three-wave longitudinal survey to empirically illustrate the iterative relationships between identity and obsessive online social gaming.

Third, our work centered on the common antecedents and psychological mechanisms that shape the four obsessive online social gaming archetypes. Future studies should investigate the differential antecedents and psychological mechanisms of impulsive use, compulsive use, excessive use, and addictive use given their distinctive natures. The obsessive technology use literature suggests that consumers' impulsive and excessive use are primarily stimulated by external triggers, such as sensory attributes, whereas compulsive and addictive use are largely motivated by internal triggers, such as a reduction in negative emotions (Chan et al., 2017; Osatuyi & Turel, 2020). Future research should incorporate these factors into a research model to further understand the four obsessive online social gaming archetypes.

Fourth, our work constructed a contextual nomological network of obsessive online social gaming by incorporating contextual factors as antecedents of endogenous variables. Another future direction of contextualization would be to investigate contextual factors as potential boundary conditions that may moderate the relationship between identity and the four obsessive online social gaming archetypes. According to Liu et al. (2013), online social games can be grouped into three categories: (1) competitive—casual online games that allow competitive activities between two or more users, (2) cooperative—team simulation games that allow cooperative interactions between team users facing a common challenge, and (3) cooperative-competitive—massive multiplayer games that enable competitive and cooperative interactions in which users join groups and compete as a group. Given that different online social games have different social interaction environments, these contextual characteristics may serve as important boundary conditions to moderate the effects of identity on obsessive online social gaming.

7.4 Conclusion

Obsessive online social gaming has become a societal challenge worldwide. It is not only a growing problem among adolescents but also a significant phenomenon among adults, with harmful consequences for individuals, families, organizations, and society. The findings of this study offer important insights into obsessive technology use. First, we derive a typology of obsessive technology use with four interrelated forms and contextually adapt the typology to

conceptualize obsessive online social gaming. Second, we incorporate contextualization into theory development and identify contextual antecedents (i.e., IT identity and social identity) of obsessive online social gaming. We believe that our findings can serve as the basis for a new line of inquiry in the IS literature regarding the typology and contextualization of obsessive technology use. Our findings will also help managers distinguish different forms of obsessive online social gaming and provide practical guidance for designing effective interventions and regulations to curb the societal challenge it poses.

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References

Arbore, A., Soscia, I., & Bagozzi, R. P. (2014). The role of signaling identity in the adoption of personal technologies. *Journal of the Association for Information Systems*, *15*(2), 86-110.

Avgerou, C. (2019). Contextual explanation: Alternative approaches and persistent challenges. *MIS Quarterly*, *43*(3), 977-1006.

Bagozzi, R. P., & Dholakia, U. M. (2006). Open source software user communities: A study of participation in Linux user groups. *Management Science*, *52*(7), 1099-1115.

Berridge, K. C., & Robinson, T. E. (2016). Liking, wanting, and the incentive-sensitization theory of addiction. *American Psychologist*, *71*(8), 670-679.

Boss, S. R., Galletta, D. F., Lowry, P. B., Moody, G. D., & Polak, P. (2015). What do systems users have to fear? Using fear appeals to engender threats and fear that motivate protective security behaviors. *MIS Quarterly*, *39*(4), 837-864.

Brown, S. A., & Venkatesh, V. (2005). Model of adoption of technology in households: A baseline model test and extension incorporating household life cycle. *MIS Quarterly*, *29*(3), 399-426.

Burns, A. J., Roberts, T. L., Posey, C., & Lowry, P. B. (2019). The adaptive roles of positive and negative emotions in organizational insiders' security-based precaution taking. *Information Systems Research*, *30*(4), 1228-1247.

Cao, X., Masood, A., Luqman, A., & Ali, A. (2018). Excessive use of mobile social networking sites and poor academic performance: Antecedents and consequences from stressor-strain-outcome perspective. *Computers in Human Behavior*, *85*(8), 163-174.

Caplan, S. E. (2010). Theory and measurement of generalized problematic Internet use: A two-step approach. *Computers in Human Behavior*, *26*(5), 1089-1097.

Carras, M. C., Van Rooij, A. J., Van de Mheen, D., Musci, R., Xue, Q.-L., & Mendelson, T. (2017). Video gaming in a hyperconnected world: A cross-sectional study of heavy gaming, problematic gaming symptoms, and online socializing in adolescents. *Computers in Human Behavior*, *68*(3), 472-479.

Carter, M., & Grover, V. (2015). Me, my self, and I(T): Conceptualizing information technology identity and its implications. *MIS Quarterly*, *39*(4), 931-958.

Carter, M., Petter, S., & Compeau, D. (2019). Identifying with IT in a digital world. *Proceedings of the 40th International Conference on Information Systems*.

Carter, M., Petter, S., Grover, V., & Thatcher, J. B. (2020). Information technology identity: A key determinant of IT feature and exploratory usage. *MIS Quarterly*, *44*(3), 983-1021.

Carter, M., Petter, S., Grover, V., & Thatcher, J. B. (2020). IT identity: A measure and empirical investigation of its utility to IS research. *Journal of the Association for Information Systems*, *21*(5), 1313-1342.

Chan, T. K. H., Cheung, C. M. K., & Lee, Z. W. Y. (2017). The state of online impulse-buying research: A literature analysis. *Information & Management*, *54*(2), 204-217.

Chen, C., Zhang, K. Z. K., Gong, X., Lee, M. K. O., & Wang, Y. (2020). Decreasing the problematic use of an information system: An empirical investigation of smartphone game players. *Information Systems Journal*, *30*(3), 492-534.

Chen, C., Zhang, K. Z. K., Gong, X., Zhao, S. J., Lee, M. K. O., & Liang, L. (2017). Understanding compulsive smartphone use: An empirical test of a flow-based model. *International Journal of Information Management*, *37*(5), 438-454.

Chen, J. V., Su, B., & Widjaja, A. E. (2016). Facebook C2C social commerce: A study of online impulse buying. *Decision Support Systems*, *83*(3), 57-69.

Cheung, C. M. K., & Lee, M. K. O. (2010). A theoretical model of intentional social action in online social networks. *Decision Support Systems*, *49*(1), 24-30.

China Daily (2017). Tencent's gaming app slammed by Chinese media. http://africa.chinadaily.com.cn/life/2017-07/05/content_30002893.htm

Chiu, C.-M., Hsu, M.-H., & Wang, E. T. G. (2006). Understanding knowledge sharing in virtual communities: An integration of social capital and social cognitive theories. *Decision Support Systems*, *42*(3), 1872-1888.

Choi, N., Chengalur-Smith, I., & Nevo, S. (2015). Loyalty, ideology, and identification: An empirical study of the attitudes and behaviors of passive users of open source software. *Journal of the Association for Information Systems*, *16*(8), 674-706.

Craig, K., Thatcher, J. B., & Grover, V. (2019). The IT identity threat: A conceptual definition and operational measure. *Journal of Management Information Systems*, *36*(1), 259-288.

D'Arcy, J., & Lowry, P. B. (2019). Cognitive-affective drivers of employees' daily compliance with information security policies: A multilevel, longitudinal study. *Information Systems Journal*, *29*(1), 43-69.

DeSarbo, W. S., & Edwards, E. A. (1996). Typologies of compulsive buying behavior: A constrained clusterwise regression approach. *Journal of Consumer Psychology*, *5*(3), 231-262.

Domahidi, E., Breuer, J., Kowert, R., Festl, R., & Quandt, T. (2018). A longitudinal analysis of gaming- and non-gaming-related friendships and social support among social online game players. *Media Psychology*, *21*(2), 288-307.

Fang, B., Zheng, Z. (Eric), Ye, Q., & Goes, P. B. (2019). Social influence and monetization of freemium social games. *Journal of Management Information Systems*, *36*(3), 730-754.

Foster, D. W., Neighbors, C., Rodriguez, L. M., Lazorwitz, B., & Gonzales, R. (2014). Self-identification as a moderator of the relationship between gambling-related perceived norms and gambling behavior. *Journal of Gambling Studies*, *30*(1), 125-140.

Gerlach, J. P., & Cenfetelli, R. T. (2020). Constant checking is not addiction: A grounded theory of IT-mediated state-tracking. *MIS Quarterly*, *44* (4), 1705-1732

Goh, S., & Wasko, M. (2012). The effects of leader-member exchange on member performance in virtual world teams. *Journal of the Association for Information Systems*, *13*(10), 861-885.

Gong, X., Chen, C., & Lee, M. K. O. (2020). What drives problematic online gaming? The role of IT identity, maladaptive cognitions, and maladaptive emotions. *Computers in Human Behavior*, *110*(9), 106-116.

Gong, X., Zhang, K. Z. K., Cheung, C. M. K., Chen, C., & Lee, M. K. O. (2019). Alone or together? Exploring the role of desire for online group gaming in players' social game addiction. *Information & Management*, *56*(6), 103-139.

Guo, H., Hao, L., Mukhopadhyay, T., & Sun, D. (2019). Selling virtual currency in digital games: Implications for gameplay and social welfare. *Information Systems Research*, *30*(2), 430-446.

Haagsma, M. C., Caplan, S. E., Peters, O., & Pieterse, M. E. (2013). A cognitive-behavioral model of problematic online gaming in adolescents aged 12-22 years. *Computers in Human Behavior*, *29*(1), 202-209.

Hair, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2016). *A primer on partial least squares structural equation modeling (PLS-SEM)*. SAGE.

Hasan, M. R., Jha, A. K., & Liu, Y. (2018). Excessive use of online video streaming services: Impact of recommender system use, psychological factors, and motives. *Computers in Human Behavior*, *80*(3), 220-228.

Hertel, A. W., Peterson, K. P., & Lindgren, K. P. (2019). Investment in drinking identity is associated with alcohol consumption and risk of alcohol use disorder. *Addictive Behaviors*, *89*(2), 256-262.

Hinkin, T. R., & Tracey, J. B. (1999). An analysis of variance approach to content validation. *Organizational Research Methods*, *2*(2), 175-186.

Ho, S. S., Lwin, M. O., & Lee, E. W. J. (2017). Till logout do us part? Comparison of factors predicting excessive social network sites use and addiction between Singaporean adolescents and adults. *Computers in Human Behavior*, *75*(10), 632-642.

Ho, S. Y., & Lim, K. H. (2018). Nudging moods to induce unplanned purchases in imperfect mobile personalization contexts. *MIS Quarterly*, *42*(3), 757-778.

Hoehle, H., & Venkatesh, V. (2015). Mobile application usability: Conceptualization and instrument development. *MIS Quarterly*, *39*(2), 435-472.

Hofmann, W., Friese, M., & Strack, F. (2009). Impulse and self-control from a dual-systems perspective. *Perspectives on Psychological Science*, *4*(2), 162-176.

Hong, W., Chan, F. K. Y., Thong, J. Y. L., Chasalow, L. C., & Dhillon, G. (2014). A framework and guidelines for context-specific theorizing in information systems research. *Information Systems Research*, *25*(1), 111-136.

Hou, J. (Jove), Kim, K., Kim, S. S., & Ma, X. (2019). Disrupting unwanted habits in online gambling through information technology. *Journal of Management Information Systems*, *36*(4), 1213-1247.

Hsu, J. S.-C., Shih, S.-P., Hung, Y. W., & Lowry, P. B. (2015). The role of extra-role behaviors and social controls in information security policy effectiveness. *Information Systems Research*, *26*(2), 282-300.

Huang, Y., Jasin, S., & Manchanda, P. (2019). "Level up": Leveraging skill and engagement to maximize player game-play in online video games. *Information Systems Research*, *30*(3), 927-947.

James, T. L., Lowry, P. B., Wallace, L., & Warkentin, M. (2017). The effect of belongingness on obsessive-compulsive disorder in the use of online social networks. *Journal of Management Information Systems*, *34*(2), 560-596.

Jiang, Z. (Jack), Wang, W., Tan, B. C. Y., & Yu, J. (2016). The determinants and impacts of aesthetics in users' first interaction with websites. *Journal of Management Information Systems*, *33*(1), 229-259.

Johns, G. (2006). The essential impact of context on organizational behavior. *Academy of Management Review*, *31*(2), 386-408.

Johns, G. (2017). Reflections on the 2016 decade award: Incorporating context in organizational research. *Academy of Management Review*, *42*(4), 577-595.

Kaye, L. K., Kowert, R., & Quinn, S. (2017). The role of social identity and online social capital on psychosocial outcomes in MMO players. *Computers in Human Behavior*, *74*(9), 215-223.

Keith, M. J., Babb, J. S., Lowry, P. B., Furner, C. P., & Abdullat, A. (2015). The role of mobile-computing self-efficacy in consumer information disclosure: Mobile-computing self-efficacy. *Information Systems Journal*, *25*(6), 637-667.

Kim, H.-W., Chan, H. C., & Kankanhalli, A. (2012). What motivates people to purchase digital items on virtual community websites? The desire for online self-presentation. *Information Systems Research*, *23*(4), 1232-1245.

Klobas, J. E., McGill, T. J., Moghavvemi, S., & Paramanathan, T. (2018). Compulsive YouTube usage: A comparison of use motivation and personality effects. *Computers in Human Behavior*, *87*(10), 129-139.

Koob, G. F., & Moal, M. L. (1997). Drug abuse: Hedonic homeostatic dysregulation. *Science*, *278*(5335), 52-58.

Kwak, D.-H., Holtkamp, P., & Kim, S. S. (2019). Measuring and controlling social desirability bias: Applications in information systems research. *Journal of the Association for Information Systems*, *20*(4), 317-345.

Kwak, D.-H., Ma, X., Polites, G., Srite, M., Hightower, R., & Haseman, W. D. (2019). Cross-level moderation of team cohesion in individuals' utilitarian and hedonic information processing: Evidence in the context of team-based gamified training. *Journal of the Association for Information Systems*, *20*(2), 161-185.

Kwon, H. E., So, H., Han, S. P., & Oh, W. (2016). Excessive dependence on mobile social apps: A rational addiction perspective. *Information Systems Research*, *27*(4), 919-939.

Lee, D., & LaRose, R. (2007). A socio-cognitive model of video game usage. *Journal of Broadcasting & Electronic Media*, *51*(4), 632-650.

Lee, J., Ko, D. W., & Lee, H. (2019). Loneliness, regulatory focus, inter-personal competence, and online game addiction: A moderated mediation model. *Internet Research*, *29*(2), 381-394.

Lee, Y.-K., Chang, C.-T., Lin, Y., & Cheng, Z.-H. (2014). The dark side of smartphone usage: Psychological traits, compulsive behavior and technostress. *Computers in Human Behavior*, *31*(2), 373-383.

Lee, Z. W., Cheung, C. M., & Chan, T. K. (2021). Understanding massively multiplayer online role-playing game addiction: A hedonic management perspective. *Information systems Journal*, *33*(1), 33-61.

Lewis, B. R., Templeton, G. F., & Byrd, T. A. (2005). A methodology for construct development in MIS research. *European Journal of Information Systems*, *14*(4), 388-400.

Li, D., Zhou, Y., Li, X., & Zhou, Z. (2016). Perceived school climate and adolescent Internet addiction: The mediating role of deviant peer affiliation and the moderating role of effortful control. *Computers in Human Behavior*, *60*(6), 54-61.

Limayem, M., Hirt, S. G., & Cheung, C. M. (2007). How habit limits the predictive power of intention: The case of information systems continuance. *MIS Quarterly*, *31*(4), 705-737.

Lindgren, K. P., Ramirez, J. J., Namaky, N., Olin, C. C., & Teachman, B. A. (2016). Evaluating the relationship between explicit and implicit drinking identity centrality and hazardous drinking. *Addictive Behaviors Reports*, *4*(12), 87-96.

Liu, D., Li, X., & Santhanam, R. (2013). Digital games and beyond: What happens when players compete. *MIS Quarterly*, *37*(1), 111-124.

Liu, D., Santhanam, R., & Webster, J. (2017). Towards meaningful engagement: A framework for design and research of gamified information systems. *MIS Quarterly*, *41*(4), 1011-1034.

Liu, Y., Li, H., & Hu, F. (2013). Website attributes in urging online impulse purchase: An empirical investigation on consumer perceptions. *Decision Support Systems*, *55*(3), 829-837.

Lowry, P. B., & Gaskin, J. (2014). Partial least squares (PLS) structural equation modeling (SEM) for building and testing behavioral causal theory:

When to choose it and how to use It. *IEEE Transactions on Professional Communication*, *57*(2), 123-146.

Lowry, P. B., Gaskin, J., Twyman, N., Hammer, B., & Roberts, T. (2013). Taking 'fun and games' seriously: Proposing the hedonic-motivation system adoption model (HMSAM). *Journal of the Association for Information Systems*, *14*(11), 617-671.

Lowry, P. B., & Moody, G. D. (2015). Proposing the control-reactance compliance model (CRCM) to explain opposing motivations to comply with organizational information security policies. *Information Systems Journal*, *25*(5), 433-463.

Lowry, P. B., Moody, G. D., & Chatterjee, S. (2017). Using IT design to prevent cyberbullying. *Journal of Management Information Systems*, *34*(3), 863-901.

Lowry, P. B., Moody, G. D., Gaskin, J., Galletta, D. F., Humphreys, S., Barlow, J. B., & Wilson, D. (2013). Evaluating journal quality and the association for information systems (AIS) senior scholars' journal basket via bibliometric measures: Do expert journal assessments add value? *MIS Quarterly*, *37*(4), 993-1012.

Lowry, P. B., Moody, G. D., Galletta, D. F., & Vance, A. (2013). The drivers in the use of online whistle-blowing reporting systems. *Journal of Management Information Systems*, *30*(1), 153-190.

Lowry, P. B., Zhang, J., Moody, G. D., Chatterjee, S., Wang, C., & Wu, T. (2019). An integrative theory addressing cyberharassment in light of technology-based opportunism. *Journal of Management Information Systems*, *36*(4), 1142-1178.

Lowry, P. B., Zhang, J., Wang, C., & Siponen, M. (2016). Why do adults engage in cyberbullying on social media? An integration of online disinhibition and deindividuation effects with the social structure and social learning model. *Information Systems Research*, *27*(4), 962-986.

Ma, M., & Agarwal, R. (2007). Through a glass darkly: Information technology design, identity verification, and knowledge contribution in online communities. *Information Systems Research*, *18*(1), 42-67.

Ma, X., Kim, S. H., & Kim, S. S. (2014). Online gambling behavior: The impacts of cumulative outcomes, recent outcomes, and prior use. *Information Systems Research*, *25*(3), 511-527.

MacKenzie, S. B., Podsakoff, P. M., & Podsakoff, N. P. (2011). Construct measurement and validation procedures in MIS and behavioral research: Integrating new and existing techniques. *MIS Quarterly*, *35*(2), 293-334.

Malhotra, N. K., Kim, S. S., & Patil, A. (2006). Common method variance in IS research: A comparison of alternative approaches and a reanalysis of past research. *Management Science*, *52*(12), 1865-1883.

Montes, K. S., Olin, C. C., Teachman, B. A., Baldwin, S. A., & Lindgren, K. P. (2018). Hazardous drinking has unique relationships with implicit and explicit drinking identity. *Addictive Behaviors*, *87*(12), 155-161.

Moon, J., Hossain, Md. D., Sanders, G. L., Garrity, E. J., & Jo, S. (2013). Player commitment to massively multiplayer online role-playing games (MMORPGs): An integrated model. *International Journal of Electronic Commerce*, *17*(4), 7-38.

Moore, G. C., & Benbasat, I. (1991). Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information Systems Research*, *2*(3), 192-222.

Moqbel, M., & Kock, N. (2018). Unveiling the dark side of social networking sites: Personal and work-related consequences of social networking site addiction. *Information & Management*, *55*(1), 109-119.

Mueller, S. K., Mendling, J., & Bernroider, E. W. N. (2019). The roles of social identity and dynamic salient group formations for ERP program management success in a postmerger context. *Information Systems Journal*, *29*(3), 609-640.

Muusses, L. D., Finkenauer, C., Kerkhof, P., & Billedo, C. J. (2014). A longitudinal study of the association between Compulsive Internet use and wellbeing. *Computers in Human Behavior*, *36*(7), 21-28.

Neighbors, C., LaBrie, J. W., Hummer, J. F., Lewis, M. A., Lee, C. M., Desai, S., Kilmer, J. R., & Larimer, M. E. (2010). Group identification as a moderator of the relationship between perceived social norms and alcohol consumption. *Psychology of Addictive Behaviors*, *24*(3), 522-528.

Ogbanufe, O., & Gerhart, N. (2020). The mediating influence of smartwatch identity on deep use and innovative individual performance. *Information Systems Journal*, *30*(6), 977-1009.

O'Leary, M. B., Wilson, J. M., & Metiu, A. (2014). Beyond being there: The symbolic role of communication and identification in perceptions of proximity to geographically

dispersed colleagues. *MIS Quarterly*, *38*(4), 1219-1243.

Osatuyi, B., & Turel, O. (2020). Conceptualisation and validation of system use reduction as a self-regulatory IS use behaviour. *European Journal of Information Systems*, *29*(1), 44-64.

Pan, Z., Lu, Y., Wang, B., & Chau, P. Y. K. (2017). Who do you think you are? Common and differential effects of social self-identity on social media usage. *Journal of Management Information Systems*, *34*(1), 71–101.

Parboteeah, D. V., Valacich, J. S., & Wells, J. D. (2009). The influence of website characteristics on a consumer's urge to buy impulsively. *Information Systems Research*, *20*(1), 60-78.

Petter, S., Straub, D., & Rai, A. (2007). Specifying formative constructs in information systems research. *MIS Quarterly*, *31*(4), 623-656.

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*(5), 879-903.

Polites, G. L., Roberts, N., & Thatcher, J. (2012). Conceptualizing models using multidimensional constructs: A review and guidelines for their use. *European Journal of Information Systems*, *21*(1), 22-48.

Polites, G. L., Serrano, C., Thatcher, J. B., & Matthews, K. (2018). Understanding social networking site (SNS) identity from a dual systems perspective: An investigation of the dark side of SNS use. *European Journal of Information Systems*, *27*(5), 600-621.

Posey, C., Roberts, T. L., & Lowry, P. B. (2015). The impact of organizational commitment on insiders' motivation to protect organizational information assets. *Journal of Management Information Systems*, *32*(4), 179-214.

Postmes, T., & Spears, R. (1998). Deindividuation and antinormative behavior: A meta-analysis. *Psychological bulletin*, *123*(3), 238-259.

Ptaszynski, M., Lempa, P., Masui, F., Kimura, Y., Rzepka, R., Araki, K., Wroczynski, M., & Leliwa, G. (2019). Brute-force sentence pattern extortion from harmful messages for cyberbullying detection. *Journal of the Association for Information Systems*, *20*(8),1075-1127.

Quinones, C., & Kakabadse, N. K. (2015). Self-concept clarity, social support, and compulsive Internet use: A study of the US and the UAE. *Computers in Human Behavior*, *44*(3), 347-356.

Ray, S., Kim, S. S., & Morris, J. G. (2014). The central role of engagement in online communities. *Information Systems Research*, *25*(3), 528-546.

Reicher, S. D., Spears, R., & Postmes, T. (1995). A social identity model of deindividuation phenomena. *European Review of Social Psychology*, *6*(1), 161-198.

Ren, Y., Harper, F. M., Drenner, S., Terveen, L. G., Kiesler, S. B., Riedl, J., & Kraut, R. E. (2012). Building member attachment in online communities: Applying theories of group identity and interpersonal bonds. *MIS Quarterly*, *36*(3), 841-864.

Reychav, I., Beeri, R., Balapour, A., Raban, D. R., Sabherwal, R., & Azuri, J. (2019). How reliable are self-assessments using mobile technology in healthcare? The effects of technology identity and self-efficacy. *Computers in Human Behavior*, *91*(2), 52-61.

Reynolds, W. M. (1982). Development of reliable and valid short forms of the Marlowe-Crowne social desirability scale. *Journal of Clinical Psychology*, *38*(1), 119-125.

Rich, P. (1992). The organizational taxonomy: Definition and design. *Academy of Management Review*, *17*(4), 758-781.

Salehan, M., & Negahban, A. (2013). Social networking on smartphones: When mobile phones become addictive. *Computers in Human Behavior*, *29*(6), 2632-2639.

Santhanam, R., Liu, D., & Shen, W.-C. M. (2016). Gamification of technology-mediated training: Not all competitions are the same. *Information Systems Research*, *27*(2), 453-465.

Schmalz, M., Carter, M., & Lee, J. H. (2019). The I in team: IT identity and project behavior. *Proceedings of the 25th Americas Conference on Information Systems*.

Seok, S., & DaCosta, B. (2012). The world's most intense online gaming culture: Addiction and high-engagement prevalence rates among South Korean adolescents and young adults. *Computers in Human Behavior*, *28*(6), 2143-2151.

Setupgamers (2020). 13 tragic deaths caused by video games. https://www.setupgamers.com/deaths-caused-by-video-games/

Sharma, P., Sarstedt, M., Shmueli, G., Kim, K. H., & Thiele, K. O. (2019). PLS-based model selection: The role of alternative explanations in information systems research. *Journal of the Association for Information Systems*, *20*(4), 346-397.

Shen, A. X., Lee, M. K., Cheung, C. M., & Chen, H. (2010). Gender differences in intentional social action: We-intention to engage in social network-facilitated team collaboration. *Journal of Information Technology*, *25*(2), 152-169.

Shen, X., & Wang, J.-L. (2019). Loneliness and excessive smartphone use among Chinese college students: Moderated mediation effect of perceived stressed and motivation. *Computers in Human Behavior*, *95*(6), 31-36.

Shen, Y.-C., Huang, C.-Y., Chu, C.-H., & Liao, H.-C. (2010). Virtual community loyalty: An interpersonal-interaction perspective. *International Journal of Electronic Commerce*, *15*(1), 49-74.

Shih, H., Lai, K., & Cheng, T. C. E. (2017). Constraint-based and dedication-based mechanisms for encouraging online self-disclosure: Is personalization the only thing that matters? *European Journal of Information Systems*, *26*(4), 432-450.

Silic, M., & Lowry, P. B. (2020). Using design-science based gamification to improve organizational security training and compliance. *Journal of Management Information Systems*, *37*(1), 129-161.

Soror, A. A., Hammer, B. I., Steelman, Z. R., Davis, F. D., & Limayem, M. M. (2015). Good habits gone bad: Explaining negative consequences associated with the use of mobile phones from a dual-systems perspective. *Information Systems Journal*, *25*(4), 403-427.

Spaeth, S., von Krogh, G., & He, F. (2015). Perceived firm attributes and intrinsic motivation in sponsored open source software projects. *Information Systems Research*, *26*(1), 224-237.

Statista (2019a). China: Number of monthly active users of Tencent's game Honor of Kings 2019. https://www.statista.com/statistics/1004699/china-number-of-monthly-active-users-of-tencent-mobile-game-honour-of-kings/

Statista (2019b). Online Games: Worldwide. https://www.statista.com/outlook/212/100/online-games/worldwide

Steelman, Z. R., & Soror, A. A. (2017). Why do you keep doing that? The biasing effects of mental states on IT continued usage intentions. *Computers in Human Behavior*, *73*(8), 209-223.

Stryker, S., & Burke, P. J. (2000). The past, present, and future of an identity theory. *Social Psychology Quarterly*, *63*(4), 284-297.

Suh, A., Cheung, C. M. K., Ahuja, M., & Wagner, C. (2017). Gamification in the workplace: The central role of the aesthetic experience. *Journal of Management Information Systems*, *34*(1), 268-305.

Suh, K.-S., Kim, H., & Suh, E. K. (2011). What if your avatar looks like you? Dual-congruity perspectives for avatar use. *MIS Quarterly*, *35*(3), 711-729.

Tarafdar, M., Maier, C., Laumer, S., & Weitzel, T. (2020). Explaining the link between technostress and technology addiction for social networking sites: A study of distraction as a coping behavior. *Information Systems Journal*, *30*(1), 96-124.

Teng, C.-I. (2017). Impact of avatar identification on online gamer loyalty: Perspectives of social identity and social capital theories. *International Journal of Information Management*, *37*(6), 601-610.

Tsai, H.-T., & Bagozzi, R. P. (2014). Contribution behavior in virtual communities: Cognitive, emotional and social influences. *MIS Quarterly*, *38*(1), 143-163.

Tsai, H.-T., & Pai, P. (2012). Positive and negative aspects of online community cultivation: Implications for online stores' relationship management. *Information & Management*, *49*(2), 111-117.

Turel, O. (2015). Quitting the use of a habituated hedonic information system: A theoretical model and empirical examination of Facebook users. *European Journal of Information Systems*, *24*(4), 431-446.

Turel, O., & Osatuyi, B. (2018). Tug of war between social self-regulation and habit: Explaining the experience of momentary social media addiction symptoms. *Computers in Human Behavior*, *85*(8), 95-105.

Turel, O., & Qahri-Saremi, H. (2016). Problematic use of social networking sites: Antecedents and consequence from a dual-system theory perspective. *Journal of Management Information Systems*, *33*(4), 1087-1116.

Turel, O., & Qahri-Saremi, H. (2018). Explaining unplanned online media behaviors: Dual system theory models of impulsive use and swearing on social networking sites. *New Media & Society*, *20*(8), 3050-3067.

Turel, O., & Serenko, A. (2012). The benefits and dangers of enjoyment with social networking websites. *European Journal of Information Systems*, *21*(5), 512-528.

Turel, O., Serenko, A., & Giles, P. (2011). Integrating technology addiction and use: An empirical

investigation of online auction users. *MIS Quarterly*, *35*(4), 1043-1062.

Tuškej, U., Golob, U., & Podnar, K. (2013). The role of consumer-brand identification in building brand relationships. *Journal of Business Research*, *66*(1), 53-59.

Vaghefi, I., Lapointe, L., & Boudreau-Pinsonneault, C. (2017). A typology of user liability to IT addiction: Liability to IT addiction. *Information Systems Journal*, *27*(2), 125-169.

Vance, A., Lowry, P. B., & Eggett, D. (2013). Using accountability to reduce access policy violations in information systems. *Journal of Management Information Systems*, *29*(4), 263-290.

Vance, A., Lowry, P. B., & Eggett, D. (2015). Increasing accountability through user-interface design artifacts: A new approach to addressing the problem of access-policy violations. *MIS Quarterly*, *39*(2), 345-366.

Venkatesh, V., Sykes, T. A., Chan, F. K. Y., Thong, J. Y. L., & Hu, P. J. H. (2019). Children's Internet addiction, family-to-work conflict, and job outcomes: A study of parent-child dyads. *MIS Quarterly*, *43*(3), 903-927.

Venkatraman, S., Cheung, C. M. K., Lee, Z. W. Y., Davis, F. D., & Venkatesh, V. (2018). The "darth" side of technology use: An inductively derived typology of cyberdeviance. *Journal of Management Information Systems*, *35*(4), 1060-1091.

Verhagen, T., & van Dolen, W. (2011). The influence of online store beliefs on consumer online impulse buying: A model and empirical application. *Information & Management*, *48*(8), 320-327.

Wang, C., & Lee, M. K. O. (2020). Why we cannot resist our smartphones: Investigating compulsive use of mobile SNS from a stimulus-response-reinforcement perspective. *Journal of the Association for Information Systems*, *21*(1), 175-200.

Wang, C., Lee, M. K. O., & Hua, Z. (2015). A theory of social media dependence: Evidence from microblog users. *Decision Support Systems*, *69*(1), 40-49.

Wang, C., Zhou, Z., Jin, X.-L., Fang, Y., & Lee, M. K. O. (2017). The influence of affective cues on positive emotion in predicting instant information sharing on microblogs: Gender as a moderator. *Information Processing & Management*, *53*(3), 721-734.

Wells, J. D., Parboteeah, V., & Valacich, J. S. (2011). Online impulse buying: Understanding the interplay between consumer impulsiveness and website quality. *Journal of the Association for Information Systems*, *12*(1), 32-56.

World Health Organization (2018). Gaming disorder. https://www.who.int/news-room/q-a-detail/gaming-disorder

Xu, Z., Turel, O., & Yuan, Y. (2012). Online game addiction among adolescents: Motivation and prevention factors. *European Journal of Information Systems*, *21*(3), 321-340.

You, S., & Robert, Jr., Lionel P. (2018). Emotional attachment, performance, and viability in teams collaborating with embodied physical action (EPA) robots. *Journal of the Association for Information Systems*, *19*(5), 377-407.

Zhang, K. Z. K., Lee, M. K. O., Cheung, C. M. K., & Chen, H. (2009). Understanding the role of gender in bloggers' switching behavior. *Decision Support Systems*, *47*(4), 540-546.

Zhang, X. (2017). Knowledge management system use and job performance: A multilevel contingency model. *MIS Quarterly*, *41*(3), 811-840.

Zheng, X., & Lee, M. K. O. (2016). Excessive use of mobile social networking sites: Negative consequences on individuals. *Computers in Human Behavior*, *65*(12), 65-76.

Zhu, J., Zhang, W., Yu, C., & Bao, Z. (2015). Early adolescent Internet game addiction in context: How parents, school, and peers impact youth. *Computers in Human Behavior*, *50*(9), 159-168.

Appendix A: Literature Review on Obsessive Technology Use

We conducted a full-text search within major IS journals to find articles that comprise the keywords: "impulsive use," "compulsive use," "excessive use," "pathological use," "problematic use," "dependence," "addiction," and "obsessive-compulsive disorder." The major IS journals include *MIS Quarterly (MISQ)*, *Information Systems Research (ISR)*, *Journal of Management Information Systems (JMIS)*, *Journal of Association for Information Systems (JAIS)*, *Information Systems Journal (ISJ)*, *European Journal of Information Systems (EJIS)*, *Journal of Strategic Information Systems (JSIS)*, and *Journal of Information Technology (JIT)* (Lowry et al., 2013). In addition, we reviewed the publications *Decision Support Systems (DSS)*, *Information & Management (I&M)*, *Computers in Human Behavior (CHB)*, and *New Media & Society (NMS)* because they have previously published well-cited articles on obsessive technology use. The review process resulted in a total of 32 papers published in major IS journals. Table A presents the review of obsessive technology use in the IS discipline.

Table A. Prior Obsessive Technology Use Studies

Topology	Context	Source	Theory	Definition
Impulsive use: • Focus on *the state of behavioral urge* that is unplanned and spontaneous, thus promoting the on-the-spot use of a technology • Prior studies do not mention *users' awareness of negative consequences*	E-commerce websites	Chan et al. (2017)	• Stimulus organism response theory	• *Urge to buy impulsively*: an immediate and sudden online purchase urge with no planned shopping intentions.
		Chen et al. (2016)	• Latent state-trait theory	• *Urge to buy impulsively*: an immediate and sudden shopping urge with no prepurchasing intentions either to fulfill a certain shopping task or to buy a specific product
		Ho & Lim (2018)	• Mood congruence theory	• *Unplanned purchase*: a sudden and spontaneous purchase with no preshopping intention to buy a specific product category or a specific product
		Liu et al. (2013)	• Stimulus organism response theory	• *Urge to buy impulsively*: the tendencies to experience spontaneous and sudden urges to make on-the-spot purchases and to act on these felt urges with little deliberation or evaluation of consequence
		Parboteeah et al. (2009)	• Stimulus organism response theory	• *Urge to buy impulsively*: the state of purchase desire that is unplanned, the result of an exposure to a stimulus, and decided on the spot
		Verhagen & van Dolen (2011)	• Mood congruency theory	• *Urge to buy impulsively:* a sudden urge to purchase a product without a thoughtful consideration
		Wells et al. (2011)	• Latent state-trait theory	• *Urge to buy impulsively*: the tendencies to experience spontaneous and sudden urges to make on-the-spot purchases and to act on these felt urges with little deliberation or evaluation of consequence
Compulsive use: • Focus on *the state of behavioral urge* that is irresistible and uncontrollable, thus promoting the repetitive use of a technology • Prior studies have mentioned *users' awareness of negative consequences*	Internet	Caplan (2010)	• Social cognitive theory	• *Compulsive internet use*: a state of inability to resist and control the urge to surf the internet with the occurrence of harmful consequences
		Muusses et al. (2014)	• Mood congruence theory	• *Compulsive internet use*: a state of incapable to resist and control the urge to use the internet with the occurrence of harmful consequences
		Quinones & Kakabadse (2015)	• Social support theory	• *Compulsive internet use*: a pattern of internet use characterized by loss of control, cognitive preoccupation, withdrawal, and the occurrence of negative consequences
	Online game services	Haagsma et al. (2013)	• Social cognitive theory	• *Compulsive game use*: a state of inability to resist and control the urge to play online games with the occurrence of harmful consequences
	Social networking sites	James et al. (2017)	• Need to belong theory	• *Obsessive-compulsive disorder*: obsessions are persistent and unwanted images, urges, or thoughts of using social networks that a user attempts to suppress, whereas compulsions are repetitive social network usage behaviors in response to an obsession with the objective of reducing negative emotions
		Turel & Qahri-Saremi (2016)	• Dual system theory	• *Problematic/compulsive use*: a pattern of social networking site use with strong persistent urges, preoccupations, or impulsions and a lack of impulse control over these preoccupying thoughts, often coupled with various harmful consequences

		Turel & Qahri-Saremi (2018)	• Dual system theory	• *Impulsive/compulsive use*: a pattern of social networking site use with strong persistent urges, preoccupations, or impulsions and a lack of impulse control over these preoccupying thoughts, often coupled with various harmful consequences
	E-commerce websites	Turel et al. (2011)	• NA	• *Compulsive buying*: a purchase tendency with preoccupation thought and a lack of impulse control over buying
	Smartphone	Klobas et al. (2018)	• Self-determination theory	• *Compulsive smartphone use*: the extent to which users are unable to resist and control their urge to use smartphone applications with the occurrence of significant negative consequences on their personal and social lives
		(Lee et al. (2014)	• Social cognitive theory	• *Compulsive smartphone use*: a state of an irresistible-uncontrollable urge that leads users to engage in using smartphone repetitively and ultimately causes harm to users
		Wang & Lee (2020)	• Stimulus-response-reinforcement theory	• *Compulsive smartphone use*: a repetitive, ritualistic behavioral urge involving a user's inability to control, reduce, or stop the use of mobile phone
Excessive use: • Focus on *technology usage behavior* associated with spending excessive amount of time • Prior definitions do not mention *users' awareness of negative consequences*	Social networking sites	Cao et al. (2018)	• Stress-strain outcome theory	• *Excessive use*: the extent to which users feel that they spend too much time and energy on social networking for information seeking, communication, and socialization
		Kwon et al. (2016)	• Rational addiction theory	• *Excessive dependence*: the extent to which users perceive the time spent on social networks and gaming apps as excessive
		Ho et al. (2017)	• Theory of planned behavior	• *Excessive use*: the extent to which users spend more time than they expected on using social networking
		Zheng & Lee (2016)	• Cognitive behavioral theory of problematic internet use	• *Excessive use*: the extent to which social networking use is longer than the time planned
	Online video stream	Hasan et al. (2018)	• Social cognitive theory	• *Excessive online video streaming*: the extent to which users perceive the time spent on online video streaming as excessive •
	Smartphone	Gerlach & Cenfetelli (2020)	• Ground theory	• *IT-mediated state tracking*: a user's habitual and excessive use of IT to seek information that closes the gap between their knowledge about a real-world domain's state and its actual state • *IT-mediated constant checking*: a user's repetitive and constant checking of email clients, social networking systems, new websites, and other technologies at the expense of distracted driving, neglected children, and lost productivity
		Shen & Wang (2019)	• Cognitive behavioral theory of problematic internet use	• *Excessive smartphone use*: the extent to which users perceive the time spent on using smartphone as excessive
Addictive use: • Focus on *technology usage behavior* associated with impairing users' normal	Online game services	Chen et al. (2020)	• Protection motivation theory	• *Problematic/pathological use*: an obsessive pattern of playing online games with the occurrence of significant intrapersonal, interpersonal, and academic-professional problems
		Gong et al. (2019)	• Dual system theory	• *Online game addiction*: a pathological psychological dependency on using online games with a set of certain addiction symptoms, such as mood relief, salience, tolerance, withdrawal, relapse, and conflict
		Lee et al. (2021)	• Affordance theory	• *Online game addiction*: a state of maladaptive psychological dependency on online games that is manifested through the obsessive-compulsive pattern of seeking and use behaviors that take place at the expense of other important activities

functioning or conflicting with their other important activities. • Prior definitions have mentioned *users' awareness of negative consequences*		Xu et al. (2012)	• Motivation theory	• *Online game addiction*: a state of maladaptive psychological dependency on online games that is manifested through the obsessive-compulsive pattern of seeking and use behaviors that take place at the expense of other important activities
	Social networking sites	Moqbel & Kock (2018)	• Social cognitive theory	• *Social networking site addiction*: a pathological psychological dependency on using social networking sites with a set of certain addiction symptoms, such as mood relief, salience, tolerance, withdrawal, relapse, and conflict
		Osatuyi & Turel (2020)	• Social cognitive theory	• *Social networking site addiction*: a state of maladaptive psychological dependency on social networking sites with typical behavioral addiction symptoms, such as salience, mood modification, tolerance, withdrawal, loss of control, relapse, and conflicts
		Tarafdar et al. (2020)	• Coping theory	• *Social networking site addiction*: a state of maladaptive psychological dependency on social networking sites with typical behavioral addiction symptoms, such as salience, mood modification, tolerance, withdrawal, loss of control, relapse, and conflicts
		Turel (2015)	• Social cognitive theory	• *Facebook addiction*: an uncontrollable obsessive pattern of Facebook-seeking and Facebook-use behaviors that take place at the expense of other important activities and infringe normal functioning
		Turel & Osatuyi (2018)	• Dual system theory	• *Social networking site addiction*: a state of maladaptive psychological dependency on social networking sites with typical behavioral addiction symptoms, such as salience, mood modification, tolerance, withdrawal, loss of control, relapse, and conflicts
		Turel & Serenko (2012)	• Neutral sensitization theory	• *Facebook addiction*: an uncontrollable obsessive pattern of Facebook-seeking and Facebook-use behaviors that take place at the expense of other important activities and infringe normal functioning
		Wang et al. (2015)	• Cognitive behavioral theory of problematic internet use	• *Microblog dependence*: a state of maladaptive psychological dependency on microblogging that is manifested through the obsessive-compulsive pattern of seeking and use behaviors that take place at the expense of other important activities
	Smartphone	Salehan & Negahban (2013)	• Flow theory	• *Mobile phone addiction*: a maladaptive and obsessive use of mobile phones that arises a series of negative consequences
		Soror et al. (2015)	• Dual system theory	• *Mobile phone addiction*: a state of maladaptive psychological dependency on mobile phones with typical behavioral addiction symptoms
		Steelman & Soror (2017)	• Cognitive dissonance theory	• *Mobile phone addiction*: a state of maladaptive psychological dependency on social networking sites with typical behavioral addiction symptoms, such as salience, mood modification, tolerance, withdrawal, loss of control, relapse, and conflicts
		Vaghefi et al. (2017)	• Topology theory	• *Mobile phone addiction*: a type of behavior that embeds four essential elements: feelings of dependency, excessive use, failure to stop, and significant negative outcomes
	E-commerce website	Turel et al. (2011)	• NA	• *Online auction addiction*: a maladaptive psychological dependency on online purchase with typical behavioral addiction symptoms, such as mood modification, tolerance, conflict, relapse and reinstatement, salience, and withdrawal
	Internet	Venkatesh et al. (2019)	• Attachment theory	• *Internet addiction*: a psychological state of maladaptive dependency on internet use with typical behavioral addiction symptoms, such as salience, mood modification, tolerance, withdrawal, loss of control, relapse, and conflicts

Appendix B: Literature Review on Identity Theory

We conducted full-text search using the keywords "identity" and "identification" to find articles that have been published in the following major IS journals: *MISQ*, *ISR*, *JMIS*, *JAIS*, *ISJ*, *EJIS*, *JSIS*, and *JIT*. The search process generated 20 papers. Identity can be conceptualized in two different types: *material-based identity* and *human-based identity*. Material-based identity focuses on identification in relation to material objects, such as IT identity, avatar identification, and robot identification. Human-based identity centers on membership in human groups, such as personal identity, social identity, relational identity, team identification, and community identification. Table B presents the review of identity in the IS discipline.

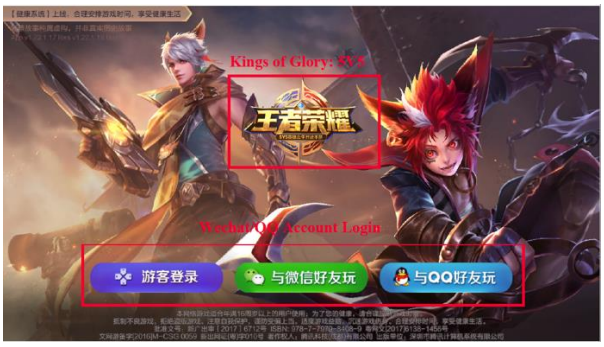
Table B. Prior Identity Studies

Source	Taxonomy	Conceptual definitions	Important findings
1	Human-based identity	• *Personal identity*: a type of self-identity that focuses on personal unique characteristics rather on group membership • *Social identity*: a type of self-identity that centers on group membership within a social group	• Symbolic drivers like the need for uniqueness and status gain are important determinants of users' personal identity and social identity • Personal identity and social identity further lead to users' technology adoption behavior
Carter and Grover (2015)	Material-based identity	• *IT identity*: the extent to which users view the use of an IT as integral to their sense of selves that comprises relatedness, emotional energy, and dependence elements	• Embeddedness, computer self-efficacy, and actualized rewards are important determinants of users' IT identity • IT identity further leads to IT use behaviors like feature use, enhanced use, and resistance use
Carter et al. (2020)	Material-based identity	• *IT identity*: the extent to which users view the use of an IT as integral to their sense of selves that comprises relatedness, emotional energy, and dependence elements	• IT identity positively influences IT feature usage and IT exploratory usage
Choi, et al. (2015)	Human-based identity	• *Community identification*: the extent to which users perceive, feel, and value their belongingness with a given open source software community	• Community identification leads to four contributory behaviors in the open source software community: endorsement, community involvement, user-brand extension, and word-of-mouth
Craig et al. (2019)	Material-based identity	• *IT identity*: the extent to which users view the use of an IT as integral to their sense of selves that comprises relatedness, emotional energy, and dependence elements	• Social identity, role identity, person identity, intergroup conflict, verification prevention, and meaning change influence IT identity threat, which further leads to identity protection
Goh & Wasko (2012)	Human-based identity	• *Team identification*: the extent to which users see themselves as members of a virtual world team	• Leader-member relationship is an important determinant of members' identification with a virtual world team • Members' identification further leads to their work performance in the virtual world team
Ma & Agarwal (2007)	Human-based identity	• *Perceived identity verification*: the perceived confirmation from other community members of a focal user's belief about his/her identity	• IT-enabled community features like virtual copresence, persistent labeling, self-presentation, and deep profiling are important determinants of perceived identity verification • Perceived identity verification further leads to knowledge contribution in online communities
Mueller et al. (2019)	Human-based identity	• *Social identity*: the extent to which users view themselves as members of a small online friendship group in a virtual community	• Social identity is a critical success factor in the large enterprise resource planning programs

Ogbanufe & Gerhart (2020)	Material-based identity	• *Smartwatch identity*: the extent to which users view the use of a smartwatch as integral to their sense of selves that comprises relatedness, emotional energy, and dependence elements	• Belongingness, social interaction, and privacy concerns are important determinants of smartwatch identity • Smartwatch identity influences deep structure use and innovative individual performance
O'Leary et al. (2014)	Human-based identity	• *Team identification*: a process of self-categorization in relation to others in a virtual world team	• Objective distance is an important determinant of team identification and communication • Team identification and communication further lead to perceived proximity and relationship quality among virtual world team members
Pan et al. (2017)	Human-based identity	• *Relational identity*: the extent to which users feel socially or emotionally attached to particular members • *Social identity*: the extent to which users view themselves as members of a social group	• Relational identity and social identity are important determinants of two types of user behaviors: reinforced use and varied use • Users' inertia will moderate the effects of relational identity and social identity on their behaviors
Ray et al. (2014)	Human-based identity	• *Perceived identity verification*: the perceived confirmation from other community members of a focal user's belief about his/her identity • *Community identification*: the extent to which users' personal identity overlaps with the positive traits, values, and goals of an online community	• Perceived identity verification and community identification positively influence community engagement and satisfaction, which further lead to users' knowledge contribution and word-of-mouth in online communities
Ren et al. (2012)	Human-based identity	• *Bond-based attachment to the individuals*: users' attachment to individual members of an online community • *Identity-based attachment to the group*: users' identification with a small friendship group of an online community • *Attachment to the large community*: users' attachment to the whole online community	• Personal information, interpersonal similarity, interpersonal comparison, familiarity with members, and interpersonal communication are important determinants of bond-based attachment to the individuals • Group categorization, group information, group homogeneity, familiarity with group, and intragroup communication are important determinants of identity-based attachment to the group • Bond-based attachment to the individuals and identity-based attachment to the group further lead to four types of user behaviors: willingness to help the group, participation, retention, and willingness to help individual members
Spaeth et al. (2015)	Human-based identity	• *Social identity*: the extent to which users view themselves as members of a small online friendship group in a sponsored open source software community	• Perceived openness and perceived community-based credibility are important determinants of social identity • Social identity further leads to intrinsic motivation and knowledge contribution in open source software communities
Suh et al. (2011)	Material-based identity	• *Avatar identification*: the extent to which users regard avatar as substitute selves or have such an illusion in virtual worlds	• Avatar similarity is an important determinant of avatar identification • Avatar identification further leads to perceived diagnosticity, emotional attachment, and intention to use avatars in virtual worlds
Tsai & Bagozzi (2014)	Human-based identity	• *Social identity*: the extent to which users identify themselves with their small online friendship groups in online communities and view themselves as group members	• Social identity, group norms, subjective norms, anticipated emotions, and attitudes toward contribution together predict users' desires and we-intention, which further lead to their contribution behavior in online communities

You & Robert (2018)	Material- and human-based identity	• *Robot identification*: the extent to which team members view their robot as an extension of themselves by including the robot as a meaningful part of their self-concept • *Team identification*: the extent to which individuals see their membership in their team as self-defining	• Robot identification and team identification are important determinants of team emotional attachment toward robots, which further leads to team performance and team viability
Polites et al. (2018)	Material-based identity	• *IT identity*: the extent to which users view the use of a social networking site as integral to their sense of selves that comprises relatedness, emotional energy, and dependence elements	• Extent of usage and habit are important determinants of IT identity • IT identity further leads to deficient self-regulation toward using social networking sites
Shih et al. (2017)	Human-based identity	• *Social identity*: the extent to which users identify themselves with their small online friendship group in online communities and view themselves as group members	• Social identity is an important determinant of switching cost, dependency, and trust, which further lead to online self-disclosure on social networking sites
Shen et al. (2010)	Human-based identity	• *Social identity*: the extent to which users identify themselves with their small online friendship group in online communities and view themselves as group members	• Social identity, group norms, subjective norms, anticipated emotions, and attitude together predict users' we-intention in online communities

Appendix C: *Honor of Kings*, Guild Group, and Friend Group



(a) Login Screen

(b1) "Guilds" Group

(b2) "Guilds" Group Playing

(c1) "Friends" Group

(c2) "Friends" Group Playing

Figure C1. *Honor of Kings*, Guild Group, and Friend Group

Appendix D: Construct Scales and Sources

To determine which constructs were reflective and which constructs were formative, we followed the five-step decision guidelines suggested by Polites et al. (2012): (1) determine the proposed construct's content domain and dimensions; (2) determine whether the dimensions are unobserved abstractions; (3) determine the exact nature of the relationship between the proposed construct and its dimensions; (4) determine how the dimension relate to each other in forming the construct; (5) determine the nature of the algebraic function. Following these guidelines, we operationalized all variables in this study as reflective first-order constructs, except for IT identity and social identity. IT identity was treated as a formative second-order construct with three reflective first-order dimensions, namely relatedness, emotional energy, and dependence. Social identity was also treated as a formative second-order construct with three reflective first-order dimensions, namely affective social identity, cognitive social identity, and evaluative social identity.

In Step 1, we determined the content domain and dimensions of IT identity and social identity. IT identity refers to the extent to which users view the use of IT as integral to their sense of selves, and consists of three distinct yet interrelated dimensions: relatedness, emotional energy, and dependence (Carter & Grover, 2015). Social identity is defined as the extent to which users identify themselves with their online small friendship group in online communities, which consist of three distinct yet interrelated dimensions: affective social identity, cognitive social identity, and evaluative social identity (Tsai & Bagozzi, 2014). In Step 2, we determined whether IT identity and social identity are multidimensional or unidimensional. Relatedness, emotional energy, and dependence are all unobserved abstractions that should be inferred from observable indicators. Likewise, affective social identity, cognitive social identity, and evaluative social identity are all unobserved abstractions that should be inferred from observable indicators. Therefore, IT identity and social identity are both multidimensional constructs. In Step 3, we determined the direction of the relationship between IT identity, social identity, and their dimensions. The direction of the relationship is from relatedness, emotional energy, and dependence on IT identity. Similarly, the direction of the relationship is from affective social identity, cognitive social identity, and evaluative social identity to social identity. In Step 4, we determined how their dimensions relate to each other in forming IT identity and social identity. Relatedness, emotional energy, and dependence combine with each other aggregately to create the meaning of IT identity, while affective social identity, cognitive social identity, and evaluative social identity also combine with each other aggregately to create the meaning of IT identity. In Step 5, we determined the nature of the algebraic function of IT identity and social identity. Relatedness, emotional energy, and dependence contribute separately and weight differentially for IT identity. Affective social identity, cognitive social identity, and evaluative social identity contribute separately and weight differentially for social identity. Therefore, IT identity and social identity are both treated as formative second-order constructs with aggregate addictive models.

Table D1. Decision Guidelines for Reflective and Formative Constructs

Decision guidelines	IT identity	Social identity
Step 1: Determine the proposed construct's content domain and dimensions	*Definition and dimensions:* IT identity refers to the extent to which users view the use of IT as integral to their sense of selves, and consists of three distinct yet interrelated dimensions—namely, relatedness, emotional energy, and dependence.	*Definition and dimensions:* Social identity is defined as the extent to which users identify themselves with their online small friendship group in online communities, which consist of three distinct yet interrelated dimensions—namely, affective social identity, cognitive social identity, and evaluative social identity.
Step 2: Are the dimensions themselves unobserved abstractions, which are not directly measurable via observed indicators?	*Multidimensional:* Relatedness, emotional energy, and dependence are all unobserved abstractions that should be inferred from observable indicators.	*Multidimensional:* Affective social identity, cognitive social identity, and evaluative social identity are all unobserved abstractions that should be inferred from observable indicators.
Step 3: Determine the exact nature of the relationship between the proposed construct and its dimensions	*Formative second-order:* Direction of the relationship is from relatedness, emotional energy, and dependence on IT identity.	*Formative second-order:* Direction of the relationship is from affective social identity, cognitive social identity, and evaluative social identity to social identity.
Step 4: Determine how the dimensions relate to each other in forming the construct	*Formative second-order:* Relatedness, emotional energy, and dependence combine with each other aggregately to create the meaning of IT identity.	*Formative second-order:* Affective social identity, cognitive social identity, and evaluative social identity combine with each other aggregately to create the meaning of IT identity.
Step 5: Determine the nature of the algebraic function	*Aggregate addictive model:* Relatedness, emotional energy, and dependence contribute separately are weighted differentially for IT identity.	*Aggregate addictive model:* Affective social identity, cognitive social identity, and evaluative social identity contribute separately and are weighted differentially for social identity.

Table D2. Construct Source, Category, and Scales

Construct/Source	Category	Scales
Embeddedness (EMB) adapted from Zhang et al. (2009)	Reflective first-order construct	EMB1. I have made significant investments dedicated to playing *Honor of Kings*.
		EMB2. A lot of energy, time, and effort have gone into playing *Honor of Kings*.
		EMB3. Overall, I have invested a lot into my play of *Honor of Kings*.
Self-efficacy (SE) adapted from Brown and Venkatesh (2005)	Reflective first-order construct	SE1. I am confident of playing *Honor of Kings* if I have only the online instructions for reference
		SE2. I am confident of playing *Honor of Kings* even if there is no one around to show me how to do it.
		SE3. I am confident of playing *Honor of Kings* even if I have never used such a system before.
Instant gratification (IG) adapted from Chen et al. (2017)	Reflective first-order construct	IG1. I play *Honor of Kings* because it fulfills my needs immediately.
		IG2. The reason I play *Honor of Kings* is to gain immediate gratification.
		IG3. I often play *Honor of Kings* because it brings me immediate enjoyment.
Group homogeneity (GH) adapted from Tuškej et al. (2013)	Reflective first-order construct	GH1. I feel that my personality and the personality of other group members are very similar.
		GH2. I have a lot in common with other group members.
		GH3. I feel that my interests/hobbies and the interests/hobbies of other group members are very similar.
Group familiarity (GF) adapted from Chiu et al. (2006)	Reflective first-order construct	GF1. I maintain close social relationships with other group members.
		GF2. I spend a lot of time interacting with other group members.
		GF3. I know other group members on a personal level.
		GF4. I am familiar with other group members.
Intragroup communication (GC) adapted from Moon et al. (2013)	Reflective first-order construct	GC1. I am able to easily share ideas with other group members through *Honor of Kings* interface features.
		GC2. I can easily express my feelings or emotions to other group members through *Honor of Kings* interface features.
		GC3. I can quickly communicate with other group members through *Honor of Kings* interface features.
		GC4. Overall, I am satisfied with my interactions with other group members through *Honor of Kings* interface features.
IT identity relatedness (ITR) adapted from instrument development process	Formative second-order construct	ITR1. I feel like a part of the group at *Honor of Kings*.
		ITR2. I feel a sense of belonging to *Honor of Kings*.
		ITR3. I feel connected to *Honor of Kings*.
		ITR4. Overall, I feel a sense of connectedness with *Honor of Kings*.
IT identity emotional energy (ITE) adapted from instrument development process		ITE1. When playing/talking about *Honor of Kings* with others, I usually feel highly excited.
		ITE2. When playing/talking about *Honor of Kings* with others, I usually show a strong sense of enthusiasm.
		ITE3. When playing/talking about *Honor of Kings* with others, I usually feel a lot of energy.
		ITE4. When playing/talking about *Honor of Kings* with others, I usually feel passionate and delighted.
IT identity dependence (ITD) adapted from instrument development process		ITD1. I rely on *Honor of Kings* for entertainment.
		ITD2. I rely on *Honor of Kings* for retrieving my bad moods (e.g., boredom, depression).
		ITD3. *Honor of Kings* is an indispensable part of my part-time life.
		ITD4. Overall, I feel a sense of reliance upon *Honor of Kings*.

Affective social identity (ASI) adapted from Tsai and Bagozzi (2014)	Formative second-order construct	ASI1. How attached are you to the group you mentioned above?
		ASI2. How strong would you say your feelings of belongingness are toward the group you mentioned above?
Cognitive social identity (CSI) adapted from Tsai and Bagozzi (2014)		CSI1. How would you express the degree of overlap between your personal identity and the identity of the group you mentioned above when you are actually part of the group and engaging in playing *Honor of Kings* in a team.
		CSI2. Please indicate to what degree your self-image overlaps with the identity of other group members as you perceive it.
Evaluative social identity (ESI) adapted from Tsai and Bagozzi (2014)		ESI1. I am a valuable member of the group.
		ESI2. I am an important member of the group.
Impulsive use (IU) adapted from Parboteeah et al. (2009)	Reflective first-order construct	IU1. I experienced strong urges to play *Honor of Kings*.
		IU2. I felt a sudden urge to play *Honor of Kings*.
		IU3. I experienced a number of sudden urge to play *Honor of Kings*.
Compulsive use (CU) adapted from Haagsma et al. (2013)	Reflective first-order construct	CU1. I find it difficult to overrule my impulse to play *Honor of Kings*.
		CU2. I find it difficult to overcome my tendency to *Honor of Kings*.
		CU3. It would be difficult to control my tendency to *Honor of Kings*.
		CU4. It is hard to restrain my urge to play *Honor of Kings*.
Excessive use (EU) adapted from Zheng and Lee (2016)	Reflective first-order construct	EU1. I have spent more time on *Honor of Kings* than most other people.
		EU2. I have used *Honor of Kings* over longer periods of time than I had intended.
		EU3. I have spent a good deal of time on *Honor of Kings*.
Addictive use (AU) adapted from Turel et al. (2011)	Reflective first-order construct	AU1. I sometimes neglect important things because of my interest in *Honor of Kings*.
		AU2. I often fail to get enough rest because of my play of *Honor of Kings*.
		AU3. My social life has sometimes suffered because of my play of *Honor of Kings*.
		AU4. Arguments have sometimes arisen because of the time I spend on *Honor of Kings*.
		AU5. Playing *Honor of Kings* has sometimes interfered with other work or study
		AU6. I am sometimes late for engagements because of my play of *Honor of Kings*.
		AU7. When I am not playing *Honor of Kings* I often feel agitated.
		AU8. I have made unsuccessful attempts to reduce the time I play *Honor of Kings*.
		AU9. I think that I am addicted to *Honor of Kings*.
Social desirability bias (SDB) adapted from Reynold (1982)	Reflective first-order construct	SDB1. It is sometimes hard for me to go on with my work if I am not encouraged.
		SDB2. I sometimes feel resentful when I don't get my way.
		SDB3. On a few occasions, I have given up doing something because I thought too little of my ability.
		SDB4. There have been times when I felt like rebelling against people in authority even though I knew they were right.
		SDB5. No matter who I'm talking to, I'm always a good listener.
		SDB6. There have been occasions when I took advantage of someone.
		SDB7. I'm always willing to admit it when I make a mistake.
		SDB8. I sometimes try to get even, rather than forgive and forget.
		SDB9. I am always courteous, even to people who are disagreeable.

		SDB10. I have never been irked when people expressed ideas very different from my own.
		SDB11. There have been times when I was quite jealous of the good fortune of others.
		SDB12. I am sometimes irritated by people who ask favors of me.
		SDB13. I have never deliberately said something that hurt someone's feelings.
Habit (HAB) adapted from Limayem et al. (2007)	Reflective first-order construct	HAB1. Playing *Honor of Kings* has become automatic to me.
		HAB2. Playing *Honor of Kings* is natural to me.
		HAB3. When I want to retrieve/entertain myself, playing *Honor of Kings* is an obvious choice for me.
Fashion consciousness (FC) adapted from Malhotra et al. (2006)	Reflective first-order construct	FC1. When I must choose between the two, I usually dress for fashion, not for comfort.
		FC2. An important part of my life and activities is dressing smartly.
		FC3. A person should try to dress in style.

Appendix E: Instrument Development Process

The instrument development process of IT identity involves three major stages: item generation, scale development, and instrument testing. At the *item generation* stage, we performed item collection and item refinement to identify an initial pool of items of IT identity (Moore & Benbasat, 1991). We initially conducted a thorough literature review to collect descriptive phrases associated with IT identity from existing validated scales. To ensure internal consistency, we created multiple items for each dimension. Furthermore, given the importance of directly seeking opinions about IT identity from digital game users, we identified additional items according to our in-depth online interviews with 20 experienced *Honor of Kings* users. A total of 31 items were collected from the existing literature and the participating players. After obtaining the item pools, the items for each dimension of IT identity were refined to remove problematic scales. First, to ensure face validity, we invited *Honor of Kings* users to examine these instruments and asked them to flag any item with confusing and ambiguous wording. Those items that the majority of the respondents flagged as problematic (e.g., "complicated," "ambiguous," or "redundant") were dropped from the questionnaire. Second, three judges, including a professor and two doctoral students with sufficient knowledge about the conceptualization of IT identity and the proposed dimensions, were asked to assess the remaining instruments. Some items that were irrelevant to the feelings of relatedness, emotional energy, and dependence but were purely about the feelings of gaming (e.g., "happy," "engagement," and "absorbed") were also dropped from the questionnaire. After this stage, we obtained 18 items for the three dimensions.

At the *scale development* stage, we conducted two rounds of card sorting to assess the reliability and validity of the instruments (Moore & Benbasat, 1991). In the first round, a panel of experts consisting of two professors, two doctoral students, and four master's students were asked to perform the item sorting. To facilitate the process, all judges were provided with a copy of Carter and Grover's (2015) paper and a three-part questionnaire, where Part 1 listed the 18 items identified in the item generation stage, Part 2 presented the construct names, entities, general properties, and definitions of the three dimensions, and Part 3 was a blank section that collected the judges' feedback regarding the revision and adaptation of the ambiguous items. We asked each judge to classify the items listed in Part 1 into the corresponding dimensions in Part 2. After the card sorting procedure, we asked the judges to write their feedback for improving the instruments in Part 3.

Interrater reliability and content validity were tested to evaluate the card sorting process. Interrater reliability was assessed based on Cohen's kappa and the item placement ratio (Jiang et al., 2016). Cohen's kappa measures the level of agreement among the judges with regard to the categorization of items, while item placement ratio denotes the percentage of items that have been correctly placed in their intended dimensions. The suggested cut-off values for Cohen's kappa and item placement ratio were 0.65 and 0.50, respectively, and higher values indicate a higher degree of interrater agreement among the judges. Table E1 shows that Cohen's kappa had an average value of 0.72, while the item placement ratios for each dimension ranged from 0.71 to 0.81. Almost all item placement ratios were higher than 0.5, with only two exceptions (i.e., ITR6 and ITE6). To assess the content validity of the instruments, we used the variance analysis approach of Hinkin and Tracey (1999) to evaluate and rate (on a five-point scale, where 1 = not at all and 5 = completely) how well each item corresponded to each dimension. This approach focused on the use of a matrix in which the items were listed in rows and the definitions of each dimension were presented at the top of the columns (MacKenzie et al., 2011). To avoid overburdening the judges by exposing them to too many rating exercises, we followed Hoehle and Venkatesh's (2015) suggestion and asked the judges to choose only one dimension for each item. Table E1 showed that almost all items obtained acceptable rating scores with only three exceptions (i.e., ITR6, ITE6, and ITD 4). On the basis of the card sorting results and the judges' feedback, we dropped ITR6, ITE6, and ITD 4 from the questionnaire and retained the remaining 15 scales for the next stage.

In the second round, we invited a new panel of judges that included eight doctoral students to independently sort the remaining scales by following the same item sorting process. The results obtained in this round had considerably better inter-rater reliability and content validity than those obtained in the first round. Table E1 showed that Cohen's kappa had an average value of 0.94, the item placement ratios for each dimension and item exceeded 0.75, and all items had acceptable content validity. Therefore, these items were sorted into their intended dimensions, obtained high agreement among the judges, and showed high potential for good instrument validity. To ensure a parsimonious and rigorous questionnaire design, only the four items with the highest item placement ratios and content validity scores were selected for the instrument testing.

Table E1. Results of Scale Development

		The first-round card sorting				The second-round card sorting			
Dimension	**Item**	**CK**	**IPRD**	**IPRI**	**CV**	**CK**	**IPRD**	**IPRI**	**CV**
IT identity relatedness (ITR)	ITR1	0.72	0.71	0.75	3.25	0.94	0.95	1.00	4.50
	ITR2			0.63	3.38			1.00	4.13
	ITR3			1.00	4.13			1.00	4.75
	ITR4			1.00	4.38			1.00	4.25
	ITR5			0.50	3.25			0.75	**3.13**
	ITR6			**0.38**	**1.50**			NA	NA
IT identity emotional energy (ITE)	ITE1		0.79	0.88	4.13		0.98	1.00	4.63
	ITE2			1.00	4.75			1.00	4.75
	ITE3			1.00	4.75			1.00	4.75
	ITE4			1.00	4.63			1.00	4.50
	ITE5			0.75	3.38			0.88	**4.13**
	ITE6			**0.38**	**1.88**			NA	NA
IT identity dependence (ITD)	ITD1		0.81	0.75	3.75		0.98	1.00	4.75
	ITD2			0.75	3.50			1.00	4.75
	ITD3			0.75	3.50			0.88	**4.13**
	ITD4			0.63	**2.38**			NA	NA
	ITD5			0.75	3.25			1.00	4.75
	ITD6			1.00	4.75			1.00	4.75

Note: CK = Cohen's kappa; IPRD = item placement ratio for each dimension; IPIR = item placement ratio for each item; CV = content validity.

At the *instrument testing* stage, we performed a pilot test of 57 *Honor of Kings* users and a field test of 241 users to evaluate the instrument properties (Moore & Benbasat, 1991). Following Lewis et al. (2005), we employed exploratory and confirmatory factor analyses to validate the scale properties of the first and second samples, respectively. In the pilot test, we conducted an initial assessment of the instrument's validity and reliability and gathered feedback for improving the scales. A self-administered questionnaire was used to collect data. The remaining scales were measured by using a seven-point scale (1 = strongly disagree; 7 = strongly agree). The AVE, CR, CA, and item loadings were calculated to assess the reliability and validity of the instruments. Table E2 shows that the AVE values of the three proposed dimensions were all higher than 0.5, their CR values ranged from 0.90 to 0.91, their CA values were greater than 0.7, and the items loaded well on their intended dimensions. Exploratory factor analysis indicated that our scales had high potential for good reliability and validity.

In the field test, we collected a new and relatively large sample for the confirmatory factor analysis by following the procedure used in the pilot test. As an indispensable part of confirmatory assessment in the instrument testing process, we also evaluated nomological validity, which refers to the ability of a construct's instruments to predict the other constructs' measures within a theoretical framework or as theoretically anticipated (Lewis et al., 2005). Consistent with our hypotheses, we selected four dependent variables, namely, impulsive use, compulsive use, excessive use, and addictive use. The refined self-administered questionnaire was then distributed to the *Honor of Kings* players. Table E2 shows that the AVE values of all dimensions exceeded 0.5, their CR scores were higher than 0.7, their CA values were greater than 0.7, and the item loadings were all above 0.7, thereby suggesting satisfactory discriminant and converge validities. Aggregate IT identity also demonstrated significant effects on impulsive use ($\beta = 0.47$, $p < 0.001$), compulsive use ($\beta = 0.50$, $p < 0.001$), excessive use ($\beta = 0.28$, $p < 0.001$), and addictive use ($\beta = 0.51$, $p < 0.001$). The variances explained in impulsive use, compulsive use, excessive use, and addictive use were 22%, 25%, 8%, and 26%, respectively.

Table E2. Results of Instrument Testing

		Pilot test				Field test			
Dimension	**Item**	**AVE**	**CR**	**CA**	**Loadings**	**AVE**	**CR**	**CA**	**Loadings**
IT identity relatedness (ITR)	ITR1	0.71	0.90	0.86	0.72	0.67	0.89	0.84	0.73
	ITR2				0.91				0.86
	ITR3				0.93				0.87
	ITR4				0.93				0.90
	ITR5				NA				NA
	ITR6				NA				NA
IT identity emotional energy (ITE)	ITE1	0.89	0.97	0.96	0.94	0.83	0.95	0.93	0.92
	ITE2				0.94				0.89
	ITE3				0.94				0.90
	ITE4				0.96				0.92
	ITE5				NA				NA
	ITE6				NA				NA
IT identity dependence (ITD)	ITD1	0.72	0.91	0.88	0.81	0.77	0.93	0.90	0.88
	ITD2				0.79				0.80
	ITD3				NA				NA
	ITD4				NA				NA
	ITD5				0.89				0.91
	ITD6				0.91				0.92

Note: AVE = average variance extracted; CR = composite reliability; CA = Cronbach's alpha.

Appendix F. Construct Validity and Reliability

Table F1. PLS Factor Loadings and Cross-Loadings

	EMB	SE	IG	GH	GF	GC	ITR	ITE	ITD	ASI	CSI	ESI	IU	CU	EU	AU
EMB1	0.90	0.32	0.27	0.41	0.27	0.30	0.60	0.57	0.64	0.42	0.40	0.33	0.36	0.43	0.28	0.42
EMB2	0.95	0.33	0.29	0.42	0.28	0.30	0.61	0.58	0.66	0.44	0.40	0.35	0.41	0.45	0.40	0.46
EMB3	0.95	0.33	0.31	0.43	0.28	0.30	0.61	0.60	0.69	0.45	0.44	0.34	0.41	0.44	0.38	0.47
SE1	0.32	0.90	0.26	0.29	0.22	0.26	0.38	0.35	0.34	0.29	0.36	0.36	0.18	0.19	0.14	0.13
SE2	0.29	0.90	0.23	0.27	0.19	0.23	0.33	0.29	0.27	0.20	0.32	0.37	0.17	0.17	0.11	0.14
SE3	0.31	0.85	0.22	0.32	0.23	0.26	0.29	0.24	0.25	0.23	0.36	0.38	0.13	0.16	0.10	0.12
IG1	0.25	0.26	0.87	0.26	0.20	0.19	0.31	0.32	0.34	0.30	0.21	0.20	0.36	0.34	0.35	0.30
IG2	0.32	0.22	0.90	0.25	0.22	0.17	0.30	0.31	0.32	0.28	0.21	0.19	0.41	0.33	0.44	0.35
IG3	0.26	0.22	0.87	0.23	0.16	0.11	0.29	0.28	0.29	0.26	0.18	0.15	0.40	0.30	0.41	0.34
GH1	0.41	0.29	0.25	0.91	0.53	0.50	0.45	0.43	0.46	0.49	0.45	0.38	0.25	0.28	0.18	0.23
GH2	0.41	0.33	0.24	0.93	0.54	0.48	0.45	0.43	0.45	0.50	0.48	0.40	0.25	0.23	0.18	0.21
GH3	0.42	0.28	0.28	0.89	0.56	0.46	0.47	0.46	0.47	0.52	0.44	0.41	0.27	0.25	0.20	0.19
GF1	0.25	0.22	0.19	0.57	0.89	0.44	0.35	0.31	0.32	0.45	0.29	0.32	0.20	0.17	0.14	0.10
GF2	0.34	0.26	0.22	0.56	0.87	0.47	0.43	0.36	0.34	0.44	0.37	0.37	0.22	0.20	0.18	0.15
GF3	0.23	0.19	0.16	0.49	0.89	0.38	0.31	0.26	0.28	0.37	0.26	0.29	0.15	0.17	0.13	0.08
GF4	0.22	0.19	0.20	0.49	0.90	0.39	0.32	0.26	0.28	0.37	0.27	0.33	0.18	0.17	0.13	0.11
GC1	0.32	0.29	0.16	0.51	0.44	0.89	0.46	0.40	0.39	0.41	0.25	0.33	0.24	0.19	0.13	0.16
GC2	0.34	0.27	0.15	0.48	0.44	0.89	0.43	0.37	0.38	0.38	0.27	0.32	0.21	0.19	0.14	0.16
GC3	0.26	0.24	0.15	0.46	0.42	0.90	0.42	0.33	0.36	0.37	0.26	0.34	0.20	0.16	0.09	0.13
GC4	0.24	0.22	0.18	0.43	0.41	0.90	0.41	0.31	0.31	0.37	0.28	0.34	0.21	0.14	0.13	0.12
ITR1	0.38	0.33	0.22	0.31	0.27	0.32	0.74	0.48	0.42	0.30	0.27	0.31	0.25	0.18	0.21	0.10
ITR2	0.65	0.30	0.32	0.46	0.35	0.42	0.87	0.68	0.67	0.50	0.35	0.40	0.41	0.41	0.28	0.35
ITR3	0.55	0.35	0.29	0.45	0.36	0.41	0.88	0.57	0.58	0.42	0.31	0.38	0.30	0.32	0.22	0.29
ITR4	0.52	0.31	0.29	0.42	0.34	0.42	0.90	0.61	0.59	0.44	0.28	0.37	0.32	0.33	0.26	0.30
ITE1	0.54	0.29	0.31	0.44	0.33	0.36	0.66	0.92	0.64	0.46	0.33	0.36	0.38	0.36	0.29	0.31
ITE2	0.55	0.30	0.29	0.43	0.31	0.36	0.66	0.92	0.61	0.47	0.32	0.38	0.34	0.33	0.23	0.28
ITE3	0.61	0.31	0.33	0.46	0.31	0.38	0.58	0.92	0.67	0.51	0.38	0.36	0.41	0.44	0.30	0.39
ITE4	0.58	0.34	0.34	0.45	0.29	0.36	0.58	0.93	0.65	0.49	0.38	0.37	0.37	0.38	0.31	0.35
ITD1	0.62	0.27	0.30	0.40	0.30	0.31	0.58	0.60	0.87	0.38	0.28	0.25	0.39	0.43	0.26	0.39
ITD2	0.46	0.29	0.22	0.32	0.25	0.27	0.47	0.43	0.75	0.29	0.27	0.24	0.33	0.31	0.21	0.29
ITD3	0.64	0.31	0.34	0.49	0.31	0.40	0.65	0.67	0.89	0.46	0.34	0.36	0.45	0.44	0.27	0.41
ITD4	0.68	0.28	0.36	0.49	0.32	0.38	0.66	0.66	0.91	0.44	0.36	0.31	0.51	0.51	0.31	0.49
ASI1	0.46	0.26	0.32	0.51	0.42	0.36	0.48	0.48	0.45	0.94	0.53	0.53	0.28	0.29	0.26	0.26
ASI2	0.42	0.26	0.29	0.53	0.45	0.44	0.48	0.51	0.43	0.94	0.47	0.58	0.26	0.25	0.23	0.23
CSI1	0.39	0.41	0.23	0.48	0.32	0.29	0.32	0.35	0.33	0.47	0.93	0.52	0.26	0.22	0.15	0.20
CSI2	0.42	0.32	0.19	0.45	0.31	0.25	0.36	0.36	0.35	0.51	0.92	0.47	0.26	0.24	0.17	0.19
ESI1	0.34	0.37	0.19	0.44	0.36	0.33	0.41	0.36	0.31	0.59	0.51	0.94	0.23	0.19	0.14	0.17
ESI2	0.34	0.41	0.20	0.37	0.32	0.36	0.41	0.38	0.33	0.51	0.50	0.92	0.23	0.18	0.09	0.15
IU1	0.44	0.19	0.41	0.30	0.21	0.24	0.40	0.42	0.52	0.32	0.28	0.25	0.90	0.66	0.35	0.59
IU2	0.29	0.14	0.38	0.18	0.16	0.19	0.30	0.30	0.34	0.19	0.21	0.18	0.84	0.44	0.37	0.43
IU3	0.37	0.15	0.38	0.25	0.19	0.21	0.33	0.35	0.44	0.25	0.25	0.22	0.92	0.56	0.43	0.52
CU1	0.45	0.20	0.33	0.26	0.22	0.18	0.35	0.39	0.48	0.25	0.23	0.17	0.60	0.92	0.33	0.61
CU2	0.45	0.18	0.35	0.27	0.20	0.20	0.36	0.39	0.48	0.29	0.23	0.19	0.61	0.95	0.36	0.64
CU3	0.44	0.16	0.34	0.26	0.17	0.17	0.35	0.39	0.45	0.26	0.23	0.19	0.57	0.93	0.35	0.64
CU4	0.40	0.18	0.33	0.24	0.14	0.15	0.36	0.36	0.43	0.24	0.22	0.17	0.58	0.89	0.35	0.62
EU1	0.24	0.13	0.41	0.17	0.14	0.13	0.24	0.27	0.24	0.19	0.10	0.09	0.29	0.22	0.80	0.30
EU2	0.30	0.12	0.39	0.16	0.14	0.12	0.24	0.26	0.24	0.22	0.14	0.09	0.35	0.29	0.90	0.42
EU3	0.42	0.10	0.38	0.20	0.15	0.11	0.28	0.28	0.32	0.25	0.20	0.15	0.46	0.44	0.90	0.53
AU1	0.30	0.14	0.39	0.16	0.10	0.07	0.23	0.30	0.32	0.19	0.16	0.08	0.38	0.38	0.43	0.65
AU2	0.32	0.13	0.28	0.12	0.05	0.05	0.19	0.20	0.25	0.17	0.13	0.13	0.34	0.35	0.47	0.69
AU3	0.36	0.09	0.20	0.15	0.05	0.08	0.18	0.21	0.28	0.15	0.13	0.14	0.31	0.42	0.35	0.76
AU4	0.35	0.08	0.20	0.14	0.07	0.07	0.17	0.22	0.31	0.17	0.16	0.14	0.32	0.43	0.32	0.77
AU5	0.29	0.04	0.19	0.07	0.03	0.08	0.12	0.16	0.20	0.11	0.08	0.07	0.26	0.34	0.36	0.72
AU6	0.35	0.10	0.18	0.09	0.07	0.11	0.20	0.19	0.27	0.13	0.13	0.13	0.30	0.40	0.34	0.74
AU7	0.37	0.12	0.30	0.24	0.13	0.17	0.34	0.31	0.43	0.26	0.21	0.16	0.51	0.56	0.29	0.71
AU8	0.39	0.13	0.32	0.24	0.15	0.18	0.33	0.33	0.45	0.23	0.18	0.12	0.58	0.67	0.34	0.75
AU9	0.41	0.11	0.35	0.21	0.12	0.16	0.32	0.35	0.45	0.23	0.16	0.16	0.66	0.69	0.38	0.78

Note: EMB = embeddedness; SE = self-efficacy; IG = instant gratification; GH = group homogeneity; GF = group familiarity; GC = group communication; ITR = IT identity relatedness; ITE = IT identity emotional energy; ITD = IT identity dependence; ASI = affective social identity; CSI = cognitive social identity; ESI = evaluative social identity; UI = impulsive use; CU = compulsive use; EU = excessive use; AU = addictive use; we removed items loaded below 0.70.

Table F2. Descriptive Statistics and Interconstruct Correlations

	AVE	CR	CA	Mean	SD	EMB	SE	IG	GH	GF	GC	ITR	ITE	ITD	ASI	CSI	ESI	IU	CU	EU	AU
EMB	0.87	0.95	0.93	4.34	1.69	**0.93**															
SE	0.78	0.91	0.86	5.61	1.11	0.35	**0.88**														
IG	0.77	0.91	0.85	5.02	1.07	0.31	0.27	**0.88**													
GH	0.83	0.94	0.90	4.82	1.21	0.45	0.33	0.28	**0.91**												
GF	0.79	0.94	0.91	5.13	1.27	0.30	0.24	0.22	0.60	**0.89**											
GC	0.80	0.94	0.92	5.13	1.28	0.32	0.28	0.18	0.53	0.48	**0.90**										
ITR	0.69	0.90	0.84	5.09	1.14	0.65	0.38	0.34	0.50	0.40	0.48	**0.83**									
ITE	0.85	0.96	0.94	4.98	1.31	0.62	0.34	0.34	0.48	0.34	0.39	0.69	**0.92**								
ITD	0.74	0.92	0.88	4.52	1.42	0.71	0.33	0.36	0.51	0.35	0.40	0.66	0.68	**0.86**							
ASI	0.89	0.94	0.87	5.03	1.29	0.47	0.28	0.32	0.55	0.46	0.43	0.51	0.53	0.47	**0.94**						
CSI	0.85	0.92	0.83	5.14	1.18	0.44	0.39	0.23	0.50	0.34	0.29	0.37	0.38	0.37	0.53	**0.92**					
ESI	0.86	0.93	0.84	5.39	1.21	0.36	0.42	0.21	0.44	0.37	0.37	0.44	0.40	0.34	0.59	0.54	**0.93**				
IU	0.78	0.92	0.86	4.21	1.46	0.42	0.18	0.44	0.28	0.21	0.24	0.40	0.41	0.50	0.29	0.28	0.25	**0.89**			
CU	0.85	0.96	0.94	3.55	1.56	0.47	0.20	0.37	0.28	0.20	0.19	0.39	0.41	0.50	0.28	0.25	0.20	0.64	**0.92**		
EU	0.75	0.90	0.83	5.29	1.20	0.38	0.14	0.45	0.20	0.17	0.14	0.30	0.31	0.31	0.26	0.17	0.13	0.43	0.38	**0.87**	
AU	0.53	0.91	0.89	3.59	1.23	0.48	0.15	0.38	0.23	0.13	0.16	0.33	0.36	0.47	0.26	0.21	0.18	0.59	0.68	0.50	**0.73**

Note: EMB = embeddedness; SE = self-efficacy; IG = instant gratification; GH = group homogeneity; GF = group familiarity; GC = group communication; ITR = IT identity relatedness; ITE = IT identity emotional energy; ITD = IT identity dependence; ASI = affective social identity; CSI = cognitive social identity; ESI = evaluative social identity; IU = impulsive use; CU = compulsive use; EU = excessive use; AU = addictive use; AVE = average variance extracted; CR = composite reliability; CA = Cronbach's alpha; Mean = mean value; SD = standard deviation; shaded diagonal represents the square root of AVE.

Table F3. Weights, VIFs, and Loadings of Formative Constructs

Construct	Dimension	Weights	VIFs	Loadings
IT identity	Relatedness	0.16*	2.96	0.82***
	Emotional energy	0.23***	2.65	0.83***
	Dependence	0.70***	2.99	0.97***
Social identity	Affective social identity	0.67***	2.22	0.94***
	Cognitive social identity	0.38***	1.83	0.79***
	Evaluative social identity	0.10	1.93	0.70***

Note: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$; VIFs = variance inflation factors.

Appendix G: Post Hoc Analysis

Effect Size Test

We conducted an effect size test to determine whether the significant paths were substantive (Hair Jr. et al., 2016). Table G1 showed that embeddedness, self-efficacy, and instant gratification had large (ΔR^2 = 36%, f^2 = 0.86), small-to-medium (ΔR^2 = 2%, f^2 = 0.05), and small-to-medium (ΔR^2 = 3%, f^2 = 0.07) effects on IT identity, respectively. Group homogeneity, group familiarity, and intragroup communication had medium-to-large (ΔR^2 =11%, f^2 = 0.18), small-to-medium (ΔR^2 = 2%, f^2 = 0.04), and small-to-medium (ΔR^2 = 2%, f^2 = 0.04) effects on social identity. Moreover, IT identity showed medium-to-large (ΔR^2 = 14%, f^2 = 0.19), medium-to-large (ΔR^2 = 14%, f^2 = 0.20), small-to-medium (ΔR^2 = 4%, f^2 = 0.05), and medium-to-large (ΔR^2 = 12%, f^2 = 0.17) effects on impulsive use, compulsive use, excessive use, and addictive use, respectively.

Table G1. Effect Size Test

Path	ΔR^2	Effect size (f^2)	Results
H1a: Embeddedness → IT identity	36%	0.86	Large
H1b: Self-efficacy → IT identity	2%	0.05	Small-to-medium
H1c: Instant gratification → IT identity	3%	0.07	Small-to-medium
H2a: Group homogeneity → social identity	11%	0.18	Medium-to-large
H2b: Group familiarity → social identity	2%	0.04	Small-to-medium
H2c: Intragroup communication → social identity	2%	0.04	Small-to-medium
H3a: IT identity → impulsive use	14%	0.19	Medium-to-large
H3b: IT identity → compulsive use	14%	0.20	Medium-to-large
H3c: IT identity → excessive use	4%	0.05	Small-to-medium
H3d: IT identity → addictive use	12%	0.17	Medium-to-large

Note: Effect size (f^2) = ($R^2_{full\ model} - R^2_{baseline\ model}$) / ($1 - R^2_{full\ model}$); the cut-off values for large, medium, and small effect size are 0.35, 0.15, and 0.02, respectively.

Mediation Effect Test

We performed mediation effect tests to seek potential explanations for the nonsignificant effects of social identity on obsessive online social gaming (Vance et al., 2015). Table G2 presents the three-step bootstrapped confidence intervals (CIs) test for mediation. In Step 1, we evaluated three paths using resample 5000: (1) path *a* – the path from the independent variable to the mediating variable, (2) path *b* – the path from the mediating variable to the dependent variable, and (3) path *c′* – the path from the independent variable to the dependent variable when paths *a* and *b* are considered simultaneously. The value of *ab* was calculated by multiplying the coefficients of paths *a* and *b*. In Step 2, we sorted the values for *ab* and *c′* from the smallest to the largest, and percentile-based CIs were generated. The 2.5% lower bound and 97.5% upper bound of the CIs were represented by the *ab* (*c′*) values in the 125th and 4876th position. In Step 3, we calculated the types of mediation. If the CIs for *ab* do not include zero, then the mediation effect exists. If the CIs for *ab* do not include zero and the CIs for *c′* included zero, then the full mediation effect exists. If the CIs for *ab* and *c′* both do not include zero, then the partial mediation effect exists. Results show that IT identity fully mediated the effects of social identity on impulsive use, compulsive use, excessive use, and addictive use. These mediating analyses provide a credible explanation for the nonsignificant direct effects of social identity on obsessive online social gaming and suggest that social identity with players does not lead to deviant social gaming without the formation of an IT identity toward social games.

Table G2. Bootstrapped Confidence Intervals for Mediation

Proposed relationship	Mediation test (*ab*)			Full/partial mediation test (c')			Type of mediation
	2.5% lower bound (125th)	97.5% upper bound (4876th)	Zero included?	2.5% lower bound (125th)	97.5% upper bound (4876th)	Zero included?	
Social identity (a1) → IT identity (b1) → impulsive use (*c′*)	0.20	0.33	No	–0.03	0.16	Yes	Full
Social identity (a2) → IT identity (b2) → compulsive use (*c′*)	0.22	0.33	No	–0.05	0.12	Yes	Full
Social identity (a3) → IT identity (b3) → excessive use (*c′*)	0.11	0.21	No	–0.01	0.19	Yes	Full
Social identity (a3) → IT identity (b4) → addictive use(*c′*)	0.21	0.31	No	–0.06	0.11	Yes	Full

The Influence of Social Identity on IT Identity and Its Dimensions

We also conducted a post hoc test of the potential influence of social identity on IT identity and its dimensions. Table G3 presents the results of post-hoc analysis. In the baseline model, the independent variable collectively explained 46%, 42%, 53%, and 59% variance in relatedness, emotional energy, dependence, and IT identity, respectively. In the full model, we added social identity to predict IT identity and its dimensions. The *R*-square of relatedness changes by up to 4%, indicating a small-to-medium effect size ($f^2 = 0.08$). The *R*-square of emotional energy changes by up to 5%, indicating a small-to-medium effect size ($f^2 = 0.09$). The *R*-square of dependence changes by up to 1%, indicating a small effect size ($f^2 = 0.02$). The *R*-square of IT identity changes by up to 3%, indicating a small-to-medium effect size ($f^2 = 0.08$). These results indicated that social identity is an additional and important antecedent of IT identity and its dimensions.

Table G3. The Influence of Social Identity on IT Identity and Its Dimensions

	Relatedness		**Emotional energy**		**Dependence**		**IT identity**	
	Baseline model	**Full model**	**Baseline model**	**Full model**	**Baseline model**	**Full model**	**Baseline model**	**Full model**
Embeddedness	0.55^{***}	0.46^{***}	0.54^{***}	0.43^{***}	0.64^{***}	0.59^{***}	0.66^{***}	0.57^{***}
Self-efficacy	0.16^{***}	0.11^{**}	0.11^{**}	0.06	0.07^{*}	0.04	0.11^{**}	0.08^{*}
Instant gratification	0.12^{***}	0.09^{**}	0.15^{***}	0.11^{***}	0.14^{***}	0.12^{***}	0.15^{***}	0.12^{***}
Social identity		0.24^{***}		0.27^{***}		0.14^{***}		0.22^{***}
R^2	46%	50%	42%	47%	53%	54%	59%	62%
ΔR^2		4%		5%		1%		3%
Effect size (f^2)		0.08		0.09		0.02		0.08

Note: $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$; effect size (f^2) = ($R^2_{full\ model} - R^2_{baseline\ model}$) / ($1 - R^2_{full\ model}$); the cut-off values for large, medium, and small effect size are 0.35, 0.15, and 0.02, respectively.

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