Problematic Internet use and psychosocial well-being among MMO players

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ABSTRACT

The current study examined problematic Internet use (PIU) among people who play MMO games and sought to determine whether aspects of the MMO experience are useful predictors of PIU. The study sought to determine whether game-related variables could predict PIU scores after accounting for their relationships with psychosocial well-being. Novel methods allowed us, for the first time, to connect in-game behaviors with survey results of over 4000 MMO players. The results revealed that MMO gaming variables contributed a substantively small, but statistically significant amount of explained variance to PIU scores.

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1. Introduction

1.1. Overview

For over a decade, researchers have sought to learn more about problematic Internet use (PIU) (for recent reviews, see Morahan-Martin, 2007, 2008; Widyanto & Griffiths, 2007). One of the most consistent themes to emerge from the PIU literature is that individuals who report negative outcomes associated with their Internet use appear to be especially drawn to its interpersonal functions (Caplan, 2002, 2003; Chak & Leung, 2004; Davis, Flett, & Besser, 2002; McKenna & Bargh, 2000; Morahan-Martin & Schumacher, 2000, 2003; van den Eijnden, Meerkerk, Vermulst, Spijkerman, & Engles, 2008; Young, 1998; Young & Rogers, 1998). To date, however, PIU researchers have devoted relatively little attention to an increasingly popular and interesting form of online interpersonal behavior—playing massively multiplayer online (MMO) games. In one recent review, Morahan-Martin (2008) noted that, although activities such as online socially interactive gaming may be important contributors to PIU, it is not clear how much influence they have. MMO games are relevant to PIU research for two reasons: (a) MMO games are a popular form of Internet activity, and (b) perhaps more than any other kind of computer game, interpersonal behavior and relationships are central features of the MMO experience. The current study examined the relationship between MMO gaming and PIU.

MMOs are a rapidly growing segment of Internet activity (Chan & Vorderer, 2006) with the total number of subscriptions now over 47 million (White, 2008). Moreover, individuals who subscribe to MMO games often engage in a variety of forms of computer-mediated interpersonal interactions with other players (Cole & Griffiths, 2007; Lo, Wang, & Fang, 2005; Taylor, 2006; Yee, 2007). A recent survey of MMO players found that, "for many players, the social aspects of the game were the most important factor in playing" (Griffiths, Davies, & Chappell, 2004, p. 87). MMO players typically band together to accomplish tasks, sometimes forming ad hoc groups, but most often joining longer-term associations known as "guilds" (Williams, Xiong, Zhang, Yee, & Nickell, 2006). Within guilds, players interact intensely, creating new relationships and managing pre-existing ones. Players need each other to progress in the game, so managing relationships and spending time with one another becomes an important means to an end, and often an end in itself. These interactions occur primarily through person-to-person instant messaging, through group-wide text channels, and over voice-based systems (Williams, Caplan, & Xiong, 2007). Given that MMOs are a highly interpersonal online activity, we argue that a closer look at PIU among MMO gamers will help advance the research on both phenomena. Although studies have examined problematic, and even addictive, aspects of MMO games, only a few studies have specifically examined PIU among MMO gamers (e.g., Ng & Wiemer-Hastings, 2005; Yee, 2006a, 2006b). However, those studies have not controlled for the association that PIU and MMO gaming may both share with psychosocial well-being. In other words, both PIU and MMO gaming may be driven by depression or social anxiety. Thus, the previously reported associations between MMO use and PIU may be spurious, and be merely an artifact of the relationships both share with psychosocial well-being.

The study reported here sought to further integrate the PIU and MMO literatures by examining PIU among people who play MMO games to first determine whether their PIU levels are associated

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with broader Internet usage patterns. Then, the study examined whether game-related variables predict PIU scores after controlling for the influence of psychosocial well-being. To explore these two issues, the current study employed a unique method—combining a survey of thousands of MMO players with behavioral data obtained directly from the game servers.

The following paragraphs briefly demonstrate that psychosocial well-being has significant associations with both MMO gaming and PIU. With these empirical associations established, we parsed out these two factors to explore whether use of the game itself has an impact on PIU. The results revealed that gaming variables contributed only a small, if statistically significant, amount of explained variance to predicting PIU scores after controlling for psychosocial well-being variables.

1.2. Problematic Internet use and psychosocial well-being

PIU is a multidimensional syndrome that consists of cognitive, emotional, and behavioral symptoms that result in difficulties with managing one's offline life (Caplan, 2002, 2003, 2005a, 2005b; Davis, 2001; Davis et al., 2002; Morahan-Martin & Schumacher, 2003). Although researchers still disagree on the scope, nature, etiology, and effects of PIU (for reviews, Morahan-Martin, 2007, 2008; Widyanto & Griffiths, 2007), the literature suggests that symptoms of PIU include using the Internet as maladaptive mood regulation, compulsive use of the Internet, a preference for online social interaction, cognitive preoccupation with the Internet, and negative outcomes due to Internet use (Caplan, 2005a, 2005b). LaRose, Lin, and Eastin (2003) argue that PIU involves going online to alleviate negative moods, "to relieve stress, loneliness, depression, or anxiety" (p. 231). Similarly, Spada, Langston, Nikcevic, and Moneta (2008) suggest it is using the Internet to reduce negative emotional drives.

Thus far, the PIU literature suggests two important points. First, PIU is associated with broader psychosocial well-being (Morahan-Martin, 2007, 2008; Spada et al., 2008). Studies report significant correlations between PIU and loneliness (Amichai-Hamburger & Ben-Artzi, 2003; Caplan, 2002; Kubey, Lavin, & Barrows, 2001; Morahan-Martin & Schumacher, 2003), depression (Ybarra, Alexander, & Mitchell, 2005; Young & Rogers, 1998), anxiety (Caplan, 2005a, 2005b; Spada et al., 2008; Yu-yuan, 2007), shyness (Chak & Leung, 2004; Roberts, Smith, & Pollock, 2000), aggression (Kim, Namkoong, Ku, & Kim, 2008), introversion (Ebeling-Witte, Frank, & Lester, 2007), and social skill deficits (Caplan, 2005a). The cognitive behavioral model of PIU (Davis, 2001) suggests that individuals who suffer from psychosocial problems are more likely to develop PIU.

Second, the cognitive and behavioral symptoms of PIU appear to be especially related to online social interaction. Davis (2001) argues that PIU arises, to a large extent, from the unique social environment available online. A study by Morahan-Martin and Schumacher (2000) found that interpersonal uses of the Internet differentiated those with problematic use from those with less problematic use. Morahan-Martin explains "there is a growing consensus that the unique social interactions made possible by the Internet play a major role in the development of Internet abuse" (2007, p. 335). As noted earlier, those who report negative outcomes due to their Internet use are more likely to use the Internet for interpersonal activities (e.g., chatrooms, interactive gaming, and instant messaging) and to go online to meet people, form relationships, and seek emotional support (Morahan-Martin, 2007). Additionally, Caplan (2003, 2005a, 2005b) found that a preference for online social interaction (over FtF conversation) was a significant predictor of compulsive Internet use and of the extent to which individuals reported experiencing negative outcomes due to their Internet use.

Although PIU researchers have examined a number of different online interpersonal behaviors, they have not devoted sufficient attention to one of the fastest growing and most popular forms of online social activity, MMO gaming. Given the robust trend in the literature documenting associations among psychosocial health, online interpersonal behavior, and PIU, a worthwhile research question to pursue is whether some aspects of MMO gaming contribute additional explained variance to models predicting PIU. But even more germane to the theoretical framework of PIU researchers, MMOs are an ideal context to examine the interpersonal aspects of the syndrome because they are highly social. The next section describes the interpersonal features of MMOs, which may make them especially attractive to those who exhibit PIU.

1.3. Interpersonal features of MMO games

The predecessors of MMO games were text-based persistent worlds—known as multiuser domains (MUDs)—where users interacted entirely via typed descriptions and chat. Although early qualitative studies of MUDs touched upon both the potential therapeutic and problematic outcomes of social interaction in these environments (Suler, 1996; Turkle, 1995), these relationships have not been examined systematically. MMO games have a number of interpersonal features which make them important sites for investigating these issues. A number of researchers have examined interpersonal phenomena in MMOs including the interactions between players (Cole & Griffiths, 2007; Ducheneaut, Moore, & Nickell, 2007), between avatars (Moore, Gathman, Ducheneaut, & Nickell, 2007), and the social processes that take place among individuals, avatars, and the communities they play in (Taylor, 2006; Williams et al., 2006; Yee, 2006a, 2006b).

Some of the interpersonal features of MMOs are similar to other forms of online interpersonal communication. As Lo et al. (2005) describe them, "players interact with others anonymously and instantly and even form virtual interpersonal relationships and organize virtual communities" (p. 15). Players also engage in rule-governed nonverbal actions to signal emotions. Griffiths et al. (2003) explain that "it is possible to 'emote' visually, i.e., signal an emotional state by gesture such as kneeling, saluting, waving, etc. Within these self-contained worlds, a rule-governed behavior emerges from the various interactions between players" (p. 83). More recently, gamers have adopted digital voice technology to aid in their communication and coordination. Although one study found generally positive social outcomes from voice use (Williams et al., 2007), the potential for this modality of communication to create PIU is unclear. Cole and Griffiths (2007) describe MMO games as "extremely social games" and as "highly socially interactive environments providing the opportunity to create strong friendships and emotional relationships" (p. 575).

Cole and Griffiths (2007) also argue that positive social interaction is a necessary ingredient for success in MMO games. Indeed, since many of the games' tasks require the cooperation of small and large groups of other players, the interpersonal aspects are unavoidable. Moreover, a player seeking to avoid interpersonal contact could play a single-player game that would feature better graphics, better game play and stronger storylines. Thus, it is perhaps not surprising that a study of the game *EverQuest* found that players reported the games' social features to be their favorite aspect of the game (Griffiths et al., 2004).

In keeping with the PIU literature reviewed earlier, some evidence suggests that these interpersonal elements of MMOs might be associated with negative outcomes. For example, Ng and Weimer-Hastings (2005) argue that "it is the social aspects inherent in [MMOs] that draw in the 'hard core' players who show patterns of [Internet] addiction" (Ng & Wiemer-Hastings, 2005, p. 112–113).

Another study found that MMO game usage was positively associated with both social anxiety and negative interpersonal outcomes (Lo et al., 2005). On the other hand, Cole & Griffith (2004) suggest that the social aspects of MMOs may also be responsible for a number of beneficial outcomes, although these may not be mutually exclusive. Indeed, practicing clinicians have explicitly stated that online gaming can both help and hurt an individual at the same time (Allison, Wahide, Shockley, & Gabbard, 2006) and thus problematic usage does not preclude concurrent therapeutic usage. In this sense, problematic usage may be thought of as a maladaptive solution—an attempt to solve one problem and inadvertently creating a larger problem elsewhere.

1.4. Predicting the outcomes of psychosocial well-being, Internet use, and MMO gaming

The model tested in this study is additive. We assume that general Internet use will continue to play a role, and that MMO players also spend time online doing other things. If so, any baseline PIU effects stemming from general Internet use need to be accounted for before exploring the nuances of MMO play. As noted above, research has consistently shown that psychosocial well-being and social uses of the Internet are both strong positive predictors of PIU. Since the MMO gaming factors are additions to a base model, we hypothesize replications of the broader patterns, followed by these additional, more specific factors. Therefore, to begin with the first step:

> H1: The amount of Internet use will be a positive predictor of PIU.
> H2: Interpersonal uses of the Internet will be positive predictors of PIU.

Although Yee's game research included other variables in his model predicting problematic game use, such as gender, age, and time spent online, the analysis did not take into consideration the role that psychosocial well-being (e.g., depression, anxiety, loneliness, introversion, etc.) might play in the relationship. Given the additive approach used here, these base states also needed to be included as a second step that encompassed the psychological profile of the players. A number of studies have found low social skill, shyness, introversion, and social anxiety to all be positively related to PIU (Anolli, Villani, & Riva, 2005; Caplan, 2005a, 2005b; Chak & Leung, 2004; Ebeling-Witte et al., 2007; Roberts et al., 2000) and suggest that individuals' who experience social difficulties are more likely to report higher PIU scores:

> H3: Indicators of psychosocial well-being will be significant positive predictors of PIU.

There has also been extensive research on aggression effects and video games more generally (Bushman & Huesmann, 2006; Sherry, 2001). Work using the General Aggression Model (GAM) predicts that time spent in violent games leads to aggressive thoughts, behaviors, and cognitions (Anderson, 2004; Anderson & Dill, 2000). Although the only study of online games and aggression to date found no such effects (Williams & Skoric, 2005), the potential connection suggests that aggression variables are worth including in any study because Kim et al. (2008) suggest a link between aggression and PIU. Thus:

> H4: Aggression will be a positive predictor of PIU.

Another important psychosocial factor is the player's social milieu. There is a robust, if not always consistent, literature on so-

cial and emotional support as a buffer for stress (Cohen & Wills, 1985). The buffer hypothesis states that individuals with strong social and familial networks will be better able to cope with and resist the stresses and strains of modern life, and of difficult events (Cohen & Hoberman, 1983). Buffers can either be material—such as financial support—or psychological. We focus on the latter here, as we are chiefly interested in psychological and interpersonal processes. Social support is often measured in terms of community sensibility; those who experience greater connections to their communities have a greater sense of belonging, which is thought to provide both a general elevated mood and access to crucial information streams needed to cope with changes and stressors (Cohen & McKay, 1984). We would therefore expect a sense of community derived from traditional face to face relationships to provide a buffer from PIU:

> H5a: Deriving sense of community from face to face relationships at school and work will be a negative predictor of PIU.

The literature on the relationship between preference for online social interaction and negative outcomes due to Internet use (e.g., Caplan, 2003, 2005a) suggests the that those who prefer online social interaction are more likely to experience negative outcomes due to their Internet use. Thus, we predicted the following regarding PIU and depending on online relationships for one's sense of community:

> H5b: Deriving a sense of community from online relationships will be a positive predictor of PIU.

Whereas the first step of our predictive model of PIU includes general Internet usage of the player and the second step involves psychological and social background, the final step moves to game-centric predictors of PIU. If there is an impact from playing an MMO, it should be noticeable over and above what we might expect to find after testing a baseline PIU model with general Internet use and well-being as predictors. Therefore, we asked whether game-related variables might explain any further variance in a model. The most basic element would include amount of time playing the game:

> RQ1: Is the amount of time one spends playing an MMO game a positive predictor of PIU?

The second element is based on the notion of communication modality noted earlier. If PIU is indeed tied to social aspects of CMC, then particularly social forms of MMO activity might play a key role. As noted earlier, voice users appear to be among the more socially bonded in MMO play (Williams et al., 2007). Thus:

> RQ2: Is the use of voice technology when playing an MMO game a positive predictor of PIU?

The other potential game-related variables include individuals' motivations for playing an MMO. A number of articles have documented the potentially unhealthy or problematic aspects of online gaming (Chappell, Eatough, Davies, & Griffiths, 2006; Charlton & Danforth, 2007; Griffiths, Davies & Chappell, 2003, 2004; Grüsser, Thalemann, & Griffiths, 2007; Kim et al., 2008; Lo et al., 2005; Morahan-Martin, 2008; Ng & Wiemer-Hastings, 2005; Wan & Chiou, 2006; Yee, 2006a, 2006b). In summarizing this line of research, Charlton and Danforth (2007) suggest that three characteristics of MMOs might foster problematic or addictive game use: (a) the achievement model used—MMOs induce operant conditioning via variable-ratio reinforcement schedules, (b) the social nature of

MMOs may foster social reinforcement, and (c) the immersive nature of MMOs might represent an addictive potential. Consistent with Turkle's (1995) work on MUD play, Charlton and Danforth (2007) suggest that the problematic aspects of MMO gaming had less to do with pleasure-seeking (i.e., euphoric feelings) and more to do with escapism afforded by the games' immersive qualities. The characteristics that Charlton and Danforth (2007) propose foster problematic game use are conceptually similar to the three MMO motivations (achievement, social, and immersive) proposed by Yee (2006a, 2006b).

The achievement motivation involves one's desire to gain power, advance rapidly, and accumulate in-game status or wealth. The social motivation pertains to forming meaningful long-term relationships with other players, deriving satisfaction from participating in group efforts in the game, and the desire to help or chat with other players in the game. Finally, the immersion motivation consists of role-playing with other players, customizing the appearance of one's characters, and finding and knowing things about the game that most other players do not know about, and escapism (i.e., using the game to relax, escape from real life, or to avoid real life problems). Yee's (2006a, 2006b) research further suggests that these three motivations may be associated with PIU.

Yee (2006a) argues that the above motivations "may clarify whether certain players are more susceptible to problematic usage" (p. 772). In the same study, Yee found that participants' motivations were associated with scores on a variation of Young's (1998) diagnostic questionnaire for Internet dependence. Additionally, among the different motivational variables examined, Yee found that escapism (a form of immersion) and advancement (a form of achievement) were both significant predictors of PIU, although the effect of escapism was close to twice the magnitude of the effect of achievement. Therefore, it is reasonable to suggest that these game-related motivations might join playing time and voice use as possible additional predictors of PIU:

H7: Motivations for game play will predict PIU.

The current test offers the additional ability to look more closely at these motivation predictors, beyond their ability to round out a predictive PIU model, and to begin to examine some of the mechanisms at play within an MMO. As noted by practicing clinicians (Allison, Wahide, Shockley, & Gabbard, 2006), MMOs may encourage the formation of a maladaptive solution by allowing the player to escape temporarily while causing the source problem to fester over time. The high predictive value of escapism from Yee's (2006a, 2006b) study is consistent with this clinical observation. As for the achievement motivation, players who enjoy progression and reaching goals may be more susceptible to the elaborate behavioral conditioning in MMOs. In these games, players are constantly rewarded for a variety of accomplishments—killing a monster, reaching the next level, crafting an item, completing a quest, and so forth. Progress bars for most goals are also shown and due to the large number of concurrent goals, players are constantly close to one accomplishment or another. In the early stages of the game, these reinforcement structures provide rapid rewards to shape behaviors and then gradually increase in time needed to reach those accomplishments. What took minutes at low levels of the game will require hours of play at higher levels. Thus, players with a high achievement motivation may be more likely to devote an increasingly larger amount of time to complete in-game goals. Still, in light of Yee's findings, we might expect that the immersion motivation is a stronger predictor of PIU than the other two forms of motivation:

H8: The immersion motivation will be a stronger predictor of PIU than the achievement motivation.

2. Methods

The method reported here is the first to use a combination of survey data along with in-game data collected by commercial servers. For the current study, server-based data provided the precise amount of time each week that the participants spent playing the game. This unobtrusive collection is novel to the research area, and provides a significantly higher degree of accuracy than self-reporting. The balance of the measures came from an original survey of players conducted with the cooperation of the game developer.

The current study focused on the MMO *EverQuest 2* (*EQ2*). *EQ2* is a popular MMO that is representative of mainstream titles. The game represents the mainstay of the MMO market—fantasy role playing games—which altogether account for 85% of all MMO subscriptions (White, 2008). The game operator, Sony Online Entertainment, agreed to cooperate with the research team, and to provide access to data from the game's large back-end databases. Sony further worked with the research team to help field the large survey described below. This collaboration yielded a large stratified sample and established trust with the potential survey takers. Most importantly, it allowed the linkage of survey data with unobtrusively collected game-based behavioral data.

2.1. Sampling and procedures

Players have the option of playing on one of four main server types, each corresponding to slight differences in the rule sets. The sample covered one server for each of these four types, and the study invited all players to participate in a survey if they logged in during the study time window. If they agreed, players were directed to a separate website linked to their account information. The survey results were then downloaded to a private computer and linked with the time-played variables for each player's account.

After providing consent, players completed an online web-based survey that took about 25 minutes. There was no cover story for the instrument, and players were not offered money as an incentive. Instead, they were promised a special in-game item as compensation. This item, the "Greatstaff of the Sun Serpent" was created by Sony for the study. According to the Sony team, the item was made to be desirable for players of all levels because of its rarity, and it proved to be a valuable recruiting tool for the survey. A total of 7129 players participated in the survey in just over two days. After removing cases with missing values for the variables in current study, the final sample size was 4278 (81% male). Participants ranged in age from 18 to 65 (*M* = 32.47, *SD* = 8.73).

2.2. Measures

To estimate the amount of time participants spent using the Internet, the survey asked participants to answer a single item that asked them how many hours they spent on the Internet or email in a typical week, not counting when they used it for work. The participants reported spending an average of 30 h (*SD* = 19.75) using the Internet per week.

The study also examined how the participants used the Internet for social and informational purposes. Participants were asked to rate, on a scale ranging from (1) "never" to (5) "frequently," four single-item questions asking how frequently they used the Internet for finding information about national or international events, sending instant messages, meeting someone new, and visiting forums.

Psychological well-being was assessed with several items. Loneliness was measured with the UCLA Loneliness Scale (Russell, Peplau, & Cutrona, 1980). In the current study, the UCLA scale was reliable (α = .92).[1] Introversion was assessed with an updated and abridged version of the extraversion subscale of the Revised Eysenck Personality Questionnaire (*EPQR-A*; Francis, Brown, & Philipchalk, 1992) (α = .79). Additionally, participants responded to single-item "yes or no" questions about whether they had ever been diagnosed with depression (22.20% responded yes), anxiety (15.90% responded yes), behavioral addiction (3.20% responded yes), and substance addiction (5.30% responded yes). Aggression was measured with two subcales (physical and verbal aggression) from the Aggression Questionnaire (Buss & Perry, 1992) (verbal α = .77; physical α = .73).

Finally, the last indicator of psychosocial well-being, sense of community, was assessed with standard question forms from the National Election Study. Participants were asked to rate the extent they agreed with three statements about where they derived their sense of community from. For each item, participants responded on a three point scale: (1) "No, they don't," (2) "It depends/I have no strong feelings," or (3) "Yes, they do.": "The people I work with or go to school with give me a sense of community," "The people I have met online give me a sense of community," and "The people in my neighborhood give me a sense of community."

PIU was measured with the Generalized Problematic Internet Use Scale 2 (Caplan, 2005b). The GPIUS2 consists of 15 items that tap five components of PIU: preference for online social interaction, using the Internet for mood regulation, compulsive Internet use, cognitive preoccupation with the Internet, and negative outcomes due to Internet use. Participants' scores on the 15 items were summed to create an overall PIU score for each participant (α = .93).

The final set of measures operationalized several game-related variables: game-playing motivations, use of voice-over-Internet (VOIP) technology during the game, and number of hours per week spent playing the game. The motivation measures were a condensed 10-item version of Yee's inventory of MMO motivations (Williams, Yee, & Caplan, 2008). The motivation inventory measures a player's orientation in three broad motivations related to online gaming: achievement, social interaction, and immersion. The inventory items used a five-point scale ranging from (1) "Not Important At All" to (5) "Extremely Important." Each participant received a score for their achievement motivation (α = .66), social motivation (α = .76), and immersion motivation (α = .61).[2]

Participants' use of voice technology was assessed with a single-item: "How often do you use a voice system (e.g., TeamSpeak, Ventrilo) to talk to other players" on a scale ranging from (1) "never" to (5) "always" (*M* = 2.89, *SD* = 1.46).

Finally, the number of hours per week that participants played the game was obtained by server-side data provided by the game operator (*M* = 25.69 h, *SD* = 18.67).

3. Results

All hypotheses and research questions were addressed with a hierarchical multiple regression analysis with PIU scores as the dependent variable. All of the regression results appear in Table 1. An omnibus *F* test revealed that the final regression model, as a whole, was significant, $F_{(22, 4255)}$ = 118.41, $p < .001$. Together, all of the variables in the final model explained 38% of variance in participants' PIU scores. In order to control for the effects of age, gender, and Internet use on the model, these variables were entered together at the first step. At Step 1, the Internet use and control variables accounted for 14% of the variance in PIU scores. At Step 2, indicators of psychosocial well-being were entered into the model. Consistent with H3, the psychosocial well-being variables accounted for a significant increase of 22% in the explained variance in PIU scores. Finally, at Step 3, the MMO game variables were added into the model. With regard to RQ1, the analysis revealed that the game-related variables accounted for a statistically significant, but substantively small, additional 2% in explained variance in PIU scores.

The results of the final step of the regression analysis were used to test the hypotheses presented earlier (see Table 1). As predicted, participants' amount of Internet use was a positive predictor of PIU. Additionally, consistent with the hypotheses presented earlier, social uses of the Internet were significant positive predictors of PIU. The information-gathering form of Internet use (news gathering) was not significant.

As noted above, the addition of the set of psychosocial predictor variables in Step 2 resulted in a significant increase in the model's R^2 value. Moreover, the predictions regarding the psychosocial variables were largely supported. Loneliness and introversion were significant positive predictors of PIU. Additionally, depression, substance addiction, and behavioral addiction diagnoses were all positive predictors of PIU. However, there was no association between having a diagnosis of anxiety and PIU.

The analysis also revealed that physical and verbal aggression were both significant positive predictors of PIU. As predicted, deriving a sense of community from classmates and co-workers was a negative predictor of PIU, whereas deriving a sense of community from people met online was a significant positive predictor.

After controlling for age, gender, Internet use, and psychosocial well-being, MMO gaming variables did contribute additional significant explained variance to the regression model. As Table 1 indicates, the number of hours per week playing *EQ2* was a significant positive predictor of PIU, as was voice use. The test of motivation variables yielded mixed results. As predicted, the immersion motivation was a significant positive predictor of PIU; contrary to the hypothesis, achievement was not. There was also no link found for the social motivation to PIU.

4. Discussion

The purpose of the study reported above was to examine PIU among people who play MMO games and to determine whether aspects of the MMO experience are useful predictors of PIU. The study examined whether game-related variables could predict PIU scores after accounting for their relationships with psychosocial well-being. The study employed novel methods which allowed us, for the first time, to connect in-game behaviors with survey results of over 4000 MMO players.

Given that PIU researchers have consistently documented associations between PIU and online social behaviors, and given that MMO gaming is a highly social activity, we expected that these aspects of online behavior would help predict PIU scores. The strongest predictors of PIU were age, patterns of Internet use, and

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[1] Due to a typographical error on the survey, one of the UCLA loneliness items had to be dropped from analysis. The variable was computed using 19, rather than 20, of the original scale items. Removing this single item from our analyses did not change the overall reliability of the loneliness scale.

[2] The three motivation subscales each consisted of relatively few items (the achievement and social motivation scales consisted of three items and the immersion scale consisted of four items). Since Chronbach's α is influenced by the number of items in a subscale, scales with few items are likely to produce low estimates of internal consistency. Thus, in addition to computing each subscale's reliability estimate, we also tested the subscale items' intraclass correlations (ρ) to establish internal consistency. All three subscales' intraclass correlation coefficients achievement, ρ = .40, social, ρ = .52, and immersion, ρ = .28, were significant at $p < .05$.

Table 1
Hierarchical regression on problematic Internet use scores among EverQuest 2 players.

Model	Variables	Std. β	t	Model R²	R²Δ
1				.14	.14***
	Age	−.114	−7.60***		
	Sex (0M, 1F)	.002	.15		
	Internet hours per week	.172	11.63***		
	Use Internet for news	−.091	−6.21***		
	Use Internet for instant messaging	.073	4.64***		
	Use Internet to meet new people	.146	9.37***		
	Use Internet to visit forums	.091	6.12***		
2				.36	.22***
	Age	−.079	−5.93***		
	Sex (0M, 1F)	.057	4.40***		
	Internet hours per week	.088	6.77***		
	Use Internet for news	−.047	−3.71***		
	Use Internet for instant messaging	.075	5.48***		
	Use Internet to meet new people	.080	5.85***		
	Use Internet to visit forums	.071	5.49***		
	Loneliness	.323	21.37***		
	Introversion	−.055	3.77***		
	Diagnosed depression	.033	2.18*		
	Diagnosed anxiety	.022	1.48		
	Diagnosed substance addiction	.054	3.98***		
	Diagnosed behavioral addiction	.066	4.93***		
	Physical aggression	.138	9.04***		
	Verbal aggression	.076	5.03***		
	Sense of community from people I work with or go to school with	−.036	−2.78**		
	Sense of community from people met online	.149	11.29***		
3				.38	.02***
	Age	−.067	−4.99***		
	Sex (0M, 1F)	.057	4.36***		
	Internet hours per week	.068	5.20***		
	Use Internet for news	−.041	−3.24**		
	Use Internet for instant messaging	.066	4.83***		
	Use Internet to meet new people	.065	4.76***		
	Use Internet to visit forums	.049	3.77***		
	Loneliness	.312	20.79***		
	Introversion	−.077	5.26***		
	Diagnosed depression	.034	2.26*		
	Diagnosed anxiety	.023	1.55		
	Diagnosed substance addiction	.052	3.94***		
	Diagnosed behavioral addiction	.068	5.13***		
	Physical aggression	.127	8.40***		
	Verbal aggression	.078	5.24***		
	Sense of community from people I work with or go to school with	−.030	−2.36*		
	Sense of community from people met online	.119	8.72***		
	EQ2 hours per week	.034	2.61**		
	Voice use in game	.080	5.91***		
	Game achievement motivation	.022	1.69		
	Game social motivation	.023	1.49		
	Game immersion motivation	.090	6.56***		

* p < .05.
** p < .01.
*** p < .001.

psychosocial well-being. After those factors were entered into the model, only a small amount of additional variance was explained by the game-related variables.

An examination of the standardized regression coefficients for the game-related variables revealed that the immersion motivation was the strongest MMO predictor of PIU, followed by the use of voice technology in the game, and the number of hours a person played the game per week. Neither the achievement motivation nor the social motivation variables were significant predictors of PIU. Although the overall effect size for the gaming variables was small, an examination of the regression coefficients is suggestive.

The fact that the immersion motivation was the strongest gaming predictor is not surprising in light of the research by Yee (2006a, 2006b) reviewed earlier. Recall that Yee found that the association between PIU and the immersion motivation was twice as strong as the associations between PIU and the other two motivation factors. Yee's results, along with the current findings, suggest that those who use MMO games for escapism and immersion are more likely to also exhibit PIU, even after controlling for the influences of age, Internet use patterns, and well-being. These findings are consistent with Turkle's (1995) assertions about escapism—although some use immersion for positive exploration and creativity, many apparently are finding unhealthy escapism instead. The results also lend support to the argument made in the PIU literature that PIU arises from a desire to avoid real-world social interaction and, instead, engage in online social behavior (Caplan, 2003, 2005a; Morhan-Martin & Schumacher, 2000).

On the other hand, it was surprising that the achievement motivation did not emerge as a significant predictor of PIU as found in Yee's earlier study (2006a, 2006b). One possible reason is that our measures for achievement did not isolate and directly measure the need for structured advancement, but instead measured a set of related variables such as desire for competition, power, and optimization. The importance of the need for structured advancement is something that future studies may examine more specifically. Nevertheless, the findings here do confirm Yee's earlier study (2006a, 2006b) in showing that immersion factors are the best predictors of problematic usage.

The second-strongest gaming predictor was the use of voice technology. This finding is consistent with the results for the players' sense of community—deriving one's sense of community from online relationships was a positive predictor of PIU. If voice use and online sense of community predict PIU, this lends further weight to the early research assumption that online community is inevitably weaker and more problematic than its FTF counterpart (Kraut et al., 1996; Nie, 2001)—a finding that received empirical support in early MMO work as well (Williams, 2006). These results further suggest that the voice-using players are among the most social players. This may be putting them at higher risk of PIU outcomes. Ironically, the players foregoing voice, i.e., the less social ones, may be avoiding PIU outcomes because they have weaker social connections—normally a negative situation.

The amount of time participants spent playing EQ2 turned out to be the weakest significant gaming predictor. This finding reinforces arguments made in the PIU literature that it is not the quantity of the activity, per se, that may be problematic—rather, it is the quality, or perhaps the interaction effects (Caplan, 2002). A more nuanced explanation may lie in the social atmosphere of different forms of Internet use. PIU may be so driven by interpersonal mechanisms that the relative paucity of community in MMOs provides something of an inadvertent shield against PIU outcomes. The finding on voice, i.e., the more strongly tied players had the worse PIU outcomes, supports this idea. In other words, the MMO relationships and communities that are not particularly robust may provide a silver lining because, as Caplan (2003, 2005a, 2005b) and Morahan-Martin (2007) note, PIU is more likely among those who prefer online social contexts. A test of this assumption would be to compare users of some hypothetically richer online social environment, e.g., Facebook, with MMO players. If PIU is indeed driven more by the social atmosphere than by the everyday tasks and functions of the environment, we would expect to find that MMO players have comparable (or even lower) PIU rates than their Facebook counterparts because their social environments are less compelling. We would expect the Facebook users to have stronger social ties, and perhaps less loneliness than the MMO players. So, a direct test should be made of the social atmosphere and the simultaneous positive and negative outcomes. Hypothetically, loneliness

and PIU may function on a sliding scale in that the richer social environments would lead to less loneliness and higher PIU, while the poorer environment would lead to more loneliness but lower PIU.

The findings also lend support to the growing body of empirical data on PIU and psychosocial well-being. Consistent with prior work, the current study found that loneliness, introversion, aggression, addiction, and depression were significant predictors of PIU and that loneliness was the single most influential predictor in the model. Interestingly, a previous diagnosis of anxiety disorder was not a significant predictor. The community variables add additional information to the current literature since these variables had not been examined in relation to PIU.

The current study's findings also reinforce the extant literature indicating that interpersonal uses of the Internet and psychosocial well-being predict PIU. With regard to online social behavior and PIU, our findings are consistent with previous research: the results revealed that IM use, using the Internet to meet new people, and participating in forums were all significant predictors of PIU. On the other hand, using the Internet for information purposes (i.e., for news) was negatively related to PIU. Additionally, we found that deriving a sense of community from online relationships predicts PIU while having a sense of community from face to face relationships predicted lower PIU scores. These findings are consistent with Caplan's arguments that a preference for online social interaction plays an important role in PIU (Caplan 2003, 2005a, 2005b).

4.1. Limitations

The current study was the first to use a within-game measure of time spent. As such it improves on the validity of prior work. Ironically, though, time spent playing the MMO did not play much of a role in the outcomes. The study's chief limitation was its cross-sectional nature. Without a control group and without accounting for the impact of time, we cannot say whether players with problematic tendencies come to MMOs, or whether MMOs create problematic tendencies. However, given the very small substantive impact of game-related variables in the model, it would seem that future research would more profitably explore the online social variables and personality backgrounds within experimental designs.

5. Conclusion

Although the game-related variable findings are interesting, it is important to qualify the above discussion by reminding the reader that these variables had a substantively small effect on PIU scores. We do not suggest that these small impacts on PIU are negligible or unimportant. Indeed, to the partner or parent of someone experiencing problematic outcomes related to Internet use, any additional impact is unwelcome. What we do want to highlight, however, is that the game-related impacts appear to be a very small part of the overall complex. The overwhelming influence on PIU scores in the current study was psychosocial well-being and other online activities, and we suggest that any efforts at intervention or therapy start there. If 36% of the outcomes can be explained by being online and having a certain psychological profile, and only 2% can be explained by time played and the reasons for playing, we suggest that corrective action (and further research) focus on the 36%. However, the potential interaction of personality with the game environment is an unknown here: Is it that players with a certain profile are attracted to MMOs, and that these players then have poor outcomes? This is a hypothesis that calls for experimental testing.

Indeed, this resonates with the observations of practicing clinicians (Allison, Wahide, Shockley, & Gabbard, 2006) who have noted that problems with MMOs can be conceptualized as maladaptive solutions. People who bring their problems online may find temporary relief, but the long-term reliance on MMOs may lead to an aggravation of the source problem. For example, people with social anxiety may leverage MMOs for accessible and superficial relationships, discouraging them from forming stable FTF relationships which they increasingly perceive to be risky and threatening. Others may go online in search of escapism that ultimately stops them from addressing some original problem. In this sense, MMOs might be problematic for players with these pre-existing profiles or conditions. However, we caution against looking at online gaming problems as fundamentally technological. Such an approach may very well distract practitioners from examining and understanding the root causes that lie outside of the virtual world. As we mentioned, it is the 36% of non-gaming-related variables, rather than the 2% of gaming-related variables, that we should focus our attention on. What our data suggest is that problematic Internet usage is mostly driven by factors outside of the Internet.

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