

# Understanding the Development of Problematic Use of Massively Multiplayer Online Game

*Research-in-Progress*

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## Abstract

*Online gaming has become one of the most popular forms of online leisure activity today. Massively multiplayer online game (MMOG), being highly persistent and immersive, is however often presented as being potentially dangerous of leading to problematic use. Despite a rising concern over this emerging societal challenge, the theoretical understanding of problematic use of MMOG is lacking in the information systems literature. Therefore, the objective of this study is to propose and empirically test a theory-guided model that explains the development of problematic use of MMOG. We built our research model on the hedonic management model of addictions, and explained the role of mood modification and deficient self-regulation in the development of problematic use of MMOG. We will validate the research model using longitudinal survey design and structural equation modeling approach. We believe that the current work presents significant implications to both research and practice.*

**Keywords:** Massively Multiplayer Online Game, Hedonic IS, Technology Addiction, Problematic Use of IS/IT, Mood Modification, Deficient Self-Regulation

## **Introduction**

Massively multiplayer online game (MMOG) is among the most popular online game genres and constitutes the largest segment of the online gaming business. MMOG has attracted millions of users and provided them with great self-fulfilling value and enjoyment. For a majority of users, playing MMOG is enjoyable. However, for some users, they enjoy the game so much that they spend excessive periods of time in the online game world, resulting in negative consequences in different life aspects (Hsu et al. 2009).

The problematic use of MMOG has been regarded as an emerging societal challenge in many countries. Prevalence rates of excessive online gaming are high across nations, ranging from 8 to 11.9 percent of all online gamers (Gentile 2009). Excessive use of MMOG has resulted in negative consequences in different aspects of users' life (Billieux et al. 2011; Liu and Peng 2009; Zhao 2010). Furthermore, there has been an increasing number of reported deaths resulted from playing MMOG excessively (Lee 2013; Sun 2011; Wu 2007). With its growing severity, the problematic use of MMOG has received increasing awareness from different sectors of the community. At the individual level, parents have turned to court for help with their children's uncontrollable online gaming (Ng 2012). At the societal level, governments have introduced revolutionary measures and laws to curb rampant online gaming (Hawkins 2012).

Research on the problematic use of MMOG has grown since the last decade. In particular, the American Psychiatric Association (2013) listed Internet gaming disorder in the section of "Conditions for Further Study" in the latest edition of the Diagnostic and Statistical Manual of Mental Disorders (5<sup>th</sup> Edition) and encouraged more research into this emerging phenomenon. Researchers from multiple disciplines have devoted considerable efforts to investigate the problematic use of MMOG. Interestingly, a majority of the existing work was found in the psychology and medical literature with a focus on the clinical aspects of the phenomenon. Research on the problematic use of MMOG remains new in the IS literature, and scientific understanding of this issue is still evolving. More research is needed to theoretically explain how it arises and of how it influences one's life (Griffiths and Meredith 2009; Turel et al. 2011). In response to the emerging societal challenge associated with the use of MMOG and the call for more IS research on technology use related problems, we aim to advance our theoretical understanding of the problematic use of MMOG. Specifically, there are two major objectives of this paper: (1) to review and analyze the research status of the problematic use of MMOG research, and (2) to propose a theoretical model explaining the development of problematic use of MMOG.

The remainder of this paper is organized as follows. In the next section, we provide a review of the conceptualization of the problematic use of MMOG and describe the current research status of this emerging phenomenon. Thereafter, we explain the theoretical foundation of this study and present our research model and hypotheses. Subsequently, we provide details on data collection procedures, measures, and data analysis approach. Last, we conclude this study with implications for research and practice.

## **Literature Review**

### ***Conceptualization and Definition of Problematic Use of MMOG***

Problematic use of MMOG is an emerging phenomenon, and existing literature is still culturally diverse, with terminology that has variously described it as online game addiction, to pathological online game use, excessive online gaming and problematic online gaming (Kim and Kim 2010). Our analysis of literature showed that terms "addiction", "problematic use", and "excessive use" were mostly used in existing studies of problematic use of MMOG. It was not uncommon that researchers use the terms "addiction", "problematic use", and "excessive use" interchangeably in referring to the phenomenon. However, over the years, researchers have made strenuous efforts to render the word "addiction" obsolete (Brown 1997). American Psychiatric Association (2000) also eschewed the concept of "addiction" carefully and referred problematic substance use as "substance abuse" or "substance dependency", and problematic behavior as "disorders of impulse control". The primary objective of this study is not to answer the debates on definition but to provide insights into facilitating the progression and accumulation of knowledge in the line of research on problematic use of MMOG. The term "problematic use" instead of "addiction" or other alternatives is used in this study. Problematic use of MMOG refers to the extent of

MMOG use that results in negative consequences (Griffiths 2010; Liu and Peng 2009). Problematic use represents an appropriate umbrella term capturing the essence of its alternatives (e.g., addiction and excessive use are associated with negative consequences), and avoids a theoretical overtone.

### **Research Status of Problematic Use of MMOG**

The problematic use of MMOG has become an emerging societal challenge and received increasing attention from the scientific community. We have witnessed an increasing number of studies on the problematic use of MMOG. Since the scope of published studies was large and fragmented, we followed Kuss and Griffiths' (2012) approach to classify the existing studies. Fifty-three studies identified in the systematic literature search were classified into three main categories: etiology (e.g., risk factors), pathology (e.g., assessments and prevalence), and ramifications (e.g., negative consequences and treatments).

The majority of the studies on the problematic use of MMOG focused on the antecedents and risk factors (i.e., etiology). Particularly, personality traits (e.g., low self-esteem and depression) that are prone to the problematic use have received the most research attention (e.g., Collins et al. 2012; Steinfield et al. 2008), followed by behavioral-based beliefs/internal factors specific to the act of playing MMOG (e.g., enjoyment and flow) and object-based beliefs/external factors specific to MMOG per se (e.g., immersion and game genre) (e.g., Dauriat et al. 2011; Elliott et al. 2012; Snodgrass et al. 2013; Wan and Chiou 2006). However, most of these existing studies focused on the association between risk factors and the problematic use of MMOG, without delineating the underlying psychological mechanisms. There were also a significant number of studies on classification/assessment, prevalence, brain activity, and comorbidity pertaining to the problematic use of MMOG (i.e., pathology) (e.g., Bergmark and Bergmark 2009; Demetrovics et al. 2012; Han et al. 2010; Stetina et al. 2011). However, consequences resulted from the problematic use of MMOG received relatively little research attention (e.g., Ahlstrom et al. 2012; Mentzoni et al. 2011). One of the possible explanations is that negative consequences are often captured as the dimensions or components of MMOG addiction/problematic MMOG use.

Unlike the research on IS acceptance and continuance which is rooted in dominant paradigms such as the technology acceptance model (TAM) (Davis 1989) and the post-acceptance model of IS continuance (Bhattacharjee 2001), there was no dominant theory or framework explaining the development of problematic use of MMOG in the previous literature. Flow theory is most commonly used to study problematic use of MMOG, signaling the importance of hedonic value in the development of problematic use of MMOG. Table 1 presents a systematic review of studies on the problematic use of MMOG, and Table 2 summarizes the theories and frameworks used to study the problematic use of MMOG.

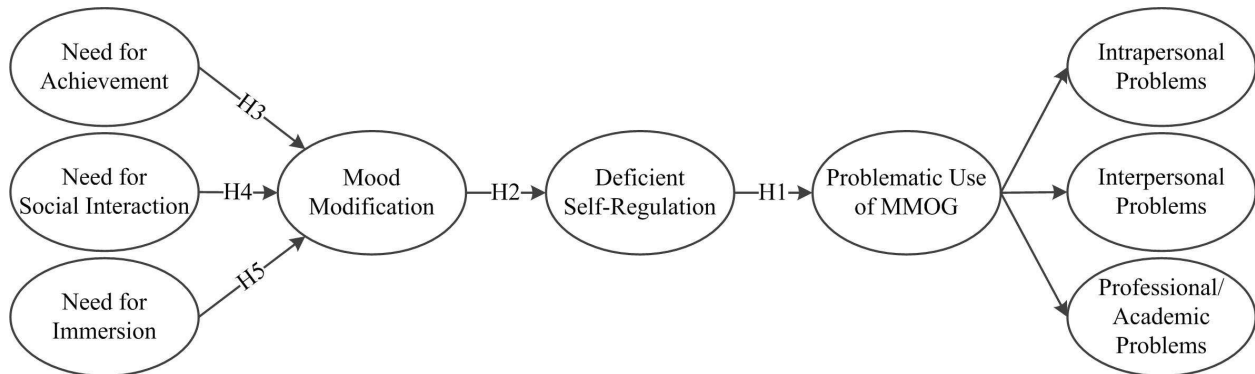
<b>Table 1. A Systematic Review of Studies on the Problematic Use of MMOG</b>		
<b>Key Issue</b>	<b>Example</b>	<b>Reference</b>
<b><i>Etiology (Risk)</i></b>		
Personality Trait	<ul style="list-style-type: none"> <li>• Absorption</li> <li>• Aggression</li> <li>• Agreeableness</li> <li>• Anxiety</li> <li>• Conscientiousness</li> <li>• Depression</li> <li>• Dysfunctional impulsivity</li> <li>• Escapism</li> <li>• Extraversion/Introversion</li> <li>• Low self-esteem</li> <li>• Narcissism</li> <li>• Neuroticism</li> <li>• Self-concept deficit</li> <li>• Self-efficacy</li> <li>• Self-regulation/Self-control</li> <li>• Social phobia</li> </ul>	Cole and Hooley (2013); Collins et al. (2012); Hussain and Griffiths (2009); Jeong and Kim (2011); Kim et al. (2008); Leménager et al. (2013); Li et al. (2011); Liu and Peng (2009); Orr et al. (2012); Peters and Malesky (2008); Son et al. (2013); Stetina et al. (2011)

Behavioral-based Belief/Internal Factor	<ul style="list-style-type: none"> <li>• Enjoyment/Playfulness</li> <li>• Flow</li> <li>• Game attitude</li> <li>• Game experience</li> <li>• Intrinsic reward</li> <li>• Mood regulation</li> <li>• Self-regulation</li> <li>• User experience</li> </ul>	Chen and Park (2005); Dauriat et al. (2011); Haagsma et al. (2013); Hsu et al. (2009); Jeong and Kim (2011); Kuss et al. (2012); Wan and Chiou (2006); Wu et al. (2013); Zhong and Yao (2013)
Object-based Belief/External Factor	<ul style="list-style-type: none"> <li>• Achievement</li> <li>• Descriptive norm</li> <li>• Extrinsic reward</li> <li>• Game characteristics</li> <li>• Game genre</li> <li>• Immersion</li> <li>• Social influence</li> <li>• Socialization</li> </ul>	Billieux et al. (2013); Chen et al. (2010); Dauriat et al. (2011); Elliott et al. (2012); Oggins and Sammis (2012); Smahel et al. (2008); Snodgrass et al. (2013); Snodgrass et al. (2012); Wan and Chiou (2007)
<b><i>Pathology (Addiction)</i></b>		
Classification/Assessment	<ul style="list-style-type: none"> <li>• Core and peripheral criteria for addiction</li> <li>• Difference with Internet addiction</li> <li>• DSM-IV criteria</li> <li>• Internet addiction disorder scale</li> <li>• Measurement development and validation</li> <li>• Orman Internet Stress Scale</li> <li>• Role of context in addiction</li> </ul>	Achab et al. (2011); Chappell et al. (2006); Charlton and Danforth (2007); Charlton and Danforth (2010); Demetrovics et al. (2012); Griffiths (2010); Ng and Wiemer-Hastings (2005)
Prevalence	<ul style="list-style-type: none"> <li>• Diffusion of addiction</li> <li>• Emergence</li> <li>• Prevalence</li> </ul>	Bergmark and Bergmark (2009); Griffiths and Davies (2002); Mentzoni et al. (2011); Pápay et al. (2013); Rehbein et al. (2010); Seok and DaCosta (2012); Young (2009)
Brain Activity	<ul style="list-style-type: none"> <li>• Cortical thickness abnormalities</li> <li>• Prefrontal cortex activity</li> <li>• Regional cerebral glucose metabolism</li> </ul>	Han et al. (2010); Ko et al. (2009); Metcalf and Pammer (2011); Park et al. (2010); Yuan et al. (2013a); Yuan et al. (2013b)
Comorbidity	<ul style="list-style-type: none"> <li>• Comorbid depression</li> </ul>	Price (2011); Stetina et al. (2011)
<b><i>Ramifications (Consequences)</i></b>		
Negative Consequence	<ul style="list-style-type: none"> <li>• Decreased decision-making competences</li> <li>• Low marital satisfaction</li> <li>• Poor school performance</li> <li>• Psychosocial health problems</li> <li>• Social stress</li> <li>• Suicide</li> <li>• Truancy</li> </ul>	Ahlstrom et al. (2012); Lafrenière et al. (2009); Mentzoni et al. (2011); Pawlikowski and Brand (2011); Rehbein et al. (2010); van Rooij et al. (2011)
Positive Consequences	<ul style="list-style-type: none"> <li>• Social Capital</li> </ul>	Brack et al. (2013)
Treatment	<ul style="list-style-type: none"> <li>• Bupropion</li> <li>• Cognitive-behavioral therapy</li> <li>• Education</li> </ul>	Kim et al. (2013); Price (2011); Young (2009)

Table 2. Theory and Framework on the Problematic Use of MMOG	
Theory/Framework	Reference
Brown's behavioral addiction framework	Charlton and Danforth (2007); Charlton and Danforth (2010)
Cognitive theory	Wan and Chiou (2007)
Cognitive-behavioral model	Haagsma et al. (2013)
Cue-reactivity paradigm	Ko et al. (2009)
Flow theory	Chen and Park (2005); Rau et al. (2006); Wan and Chiou (2006)
Problematic Internet use model	Liu and Peng (2009)
Self-discrepancy theory	Leménager et al. (2013); Li et al. (2011)
Social learning theory	Brack et al. (2013)
The dualistic model of passion	Lafrenière et al. (2009)
Theory of planned behavior	Lu and Wang (2008)
Time disorder theory	Rau et al. (2006)
Uses and gratifications theory	Chen and Park (2005); Chen et al. (2010)

## Theoretical Foundation and Research Model

Given the hedonic nature of MMOG, we used the hedonic management model of addictions (Brown 1997) to explain the development of problematic use of MMOG. The hedonic management model of addictions suggests that people make plans for attaining and maintaining their hedonic tone. When a behavioral act becomes a reliable way to produce hedonic tone, people easily lose control over the activity and spend as much of the time as possible to sustain good hedonic tone. The core of the addictive process is about the mismanagement of the quest for good hedonic tone. Figure 1 presents the research model.



**Figure 1. Research Model for Problematic Use of MMOG**

### Problematic Use of MMOG

Problematic use of MMOG refers to the extent of MMOG use that results in negative consequences (Griffiths 2010; Liu and Peng 2009). Liu and Peng (2009) classified negative consequences associated with MMOG use into three categories, namely intrapersonal problems (e.g., physical pain), interpersonal problems (e.g., conflicts with friends or family), and professional/academic problems (e.g., missing work or class). Negative consequences have long played a central role in determining problematic behaviors (Brown 1997; Orford 1985). Griffiths (2010) suggested that the problematic use of MMOG should be defined by the extent of gaming that negatively impacts users' life. In this study, we operationalize problematic use of MMOG as a second-order factor with intrapersonal problems, interpersonal problems, and professional/academic problems as the first order factors.

## **Deficient Self-Regulation**

Deficient self-regulation, alternatively termed as *deficient self-control* and *loss of control*, refers to a state of diminished self-control (LaRose et al. 2003). Deficient self-regulation has been extensively researched in prior problematic behavior studies, and has substantially shaped the thinking on problematic behaviors (Brown 1993; LaRose et al. 2003). Deficient self-regulation has been adopted to explain a wide spectrum of problematic gaming behaviors. Lee and LaRose (2007) suggested that deficient self-regulation leads to patterns of mounting usage of online games, particularly in circumstances where users acquire waves of enjoyment. In addition, Seay and Kraut (2007) found that deficient self-regulation leads users to play MMOG excessively resulting in negative consequences. Liu and Peng (2009) further argued that users manifesting deficient self-regulation encounter difficulty in reducing gaming time despite acknowledging the potential negative consequences of the excessive gaming. Therefore, we hypothesize that:

*H1: Users experiencing deficient self-regulation is more likely to develop problematic use of MMOG.*

## **Mood Modification**

Mood modification refers to the effects of enhancing one's mood or relieving one's emotion from playing MMOG. Some users derive waves of enjoyment from playing MMOG (Hussain and Griffiths 2009), whereas others relieve boredom and escape from real-life problems by immersing themselves into the virtual world (Hsu et al. 2009). When a behavioral act becomes reliable in producing positive hedonic tone, individual self-control over the hedonically rewarding act tends to be diminished. Hussain and Griffiths (2009) suggested that users experiencing pleasure of playing MMOG often manifest reduced awareness and temporary loss of consciousness. Furthermore, prior studies have indicated that when certain technology use act as an important and exclusive mechanism for mood modification, the likelihood of leading to deficient self-regulation increases (Caplan 2010; LaRose et al. 2003; Lee and Perry 2004). Therefore, we hypothesize that:

*H2: Users experiencing mood modification from playing MMOG is more likely to develop deficient self-regulation.*

## **Needs for Playing MMOG**

The utility of entertainment activities depend on both their desirability and credibility in producing good hedonic tone (Brown 1997). Playing MMOG enables the fulfillment of diverse needs from users, and gives rise to pleasant user experience (Snodgrass et al. 2012). Yee (2006) proposed an overarching categorization of needs for playing MMOG, including *Need for Achievement*, *Need for Social Interaction* and *Need for Immersion*. These needs are enabled by and are highly associated with numerous features in MMOG, such as character leveling and learning systems, guild/community systems, and character customization functions. These sophisticated features and functions make fulfillment of needs for achievement, social interaction, and immersion easy and instantaneous. Therefore, MMOG users often report pleasurable experience and mood modification upon gaming. For instance, they felt heightened and excited of attaining particular achievements; they unwinded themselves through in-game social interactions; and they escaped from real-life problems through immersing themselves into the MMOG virtual world (Chappell et al. 2006; Snodgrass et al. 2012). To conclude, playing MMOG allow users to achieve, to socialize and to immerse in the virtual world, leading to mood modification. Therefore, we hypothesize that:

*H3: Users with greater need for achievement is more likely to experience mood modification from playing MMOG.*

*H4: Users with greater need for social interaction is more likely to experience mood modification from playing MMOG.*

*H5: Users with greater need for immersion is more likely to experience mood modification from playing MMOG.*

## **Controlled Effects**

Demographic variables and experiences have been shown to be important factors affecting IS usage (Venkatesh et al. 2003). Therefore, we incorporate a number of control variables into the current investigation, including respondents' demographic variables (e.g., age and gender), gaming experiences, and psychological well-beings.

## **Methodology**

### **Sample and Data Collection**

World of Warcraft (WoW) will be used in this research project to investigate the development of problematic use of MMOG. We believe that WoW is appropriate for the current study as it is a typical example of MMOG where users assume the role of a fictional character evolving in the virtual world "Azeroth". Moreover, WoW is one of the most popular MMOG, with more than 10 million users worldwide (MMOGdata.net 2012). Our research model will be assessed in a longitudinal survey design, in which users of WoW will be invited to complete an online questionnaire at two different points of time. Online survey is the most commonly used data collection method in prior studies of problematic use of Internet-based technology (Byun et al. 2009). Longitudinal design has also been identified as an effective method to reduce common method bias (Podsakoff et al. 2003) and to draw causal inference (Bolton and Lemon 1999). Invitations will be carried out through posting in various famous gaming forums in the region (e.g., <http://www.gamer.com.tw/> or <http://www.2000fun.com/portal.php>). This recruitment approach has been found effective in prior MMOG research (Billieux et al. 2013; Utz et al. 2012).

At time  $t-1$  (Wave 0), we will conduct a pilot study with about 50 WoW users to refine the clarity of instructions and questions in the online questionnaire. At time  $t$  (Wave 1), we will recruit 1000 active WoW users to complete an online questionnaire. In Wave 1, we will collect responses related to the independent variables (e.g., mood modification and deficient self-regulation). Respondents in Wave 1 will be invited to answer another online questionnaire at time  $t+1$  (Wave 2). We aim to collect 400 responses related to the dependent variable (e.g., the problematic use of MMOG) in Wave 2. To encourage participation, respondents who complete the first wave of study will receive a gift card (e.g., itunes) worth \$5 US. Those who complete Wave 2 study will receive an additional gift card worth \$15 US. The email address of the respondents will be used to match their answers across the two rounds of data collection.

### **Measures**

Measures of all focal constructs in this study will be adapted from existing and validated scales (see Appendix). In addition, prior studies showed that people tend to under-report negative characteristics and behaviors (e.g., stealing, lying, and addiction) as they want to portray themselves in a way viewed favorably by others (Turel et al. 2011; Williams and Podsakoff 1992). This phenomenon is referred to social desirability bias. Thus, we will include the social desirability bias scale (Reynolds 1982) in our data collection.

### **Data Analysis**

The research model will be estimated using structural equation modeling (SEM) approach which is one of the most widely used analysis techniques in IS research. According to Chin (1998), SEM provides flexibility in estimating relationships among multiple indicators and criterion variables, allows modeling with latent variables, and estimates a model uncontaminated with measurement errors.

## **Conclusion and Expected Contributions**

The problematic use of MMOG has become an emerging societal challenge as indicated by the increasing number of reported negative consequences and deaths associated with the excessive gaming. However, research on problematic use of MMOG remains new in the IS literature and there is a general lack of theory-guided studies explaining its development. This study, therefore, aims to propose and test a theoretical model that explains the development of problematic use of MMOG. Given the hedonic nature

of MMOG, we built on the hedonic management model and explained how hedonic value of playing MMOG (e.g., mood modification) gives rise to deficient self-regulation, and sets the stage for the problematic use. We will continue with the empirical testing of the research model using longitudinal survey design and structural equation modeling approach.

This study presents significant implications to both research and practice. First, this study responded to the calls for IS research on technology-based problems by addressing an underexplored issue, the problematic use of MMOG. Second, we added to the growing body of knowledge on problematic use of MMOG by proposing a theoretical model to explain its development. The current research model can serve as a foundation for future investigations into problematic use of other hedonic technologies. Finally, this research project will raise the public and professional awareness of the dark side of MMOG as well as other hedonic technologies. The results will help clinicians, educators, and users understand the mechanism of its development, and will provide them with better insights into the prevention and coping strategies.

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## Appendix

<b>Table A1. Measures</b>		
Please indicate to which extent you agree with the following statements (1=strongly disagree; 7=strongly agree):		
Intrapersonal Problems (Liu and Peng 2009)	IAP1	Playing WoW causes me sleep deprivation.
	IAP2	I experience physical problems (e.g., backache, fatigue, or headache) because of playing WoW.
	IAP3	My health gets worse because of playing WoW.
Interpersonal Problems (Liu and Peng 2009)	IEP1	I miss real life social engagement because of playing WoW.
	IEP2	I give up or reduce social activities because of playing WoW.
	IEP3	Others in my life complain about my WoW playing.
	IEP4	I neglect others (e.g., friend or family) because of playing WoW.
Professional/Academic Problems (Liu and Peng 2009)	PAP1	My work or study suffered because of playing WoW.
	PAP2	Playing WoW often interferes my work or study.
	PAP3	I am not able to fulfill role obligations at workplace or campus because of playing WoW.
Deficient Self-Regulation (Kim and Kim 2010)	DSC1	I find it difficult to overrule my impulse to play WoW.
	DSC2	I find it difficult to overcome my tendency to play WoW.
	DSC3	It would be difficult to control my tendency to play WoW.
	DSC4	It is hard to restrain my urge to play WoW.
Mood Modification (Lee and Cheung 2013)	MM1	I feel good while I play WoW.
	MM2	Playing WoW is when I feel the most pleasure.
	MM3	I experience a buzz of excitement while playing WoW.
	MM4	Playing WoW makes me happy.
	MM5	Playing WoW relieves my dysphoric feelings.
	MM6	Playing WoW releases my stress.
	MM7	Playing WoW eliminates my bad feelings (e.g., sadness, nervousness, or anger).
How important are the followings to you when playing WoW (1=not at all important; 7=extremely important):		
Need for Advancement (Yee 2006)	ACH1	Acquiring rare items that most players will never have.
	ACH2	Becoming powerful.
	ACH3	Competing with other players.
	ACH4	Optimizing your character as much as possible for their profession/role.



Need for Social Interaction (Yee 2006)	SOC1	Chatting with other players.
	SOC2	Being part of a friendly, casual guild.
	SOC3	Grouping with other players.
Need for Immersion (Yee 2006)	IMM1	Exploring the world just for the sake of exploring it.
	IMM2	Being immersed in a fantasy world.
	IMM3	Making up stories and histories for your characters.

## References

- Achab, S., Nicolier, M., Mauny, F., Monnin, J., Trojak, B., Vandel, P., Sechter, D., Gorwood, P., and Haffen, E. 2011. "Massively Multiplayer Online Role-Playing Games: Comparing Characteristics of Addict Vs Non-Addict Online Recruited Gamers in a French Adult Population," *BMC Psychiatry* (11), p. 144.
- Ahlstrom, M., Lundberg, N.R., Zabriskie, R., Eggett, D., and Lindsay, G.B. 2012. "Me, My Spouse, and My Avatar," *Journal of Leisure Research* (44:1), 2012 1st Quarter, pp. 1-22.
- American Psychiatric Association. 2000. *Diagnostic Criteria from DSM-IV-TR*. Washington, D.C: American Psychiatric Association.
- American Psychiatric Association. 2013. *Diagnostic and Statistical Manual of Mental Disorders*, (5th ed.). Arlington, VA: American Psychiatric Publishing.
- Bergmark, K.H., and Bergmark, A. 2009. "The Diffusion of Addiction to the Field of MMORPGs," *Nordic Studies on Alcohol and Drugs* (26:4), pp. 415-426.
- Bhattacharjee, A. 2001. "Understanding Information Systems Continuance: An Expectation-Confirmation Model," *MIS Quarterly* (25:3), pp. 351-370.
- Billieux, J., Chanal, J., Khazaal, Y., Rochat, L., Gay, P., Zullino, D., and Van der Linden, M. 2011. "Psychological Predictors of Problematic Involvement in Massively Multiplayer Online Role-Playing Games: Illustration in a Sample of Male Cybercafe Players," *Psychopathology* (44:3), pp. 165-171.
- Billieux, J., van der Linden, M., Achab, S., Khazaal, Y., Paraskevopoulos, L., Zullino, D., and Thorens, G. 2013. "Why Do You Play World of Warcraft? An in-Depth Exploration of Self-Reported Motivations to Play Online and in-Game Behaviours in the Virtual World of Azeroth," *Computers in Human Behavior* (29:1), pp. 103-109.
- Bolton, R.N., and Lemon, K.N. 1999. "A Dynamic Model of Customers' Usage of Services: Usage as Antecedent and Consequence of Satisfaction," *Journal of Marketing Research* (36:May), pp. 171-186.
- Brack, G., Lassiter, P.S., Kitzinger, R., Hill, M., McMahon, H.G., and Fall, K.A. 2013. "Individual Psychology on the Virtual Frontier: Massive Multiplayer Online Role-Playing Gaming," *The Journal of Individual Psychology* (69:1), pp. 24-40.
- Brown, I. 1993. "Some Contributions of the Study of Gambling to the Study of Other Addictions," in *Gambling Behavior and Problem Gambling*, W.R. Eadingto and J.A. Cornelius (eds.). Reno NV: University of Nevada.
- Brown, I. 1997. "A Theoretical Model of the Behavioural Addictions - Applied to Offending," in *Addicted to Crime?*, J. Hodge, M. McMurran and C.R. Hollin (eds.). Chichester: Wiley, pp. 16-63.
- Byun, S., Ruffini, C., Mills, J.E., Douglas, A.C., Niang, M., Stepchenkova, S., Lee, S.K., Loutfi, J., Lee, J.-K., Atallah, M., and Blanton, M. 2009. "Internet Addiction: Metasynthesis of 1996-2006 Quantitative Research," *CyberPsychology & Behavior* (12), pp. 203-207.
- Caplan, S.E. 2010. "Theory and Measurement of Generalized Problematic Internet Use: A Two-Step Approach," *Computers in Human Behavior* (26:5), pp. 1089-1097.
- Chappell, D., Eatough, V., Davies, M.N.O., and Griffiths, M. 2006. "Everquest--It's Just a Computer Game Right? An Interpretative Phenomenological Analysis of Online Gaming Addiction," *International Journal of Mental Health and Addiction* (4:3), pp. 205-216.
- Charlton, J.P., and Danforth, I.D.W. 2007. "Distinguishing Addiction and High Engagement in the Context of Online Game Playing," *Computers in Human Behavior* (23:3), pp. 1531-1548.
- Charlton, J.P., and Danforth, I.D.W. 2010. "Validating the Distinction between Computer Addiction and Engagement: Online Game Playing and Personality," *Behaviour & Information Technology* (29:6), pp. 601-613.

- Chen, J.V., and Park, Y. 2005. "The Differences of Addiction Causes between Massive Multiplayer Online Game and Multi User Domain," *International Review of Information Ethics* (4), pp. 53-60.
- Chen, K., Chen, J.V., and Ross, W.H. 2010. "Antecedents of Online Game Dependency: The Implications of Multimedia Realism and Uses and Gratifications Theory," *Journal of Database Management* (21:2), p. 69.
- Chin, W. 1998. *The Partial Least Squares Approach to Structural Equation Modeling*. NJ, US: Lawrence Erlbaum Associates.
- Cole, S.H., and Hooley, J.M. 2013. "Clinical and Personality Correlates of Mmo Gaming: Anxiety and Absorption in Problematic Internet Use," *Social Science Computer Review* (31:4), pp. 424-436.
- Collins, E., Freeman, J., and Chamarro-Premuzic, T. 2012. "Personality Traits Associated with Problematic and Non-Problematic Massively Multiplayer Online Role Playing Game Use," *Personality and Individual Differences* (52:2), pp. 133-138.
- Dauriat, F.Z., Zermatten, A., Billieux, J., Thorens, G., Bondolfi, G., Zullino, D., and Khazaal, Y. 2011. "Motivations to Play Specifically Predict Excessive Involvement in Massively Multiplayer Online Role-Playing Games: Evidence from an Online Survey," *European Addiction Research* (17:4), pp. 185-189.
- Davis, F.D. 1989. "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly* (13), pp. 319-339.
- Demetrovics, Z., Urbán, R., Nagygyörgy, K., Farkas, J., Griffiths, M.D., Pápay, O., Kökönyei, G., Felvinczi, K., and Oláh, A. 2012. "The Development of the Problematic Online Gaming Questionnaire (Pogq)," *PLoS ONE* (7:5).
- Elliott, L., Ream, G., McGinsky, E., and Dunlap, E. 2012. "The Contribution of Game Genre and Other Use Patterns to Problem Video Game Play among Adult Video Gamers," *International Journal of Mental Health and Addiction* (10:6), pp. 948-969.
- Gentile, D. 2009. "Pathological Video-Game Use among Youth Ages 8 to 18: A National Study," *Psychological Science* (20:5), May, pp. 594-602.
- Griffiths, M.D. 2010. "The Role of Context in Online Gaming Excess and Addiction: Some Case Study Evidence," *International Journal of Mental Health and Addiction* (8:1), pp. 119-125.
- Griffiths, M.D., and Davies, M.N.O. 2002. "Excessive Online Computer Gaming: Implications for Education," *Journal of Computer Assisted Learning* (18), pp. 379-381.
- Griffiths, M.D., and Meredith, A. 2009. "Videogame Addiction and Its Treatment," *Journal of Contemporary Psychotherapy* (39:4), pp. 247-253.
- Haagsma, M.C., Caplan, S.E., Peters, O., and Pieterse, M.E. 2013. "A Cognitive-Behavioral Model of Problematic Online Gaming in Adolescents Aged 12a22 Years," *Computers in Human Behavior* (29:1), 2013 Jan 01, pp. 202-209.
- Han, D.H., Kim, Y.S., Lee, Y.S., Min, K.J., and Renshaw, P.F. 2010. "Changes in Cue-Induced, Prefrontal Cortex Activity with Video-Game Play," *Cyberpsychology, Behavior, and Social Networking* (13:6), pp. 655-661.
- Hawkins, M. 2012. "South Korea Introduces yet Another Law to Curb Gaming's Ills," in: *NBCNews*.
- Hsu, S.H., Wen, M.-H., and Wu, M.-C. 2009. "Exploring User Experiences as Predictors of Mmorpg Addiction," *Computers & Education* (53:3), pp. 990-999.
- Hussain, Z., and Griffiths, M.D. 2009. "Excessive Use of Massively Multi-Player Online Role-Playing Games: A Pilot Study," *International Journal of Mental Health and Addiction* (7:4), pp. 563-571.
- Jeong, E.J., and Kim, D.H. 2011. "Social Activities, Self-Efficacy, Game Attitudes, and Game Addiction," *Cyberpsychology, Behavior, and Social Networking* (14:4), pp. 213-221.
- Kim, E.J., Namkoong, K., Ku, T., and Kim, S.J. 2008. "The Relationship between Online Game Addiction and Aggression, Self-Control and Narcissistic Personality Traits," *European Psychiatry* (23:3), pp. 212-218.
- Kim, M.G., and Kim, J. 2010. "Cross-Validation of Reliability, Convergent and Discriminant Validity for the Problematic Online Game Use Scale," *Computers in Human Behavior* (26:3), pp. 389-398.
- Kim, P.W., Kim, S.Y., Shim, M., Im, C.-H., and Shon, Y.-M. 2013. "The Influence of an Educational Course on Language Expression and Treatment of Gaming Addiction for Massive Multiplayer Online Role-Playing Game (MMORPG) Players," *Computers & Education* (63), pp. 208-217.
- Ko, C.-H., Liu, G.-C., Hsiao, S., Yen, J.-Y., Yang, M.-J., Lin, W.-C., Yen, C.-F., and Chen, C.-S. 2009. "Brain Activities Associated with Gaming Urge of Online Gaming Addiction," *Journal of Psychiatric Research* (43:7), pp. 739-747.

- Kuss, D.J., and Griffiths, M.D. 2012. "Internet Gaming Addiction: A Systematic Review of Empirical Research," *International Journal of Mental Health and Addiction* (10:2), pp. 278-296.
- Kuss, D.J., Louws, J., and Wiers, R.W. 2012. "Online Gaming Addiction? Motives Predict Addictive Play Behavior in Massively Multiplayer Online Role-Playing Games," *Cyberpsychology, behavior and social networking* (15:9), pp. 480-485.
- Lafrenière, M.-A.K., Vallerand, R.J., Donahue, E.G., and Lavigne, G.L. 2009. "On the Costs and Benefits of Gaming: The Role of Passion," *CyberPsychology & Behavior* (12:3), pp. 285-290.
- LaRose, R., Lin, C.A., and Eastin, M.S. 2003. "Unregulated Internet Usage: Addiction, Habit, or Deficient Self-Regulation?," *Media Psychology* (5), pp. 225-253.
- Lee, A. 2013. "21-Year-Old Chinese Gamer Dies after 40-Hour MMO Session," in: *TechnoBuffalo*.
- Lee, D., and LaRose, R. 2007. "A Socio-Cognitive Model of Video Game Usage," *Journal of Broadcasting & Electronic Media* (51), pp. 632-650.
- Lee, K.C., and Perry, S.D. 2004. "Student Instant Message Use in a Ubiquitous Computing Environment: Effects of Deficient Self-Regulation," *Journal of Broadcasting & Electronic Media* (48:3), pp. 399-420.
- Leménager, T., Gwodz, A., Richter, A., Reinhard, I., Kämmerer, N., Sell, M., and Mann, K. 2013. "Self-Concept Deficits in Massively Multiplayer Online Role-Playing Games Addiction," *European Addiction Research* (19:5), 2013, p. 227.
- Li, D., Liao, A., and Khoo, A. 2011. "Examining the Influence of Actual-Ideal Self-Discrepancies, Depression, and Escapism, on Pathological Gaming among Massively Multiplayer Online Adolescent Games," *Cyberpsychology, Behavior, and Social Networking* (14:9), pp. 535-539.
- Liu, M., and Peng, W. 2009. "Cognitive and Psychological Predictors of the Negative Outcomes Associated with Playing Mmogs (Massively Multiplayer Online Games)," *Computers in Human Behavior* (25:6), pp. 1306-1311.
- Lu, H.-P., and Wang, S.-m. 2008. "The Role of Internet Addiction in Online Game Loyalty: An Exploratory Study," *Internet Research* (18:5), pp. 499-519.
- Mentzoni, R.A., Brunborg, G.S., Molde, H., Myrseth, H., Mår Skouverøe, K.J., Hetland, J., and Pallesen, S. 2011. "Problematic Video Game Use: Estimated Prevalence and Associations with Mental and Physical Health," *Cyberpsychology, Behavior, and Social Networking* (14:10), pp. 591-596.
- Metcalfe, O., and Pammer, K. 2011. "Attentional Bias in Excessive Massively Multiplayer Online Role-Playing Gamers Using a Modified Stroop Task," *Computers in Human Behavior* (27:5), pp. 1942-1947.
- MMOGdata.net. 2012. Retrieved October 15, 2012, from <http://mmodata.net/>
- Ng, B.D., and Wiemer-Hastings, P. 2005. "Addiction to the Internet and Online Gaming," *CyberPsychology & Behavior* (8:2), pp. 110-113.
- Ng, J. 2012. "Juvenile Courts Sees More Game Addiction Cases," in: *the Straits Times*. Singapore.
- Oggins, J., and Sammis, J. 2012. "Notions of Video Game Addiction and Their Relation to Self-Reported Addiction among Players of World of Warcraft," *International Journal of Mental Health and Addiction* (10:2), pp. 210-230.
- Orford, J. 1985. *Excessive Appetites: A Psychological View of Addictions*. Chichester: John Wiley.
- Orr, E.S., Ross, C., and Orr, R. 2012. "Trait and Symptom Differences between Factions in Online Gaming: The Vulnerable Side of Evil," *Computers in Human Behavior* (28:2), pp. 739-743.
- Pápay, O., Urbán, R., Griffiths, M.D., Nagygyörgy, K., Farkas, J., Kökönyei, G., Felvinczi, K., Oláh, A., Elekes, Z., and Demetrovics, Z. 2013. "Psychometric Properties of the Problematic Online Gaming Questionnaire Short-Form and Prevalence of Problematic Online Gaming in a National Sample of Adolescents," *Cyberpsychology, Behavior, and Social Networking* (16:5), pp. 340-348.
- Park, H.S., Kim, S.H., Bang, S.A., Yoon, E.J., Cho, S.S., and Kim, S.E. 2010. "Altered Regional Cerebral Glucose Metabolism in Internet Game Overusers: A 18f-Fluorodeoxyglucose Positron Emission Tomography Study," *CNS Spectrums* (15:3, Suppl 5), pp. 159-166.
- Pawlikowski, M., and Brand, M. 2011. "Excessive Internet Gaming and Decision Making: Do Excessive World of Warcraft Players Have Problems in Decision Making under Risky Conditions?," *Psychiatry Research* (188:3), pp. 428-433.
- Peters, C.S., and Malesky, A. 2008. "Problematic Usage among Highly-Engaged Players of Massively Multiplayer Online Role Playing Games," *CyberPsychology & Behavior* (11:4), pp. 481-484.
- Podsakoff, P.M., MacKenzie, S.B., Lee, J.-Y., and 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), pp. 879-903.

- Price, L.D. 2011. "Bupropion Effective for Treating Excessive Online Gaming and Comorbid Depression," *Brown University Psychopharmacology Update* (22:7), pp. 1-7.
- Rau, P.-L.P., Peng, S.-Y., and Yang, C.-C. 2006. "Time Distortion for Expert and Novice Online Game Players," *CyberPsychology & Behavior* (9:4), pp. 396-403.
- Rehbein, F., Psych, G., Kleimann, M., Mediasci, G., and Mößle, T. 2010. "Prevalence and Risk Factors of Video Game Dependency in Adolescence: Results of a German Nationwide Survey," *Cyberpsychology, Behavior, and Social Networking* (13:3), pp. 269-277.
- Reynolds, W.M. 1982. "Development of Reliable and Valid Short Forms of the Marlowe-Crowne Social Desirability Scale," *Journal of Clinical Psychology* (38:1), pp. 119-125.
- Seay, A.F., and Kraut, R.E. 2007. "Project Massive: Self-Regulation and Problematic Use of Online Gaming," *Conference on Human Factors in Computing Systems*, San Jose, CA.
- Seok, S., and 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), p. 2143.
- Smahel, D., Blinka, L., and Ledabyl, O. 2008. "Playing Mmorpgs: Connections between Addiction and Identifying with a Character," *CyberPsychology & Behavior* (11:6), pp. 715-718.
- Snodgrass, J.G., Dengah, H.J.F., II, Lacy, M.G., and Fagan, J. 2013. "A Formal Anthropological View of Motivation Models of Problematic Mmo Play: Achievement, Social, and Immersion Factors in the Context of Culture," *Transcultural Psychiatry* (50:2), pp. 235-262.
- Snodgrass, J.G., Dengah, H.J.F., Lacy, M.G., Fagan, J., Most, D., Blank, M., Howard, L., Kershner, C.R., Krambeer, G., Leavitt-Reynolds, A., Reynolds, A., Vyvial-Larson, J., Whaley, J., and Wintersteen, B. 2012. "Restorative Magical Adventure or Warcrack? Motivated Mmo Play and the Pleasures and Perils of Online Experience," *Games and Culture: A Journal of Interactive Media* (7:1), pp. 3-28.
- Son, D.T., Yasuoka, J., Poudel, K.C., Otsuka, K., and Jimba, M. 2013. "Massively Multiplayer Online Role-Playing Games (Mmorpg): Association between Its Addiction, Self-Control and Mental Disorders among Young People in Vietnam," *International Journal of Social Psychiatry* (59:6), pp. 570-577.
- Steinfeld, C., Ellison, N.B., and Lampe, C. 2008. "Social Capital, Self-Esteem, and Use of Online Social Network Sites: A Longitudinal Analysis," *Journal of Applied Developmental Psychology* (29:6), pp. 434-445.
- Stetina, B.U., Kothgassner, O.D., Lehenbauer, M., and Kryspin-Exner, I. 2011. "Beyond the Fascination of Online-Games: Probing Addictive Behavior and Depression in the World of Online-Gaming," *Computers in Human Behavior* (27:1), pp. 473-479.
- Sun, C. 2011. "South Korea Is the Most-Wired Country in the World - and Online Games Are the New Drug of Choice for Its Youth," in: *Newsweek*. Daily Beast Company.
- Turel, O., Serenko, A., and Giles, P. 2011. "Integrating Technology Addiction and Use: An Empirical Investigation of Online Auction Users," *MIS Quarterly* (35:4), pp. 1043-1051.
- Utz, S., Jonas, K.J., and Tonkens, E. 2012. "Effects of Passion for Massively Multiplayer Online Role-Playing Games on Interpersonal Relationships," *Journal of Media Psychology: Theories, Methods, and Applications* (24:2), pp. 77-86.
- van Rooij, A.J., Schoenmakers, T.M., Vermulst, A.A., van den Eijnden, R.J.J.M., and van de Mheen, D. 2011. "Online Video Game Addiction: Identification of Addicted Adolescent Gamers," *Addiction* (106:1), pp. 205-212.
- Venkatesh, V., Morris, M.G., Davis, G.B., and Davis, F.D. 2003. "User Acceptance of Information Technology toward a Unified View," *MIS Quarterly* (27:3), pp. 425-478.
- Wan, C.-S., and Chiou, W.-B. 2006. "Psychological Motives and Online Games Addiction: A Test of Flow Theory and Humanistic Needs Theory for Taiwanese Adolescents," *CyberPsychology & Behavior* (9:3), pp. 317-324.
- Wan, C.-S., and Chiou, W.-B. 2007. "The Motivations of Adolescents Who Are Addicted to Online Games: A Cognitive Perspective," *Adolescence* (42:165), pp. 179-197.
- Williams, M.L., and Podsakoff, P.M. 1992. "Effects of Group-Level and Individual-Level Variation in Leader Behaviours on Subordinate Attitudes and Performance," *Journal of Occupational & Organizational Psychology* (65:2), pp. 115-129.
- Wu, T.-C., Scott, D., and Yang, C.-C. 2013. "Advanced or Addicted? Exploring the Relationship of Recreation Specialization to Flow Experiences and Online Game Addiction," *Leisure Sciences* (35:3), pp. 203-217.

- Wu, Y. 2007. "Overweight Online Gamer Dies Playing," in: *China Daily*. New York, N.Y: China Daily, p. 5.
- Yee, N. 2006. "Motivations of Play in Online Games," *Cyberpsychology and Behavior* (9), pp. 772-775.
- Young, K. 2009. "Understanding Online Gaming Addiction and Treatment Issues for Adolescents," *American Journal of Family Therapy* (37:5), pp. 355-372.
- Yuan, K., Cheng, P., Dong, T., Bi, Y., Xing, L., Yu, D., Zhao, L., Dong, M., Deneen, K.M., Liu, Y., Qin, W., and Tian, J. 2013a. "Cortical Thickness Abnormalities in Late Adolescence with Online Gaming Addiction," *PLoS ONE* (8:1), Jan 2013.
- Yuan, K., Jin, C., Cheng, P., Yang, X., Dong, T., Bi, Y., Xing, L., Deneen, K.M., Yu, D., Liu, J., Liang, J., Cheng, T., Qin, W., and Tian, J. 2013b. "Amplitude of Low Frequency Fluctuation Abnormalities in Adolescents with Online Gaming Addiction," *PLoS ONE* (8:11), Nov 2013.
- Zhao, Y.R. 2010. "Online Game Addict Says "Sorry" for Violent Attack," in: *China Daily*. Chain: China Daily.
- Zhong, Z.-J., and Yao, M.Z. 2013. "Gaming Motivations, Avatar-Self Identification and Symptoms of Online Game Addiction," *Asian Journal of Communication* (23:5), Oct 2013, pp. 555-573.