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**An Exploratory Study of the Association between Online Gaming Addiction and
Enjoyment Motivations for Playing Massively Multiplayer Online Role-Playing
Games**

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Highlights:

- Latent Class Analysis revealed seven classes of motivations for playing MMORPGs.
- Five classes of gaming addiction-related experiences were extracted.
- Belonging to three out of the seven classes of motivations for playing MMORPGS was linked to higher risk of online video game addiction.

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Abstract

Massively multiplayer online role-playing games (MMORPGs) are a popular form of entertainment used by millions of gamers worldwide. Potential problems relating to MMORPG play have emerged, particularly in relation to being addicted to playing in such virtual environments. In the present study, factors relating to online gaming addiction and motivations for playing in MMORPGs were examined to establish whether they were associated with addiction. A sample comprised 1,167 gamers who were surveyed about their gaming motivations. Latent Class Analysis revealed seven classes of motivations for playing MMORPGs, which comprised: (1) novelty; (2) highly social and discovery-orientated; (3) aggressive, anti-social and non-curious; (4) highly social, competitive; (5) low intensity enjoyment; (6) discovery-orientated; and (7) social classes. Five classes of gaming addiction-related experiences were extracted including: (1) high risk of addiction, (2) time-affected, (3) intermediate risk of addiction, (4) emotional control, and (5) low risk of addiction classes. Gender was a significant predictor of intermediate risk of addiction and emotional control class membership. Membership of the high risk of addiction class was significantly predicted by belonging to a highly social and competitive class, a novelty class, or an aggressive, anti-social, and non-curious class. Implications of these findings for assessment and treatment of MMORPG addiction are discussed.

Keywords: Massively multiplayer online role-playing games; Addiction; Motivations; Latent Class Analysis; Risk; Online Gaming.

1. Introduction

Over the last decade, computer technology has greatly advanced to enable rapid interaction with other people in a range of online virtual worlds. This advancement has led to an increasing number of people using the Internet in many different ways and has arguably had a great positive impact on the lives of people that use it. Despite the many positive benefits, there has been an increase in research focusing on the use of the Internet and its negative aspects including both generalized Internet addiction and more specific online addictions such as online gaming addiction (e.g., Lopez-Fernandez, et al., 2014; Wang, 2001). Marlatt, Baer, Donovan and Kivlahan (1988) defined addictive behaviour as:

"A repetitive habit pattern that increases the risk of disease and/or associated personal and social problems. Addictive behaviours are often experienced subjectively as 'loss of control' - the behaviour contrives to occur despite volitional attempts to abstain or moderate use. These habit patterns are typically characterized by immediate gratification (short term reward), often coupled with delayed deleterious effects (long term costs). Attempts to change an addictive behaviour (via treatment or self initiation) are typically marked with high relapse rates" (p.224).

This is an all-encompassing operational definition as it can refer to both substance and non-substance behaviours (including gaming addiction). One method commonly used to determine whether a particular behaviour is addictive is to compare it against clinical criteria of more established addictions (Griffiths, 2005). This method makes potential addictive behaviours more clinically identifiable and has been supported by researchers that have carried out research into various 'technological addictions' such as television addiction (Sussman & Moran, 2013), mobile phone addiction (Carbonell, Chamarro, Beranuy et al., 2012), internet addiction (Kuss, Griffiths & Binder, 2013), and gaming addiction (King, Haagsma, Delfabbro et al., 2013). Much of the conceptualization of excessive gaming as an addiction stems back to the work of Griffiths in the 1990s who adapted versions of the DSM-III-R for pathological gambling (American Psychiatric Association, 1987) to video game addiction (e.g., Griffiths, 1997; Griffiths & Hunt, 1995; 1998). Other scholars adapted the DSM-IV criteria for pathological gambling to Internet addiction (e.g., Young, 1998).

Furthermore, it can be argued that all types of addictive behaviour have elements in common. For instance, Griffiths (2005) operationally defined addictive behaviour as any behaviour that features the six core components of addiction, which were first outlined by Brown (1993) and later modified by Griffiths (1996; 2005), (i.e., salience, mood modification, tolerance, withdrawal symptoms, conflict and relapse). Under this model, it

is argued that any behaviour (such as gaming addiction) that fulfils the six criteria can be operationally defined as an addiction.

To illustrate the level of interest in the area of online addictions, a recent systematic review identified 69 studies examining Internet addiction with sample sizes of over 1,000 participants (Kuss, et al., 2014). Moreover, sophisticated ways of conceptualising and measuring video game addiction, or risk of experiencing it, have been adopted and this has meant some authors (e.g., Kuss & Griffiths, 2012) have been arguing that gaming addiction can best be understood along a continuum, rather than as a dichotomous construct. When using cut-offs for video game addiction, research by Hussain, Griffiths and Baguley (2012) found that there could be as many as 44.5% of a sample of video game players who are deemed to be at risk of video game addiction, if using a polythetic coding method (i.e. at least four of seven items of a brief Gaming Addiction Scale being endorsed), whereas this estimate could be reduced to as low as 3.6% of all gamers, if using the monothetic coding method (i.e. all seven items being endorsed).

Clearly, there appears to be a wide range of players who could be affected by problematic video game play behaviour, but the true prevalence of video game addiction is still uncertain. This may be due to a range of measures being used to tap into the phenomenon but also the tendency of some researchers to primarily see addiction as an either/or construct with gamers being deemed to be either addicted or not. However, it has been argued that video game play, and problems associated with it, needs to be understood as multidimensional with aetiological factors such as structural characteristics and motivation for game play being just as important as differentiating whether someone is addicted to video games or not (Kuss & Griffiths, 2012)

One form of virtual world activity that has evolved on the Internet is the playing of Massively Multiplayer Online Role-Playing Games (MMORPGs). These games are now a popular form of entertainment used by millions of gamers worldwide, which provide an intense experience of immersion and can be extremely time-consuming (Kuss & Griffiths, 2012). This has also led to an increase of research into the area of online gaming over the past decade. Some of the areas of investigation have included gamer demographics (e.g. Griffiths, et al., 2003; 2004; Yee, 2006), online gaming addiction (e.g., Hussain, Griffiths & Baguley, 2012; Spekman, et al., 2013), within-game group formation (e.g., Chen, Sun, & Hsieh, 2008; Ducheneaut, Yee, Nickell, & Moore, 2006; Odrowska &

Massar, 2014), and within-game social interaction (e.g., Cole & Griffiths, 2007; Hussain & Griffiths, 2008).

Estimates of video game addiction have varied. One meta-analysis of studies (Ferguson, Coulson, & Barnett, 2011) suggested that it could be approximately 3% among gamers. These authors argued that a useful distinction, which overlaps with the continuum concept of video game addiction, is that gaming can be fully engaging and it can also interfere with one's life, but that a combination of many of these experiences would be needed for full-blown addiction to be present. Another study (Kuss, Griffiths & Binder, 2013), which focused on internet addiction, also obtained a similar prevalence rate, as 3.2% of the sample of 2,257 participants appeared to have likely characteristics of internet addiction. An interesting finding was that a combination of online gaming and openness to experience increased the risk of addiction.

A larger study by Kuss, van Rooij, Shorter, et al. (2013) investigated the risk for Internet addiction in a sample 3,105 Dutch adolescents by looking at the interplay between personality traits and different Internet applications. The adolescents completed questionnaires including the Compulsive Internet Use Scale (CIUS) and the Quick Big Five Scale. It was found that 3.7% of adolescents were classified as addicted to using the Internet. Playing online games increased the risk of Internet addiction by 2.3%. The amount of online gaming (i.e., the number of hours played) and low scores on extraversion predicted Internet addiction.

MMORPGs appear to be highly appealing environments and many gamers are motivated to use them (Griffiths, Davies & Chappell, 2003; 2004), and they have also been associated with a higher risk of video game addiction (Ng & Wiemer-Hastings, 2005). Gamer motivation is an area of importance as it provides insight into intentions for playing online from casual through to excessive play. Having knowledge about motivations for online gaming has the potential to provide insights about problematic gaming behaviour. One of the more popular theoretical standpoints of those examining gaming motivations is from a 'uses and gratifications' (UaG) perspective (e.g., Sherry, Lucas, Greenberg & Lachlan, 2006; Wu, Wang & Tsai, 2010; Yee, 2006). As Sherry et al (2006) note, UaG research is based in the structural-functionalist systems approach that attempts to understand the interface between biological entities and the context in which

they live. Research following a UaG perspective largely shows that the gaming motivations largely comprise personal and social gratifications.

Research by Ryan, Rigby and Przybylski (2006) involved using a measure of gaming motivations (Yee, 2006). The authors suggested that strong motivators for online gaming were (i) psychological need for relatedness and (ii) autonomy and competence features. Billieux, Chanel, Khazaal, et al (2011) investigated the psychological predictors of problematic involvement in MMORPG use. Their sample comprised 54 male gamers who were screened using the UPPS Impulsive Behavior Scale, the Motivations to Play Online Questionnaire (MPOQ) and Internet Addiction Test (Young, 1999). The researchers found that problematic use of MMORPGs was predicted by (i) high urgency, and (ii) a motivation to play for immersion. Urgency was defined as the tendency to act rashly when experiencing negative affect states. The findings of the study were potentially useful for understanding predictors and motivations of gamers and the role of immersion as a motivation for playing online. However, the findings were limited by the very small sample size.

However, it is worth noting that urgency has been linked to various problem behaviours including drug abuse (Verdejo-Garcia, Bechara, Recknor & Perez-Garcia, 2007), pathological gambling (Smith & Fischer et al., 2007), problematic mobile phone use (Billieux & Van der Linden, et al., 2007; Billieux, Van der Linden, & Rochat, 2008) and problem drinking (Anestis, Selby, & Joiner, 2007). According to Billieux, et al. (2011) immersing oneself in a virtual world can lead to negative, real-world consequences (e.g., procrastination, avoiding real-world problems).

Yee (2006) looked at gamer motivations by surveying a sample of 3,000 online gamers. An online questionnaire was publicised on various online forums that catered for popular MMORPGs. Yee (2006) used a 40-item inventory to create a model of player motivations. The results revealed 10 motivation sub-components of Advancement, Mechanics, Competition, Socialising, Relationship, Teamwork, Discovery, Role-Playing, Customisation, and Escapism. These components were grouped into three main motivation components of Achievement, Social, and Immersion. Further analysis to examine the association between the motivation components and problematic gaming showed that the escapism and achievement components were the best predictors of

problematic gaming. More recently, Yee, Ducheneaut and Nelson (2012) attempted to validate the motivations scale. Data were gathered from 2,071 American participants and 645 participants from Hong Kong and Taiwan. This allowed the researchers to examine motivations for playing in a non-Western culture. The findings showed that online gaming motivations can be parsimoniously captured using the three-factor model of Achievement, Social and Immersion. Furthermore, the model was validated in Western and non-Western cultures but it gathered data from players of one MMORPG - *World of Warcraft*.

Fuster, Oberst, Griffiths, et al. (2012) explored the psychological motivation for playing *World of Warcraft* in a sample of 253 male Spanish gamers using an online survey. The survey included a 32-item motivation scale that assessed the gaming motivations of socialisation, achievement, exploration, escapism and dissociation. Factor analysis of the survey responses revealed the presence of four motivations for gaming: socialisation, exploration, achievement, and dissociation. These findings were very similar to other research findings on this topic (e.g., Yee, 2006; Yee, et al., 2012). Furthermore, the results indicated that socialisation was one of the main motivational factors that may potentially link to positive outcomes for gamers' wellbeing.

In a large study of Hungarian online gamers' preferences and gaming behaviour, Nagygyörgy, et al. (2013) used an online survey to recruit 4,374 gamers from websites that catered for different types of MMORPGs. A latent profile analysis of gaming preferences revealed eight specific gamer types, of which four types emerged as clear categories, indicating clear preferences for a specific type of game (i.e. role-playing games, first-person shooter games, real-time strategy games, and other games). In general, 79% of gamers belonged to these categories. First-person shooter gamers were almost exclusively male, younger aged, and of a lower socio-economic status. Real-time strategy gamers were older. Females were more likely to play "other" games (e.g., non-violent games, puzzle games) and/or role-playing games. The authors speculated that specific games fulfil specific psychological needs and that gaming preferences are being formed in accordance with these needs. This may have implications for why some gamers play excessively.

Although there have been some studies into the motivations to play online games, there is a lack of research into online gaming motivation and its relationship to problematic gaming with MMORPGs. One of the aims of the current exploratory study was to examine the structure of online gaming addiction and to see whether it can best be represented on a continuum. Another aim of the present study was to categorise online gaming motivations and to identify motivating factors in playing various MMORPGs and their association (if any) with problematic gaming and risk of gaming addiction. The study also attempted to address the limitations of previous research by examining both male and female gamers' motivations as well as examining gamers that played many different types of MMORPGs. This study also attempted to identify the presence of distinct groups of gamers who endorsed specific addiction criteria using latent class analysis (LCA). The identification of motivating factors and addiction indicators may prove beneficial for prevention and treatment of addiction to MMORPGs.

2. Method

2.1. Participants

A total of 1,167 online gamers completed an online questionnaire. The sample comprised 880 males (75.4%) and 287 females (24.6%). The gamers ranged in age from 12 years to 62 years ($M = 23.51$ years; $SD = 8.51$ years). Most of the gamers were living in the United States (47.4%), followed by the UK (14.11%), Canada (6.5%), Australia (3.9%) and Finland (2.4%). Many other countries were also represented in the remainder of the sample (10.88%) including those from New Zealand, Greece, Norway, the Netherlands, Germany, Poland, Sweden and Japan. The final data set was obtained after data cleaning. Responses were checked in order to detect multiple, exaggerated and inappropriate responses (e.g., gamers who claimed that they played more than 100 times a week, gamers who entered profanity in text boxes instead of useable data) and were removed from the data. To avoid multiple responses, all IP addresses were checked and duplicates were removed. In total, 87 entries were removed due to duplicate IP addresses. In these instances, the survey completed first by participants was used for data analysis.

2.2. Measures

Online questionnaire software (i.e., *Survey Monkey*) was used to design an online survey and collect data for the study. This allowed the study to remain consistent with previous

studies (e.g. Charlton & Danforth, 2007; Gentile, et al., 2011) that had used a similar methodology.

2.2.1. Gamer demographics and playing behaviour: The online survey asked questions relating to basic demographics of the online gamers (e.g., age, country of residence, gender, etc.). It also contained questions relating to typical online game playing behaviour (e.g., amount of time spent playing online per week, etc.) and playing style (e.g., whether gamers preferred playing solo, with guild members, or a pick-up group, etc.).

2.2.2. Addiction to MMORPGs: The survey incorporated a slightly adapted version of the 21-item Game Addiction Scale (GAS; Lemmens, et al. 2009), which has been found to have high reliability and good concurrent validity. These items are listed in Appendix 1. This self-report measure includes seven subscales (three items in each subscale) representing seven DSM-based criteria for game addiction that had been identified in earlier research (e.g., Griffiths & Hunt, 1998). Examples of the GAS items were as follows: “Did you think about playing a game all day long?”, “Did you spend increasing amounts of time on games?”, “Did you play games to forget about real life?” All items were adapted to relate to MMORPG playing by substituting the word “games” for “MMORPGs” (i.e., “Did you think about playing a MMORPG all day long?”, “Did you spend increasing amounts of time on MMORPGs?”, and “Did you play MMORPGs to forget about real life?”). Gamers rated all items on a 5-point Likert scale (where 1 = *never*, 2 = *rarely*, 3 = *sometimes*, 4 = *often*, 5 = *very often*). For the purpose of the LCA, ratings of 1-3 were coded as ‘0’ (infrequent or absent) and ratings of 4-5 were coded as ‘1’ (i.e. frequent/present).

2.2.3. Motivation to play in Online Games Questionnaire: The Motivation to play Online Games Questionnaire (MPOGQ; Yee, 2006) was used in this study. The MPOGQ comprised 40 items that evaluated possible motivations for playing MMORPGs, 14 items that explicitly focused on enjoyment derived from the game were selected for the purpose of finding underlying patterns in the enjoyment-related motivations for playing. The 14 items are listed in Appendix 2. Participants rated each item by using a 5-point Likert scale ranging from ‘1’ = ‘not enjoyable at all’ to ‘5’ = ‘tremendously enjoyable’. Before the LCA could be undertaken, ratings of 1-3 were coded as ‘0’ (i.e. low-moderate levels of enjoyment) and ratings of 4-5 were coded as ‘1’ to signify a high level of

enjoyment with a specific motivator for playing an MMORPG. To make the data amenable for LCA, the data from the ordinal MPOGQ and the GAS scales was compressed into binary form. This legitimate practice has been used by researchers elsewhere (e.g., Anthony & Robbins; 2013; Martins et al, 2011). This was in order to attempt to unearth a person-centred analysis of how participants have responded to items relating to motivations for game play and risk of gaming addiction.

2.3. Design and Analysis

LCA was performed on the dichotomously scored data from the GAS and from the enjoyment-related items of the MPOGQ. Rosato and Baer (2012) have emphasised that one of the key strengths of LCA is that it enables researchers to glean a mainly person-centred (rather than item-centred) understanding of participants. This is because LCA analyses patterns of responses and then the likely class membership of each participant on the basis of such responses. MPlus version 4.2 was used for the LCA and SPSS for Windows Version 21 was deployed for the multinomial logistic regression. For the LCA, a wide range of fit statistics is recommended for obtaining the best fitting solution (Murphy, Houston & Shevlin, 2008; Nylund, Asparouhov, & Muthén, 2007). The fit statistics of likelihood ratio chi-square, Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC) and Sample Size Adjusted Bayesian Information Criterion (SSABIC) were used to assess model fit, with the lowest values indicating the best fitting class solution. The Lo-Mendell-Rubin Adjusted Likelihood Ratio test (LRT) indicated the parsimony of each class solution, in which the class solution that preceded the class solution with a non-significant fit would be chosen as the most parsimonious one. Entropy was used as a statistic to indicate how accurately each participant could be classified into each class, with higher entropy values being equated with a better means of classification.

2.4. Procedure

An Internet-posted message inviting gamers to participate in the study was placed in the off-topic and general discussion forums of various well-known online gaming websites (e.g., *mmorpg.com*, *womengamers.com*, *mмосite.com*, *blizzplanet.com*). Each gaming site had similar structural features (e.g., latest news, help guide, site map, forums, etc.). The online recruitment posting informed all gamers about the purpose of the study. The post contained a link to a participant information sheet and a link to the online questionnaire.

Participants were informed that the study had been approved by the research team's University Ethics Committee. Once gamers visited the hyperlink address to the questionnaire, they were given clear instructions on how to fill in the questionnaire and were assured that the data they provided would remain anonymous and confidential. A debriefing statement at the end of the questionnaire reiterated the purpose of the study and informed gamers of their right to withdraw from the study.

3. Results

The binary coded 21-item GAS was subjected to a LCA. Before doing so, the most common and least common endorsements of items as being relevant to the participants are displayed in Table 1.

Insert Table 1 here

LCA was then used to combine the response patterns that each person gave to all 21 items. There was a wide range of possible response patterns with 2^{21} (i.e. 2,097,152) possible permutations. A total of 560 response patterns were obtained for the GAS with this sample and the most common response patterns were 'infrequent/absent' for all 21 items (n=184 respondents), followed by 'frequent/present' for Item 2 only (n=84 respondents) and 'frequent/present' for Item 8 only (n=34 respondents).

The fit statistics obtained for the 1-class solution through to the 6-class solution can be found in Table 2. As can be seen, there were two fit statistics that supported the probability that 5 latent classes should be extracted. This was because the BIC reached its lowest point at the 5-class solution and the non-significant Lo-Mendell-Rubin Adjusted Likelihood Ratio test value with the 6-class solution pointed to the solution with the one fewer class.

Insert Table 2 here

After concluding that five latent classes could be extracted with the LCA, the appropriate labelling of each class was decided upon by examining the posterior probabilities profile plot (see Figure 1). Class 5 – the largest class (44.8% of the sample) – was one that was deemed to be at the lowest risk of online game addiction as gamers in that class had

probabilities of endorsing items at levels between 0% and 13.7%; only one item (Item 2) had a higher likelihood of endorsement (36.3%) but this was still at a lower probability than those in the other four latent classes.

Class 1 was the smallest class (7.2% of the sample) – labelled the ‘high risk’ class - was viewed as the respondent group most at risk of online game addiction as, relatively speaking, respondents had a higher probability than the other four classes of endorsing all but two of the 21 GAS items. An ‘intermediate risk’ of online game addiction was also identified comprising 12.2% of the sample. These were called ‘intermediate risk’ because people in this class tended to mirror the ‘high risk’ class on several items, particularly Items 1 to 7, but the likelihood of endorsing such items for those in this class was markedly lower than those in the ‘high risk’ class. This was the case for all but two of the GAS items.

The second-largest class, comprising 20.1% of the sample, was labelled as the ‘emotional control’ class as they had a high propensity to endorse items about using video games to relieve stress (90.3% likelihood) and to feel better (70.4% likelihood). Another class – the ‘time-affected’ class – was 15.7% of the sample and was epitomised by having a high likelihood of endorsing the item “Did you think about playing all day long?” and they were also second most likely of the five classes to endorse Items 5 and 21, that both focused on spending lengthier periods of time playing MMORPGs.

Insert Figure 1 here

Items relating to enjoyment-related motivations from the MPOGQ were analysed in another LCA to examine whether there were a number of consistent patterns in responding that indicated the presence of likely classes of online game enjoyment. A total of 751 response patterns were identified in this sample out of 16,384 potential response patterns (i.e. 2^{14}). The most common response patterns included low-moderate levels of enjoyment for all 14 items (n=40 participants), followed by high enjoyment with Item 1 only (n=16 participants), high enjoyment with Items 1-7, 10-11, and 13 (n=13 participants). The frequency of endorsement for each of the items is illustrated in Table 3 and the fit statistics for the possible class solutions for all of these response patterns are outlined in Table 4. As can be seen, the BIC level reached its lowest point with the 7-

class solution – it should be noted that the BIC is generally regarded as the best information criterion of all the available information criteria for assessing model fit (Nylund, et al., 2007); with the 7-class solution, accuracy of classification was generally high at 82.3%. The likelihood ratio chi-square statistic for the 7-class solution was also non-significant, which indicated acceptable model fit, although this statistic is an absolute index and all of the other class solutions produced non-significant fit too.

Tables 3 and 4 to be inserted here

Insert Figure 2 here

As can be seen in Figure 2, Class 1 (13.4% of the sample) were highly likely (97.1%) to endorse Item 2 (“Exploring the world for the sake of it”) and 92.8% likely to say that they enjoyed getting to know other players (Item 6) and 95.6% likely to enjoy chatting with other players. As a result, this class was termed the ‘novelty’ class as they were continually looking for new information, either about the MMORPG world or about their fellow players. Those in Class 2 (15.7% of those surveyed) were viewed as members of a ‘highly social and discovery-orientated’ class. Of all the seven classes, Class 2 was the top ranked in terms of endorsing items such as enjoying the collection of distinctive objects (62.5% likelihood), helping other players (86.6% likelihood), and being part of a friendly and casual guild (88.9%). They were also 100% likely to endorse Item 2, thus indicating their discovery-orientated enjoyment from playing an MMORPG.

Class 3 (9.9% of the sample) was mainly characterised by aggressive, anti-social and having non-curious tendencies. They were 93.8% likely to say that they enjoyed dominating and killing other players in the virtual world. Furthermore, gamers in Class 3 were the most likely to say that they enjoyed irritating other players, and had the lowest probabilities of all seven class in endorsing items relating to seeking out novel situations or people (namely Items 2 and 10). Respondents in Class 4 (9.2% of the sample) were differentiated by their sociability and competitiveness. They were the most likely of all seven classes to enjoy getting to know other players (99.6% probability) and in competing with other players (97.4%). As a consequence, this group was termed the ‘highly social and competitive’ class.

Class 5 (13.1% of the sample) was termed as the ‘low intensity’ enjoyment class as they were those with the lowest probability of agreeing with several of the enjoyment-related items, namely Items 3, 4, 6, 8, 9, 11, 12, and 13. For the additional analyses examining how the motivations for playing were associated with experiences of online game addiction, Class 5 appears to be a useful comparison class with the other enjoyment classes, given the limited range of enjoyment that Class 5 seemed to derive from playing an MMORPG.

Class 6 was the second largest class (17% of the sample) and was primarily characterised by exploration as the source of enjoyment when playing. This class was termed the ‘discovery-orientated’ class, which was owing to their high levels of likely endorsement of Items 2 (84.5%) and 3 (80.4%). The next most likely item for respondents in this class to be endorsing was Item 10 (“exploring every map or zone in the world”), which had a 65.6% chance of being endorsed by those in this class. The largest class – Class 7 – comprised 21.6% of those surveyed and was termed as the ‘social’ class. This was because the highest likelihood of endorsements for this group of respondents were all for socially-focused items, namely Items 1, 6 and 7.

The multinomial logistic regression analysis involved predicting online gaming addiction latent class membership based on the motivations for online game enjoyment latent class membership and demographic background. For game addiction class membership, ‘low risk’ was the reference category; likewise, game enjoyment class membership was compared with the reference class of ‘low intensity’ enjoyment. Table 5 shows that two of the predictor variables – online game enjoyment class membership and gender – were significant.

Insert Tables 5 and 6 here.

In examining Table 6, it can be seen that there is a comparison between the likely class memberships for each of the game addiction latent classes when compared with a reference class. The following statistically significant trends were observed when associating this probability with respondents’ likely online game enjoyment class memberships and demographic variables. For being part of the ‘high risk’ class versus the ‘low risk’ class, participants were 14.4 times more likely to be in the ‘highly social and

competitive' class, 9.08 times more likely to be in the 'novelty' class, and 4.78 times more likely to be in the 'aggressive, anti-social and non-curious' class rather than the 'low intensity enjoyment' class. With membership of the 'time-affected' class versus the 'low risk' class, respondents were 5.25 times more likely to be in the 'highly social and competitive' class, 3.08 times more likely to be in the 'novelty' class and 2.16 times more likely to be in the 'aggressive, anti-social and non-curious' class. In addition, age category membership was also key for membership of the 'time-affected' class, with respondents being 2.49 times more likely to be in the youngest age group or 2.31 times more likely to be in the second youngest age group rather than being in the oldest age group. In belonging to the 'intermediate risk' class versus the 'low risk' class, members were 9.15 times more likely to be in the 'highly social and competitive' class and 5.92 times more likely to be in the 'novelty' class. The likelihood of having other class memberships also ranged from being 2.39 times more likely of being in the 'social' class to 3.63 times more likely of being in the 'social and discovery-orientated' class. Furthermore, membership of the intermediate risk class was also dominated by male participants as males were 1.82 times more likely to belong to this class when compared with females.

The likelihood of being part of the 'emotional control' class versus the 'low risk' class was affected by a range of enjoyment class memberships, including being 5.61 times more likely to belong to the 'highly social and competitive' class, 5.09 times more likely to be part of the 'social and discovery-orientated' class, and 4.67 times more likely to be a member of the 'novelty' class of online game enjoyment motivations. Males were also 1.78 times more likely to belong to this class than females.

4. Discussion

This study has been able to demonstrate, as argued by Kuss and Griffiths (2012), that gaming addiction is not a dichotomous construct of being addicted or not, and that researchers should see online gaming experience as entities that are on a continuum that range from low to intermediate and then to high risk of addiction. There is also evidence in the present study to show that there are other addictive-like experiences (i.e., the amount of time spent while playing as being excessive or relying on game play to manage unpleasant emotions) but these experiences would not be frequent or severe enough to constitute a full-blown addiction. As opposed to other studies of internet addiction and online game addiction, that estimated prevalence of addiction ranging from 3.2% to 3.7%, the present study showed that there could be as high a level as 7.2% within this

sample who are at high risk of online game addiction. A further 12.2% were also deemed to have an intermediate risk of addiction in the present study.

The multinomial logistic regression conducted on the data was able to demonstrate that certain motivations for playing an MMORPG may put a player at high risk of online gaming addiction. Players who were attracted to the highly social and competitive aspects of the gaming environment were most likely to be in the high risk of addiction class. Several studies (e.g., Cole & Griffiths, 2007; Hussain, et al., 2012; Hussain & Griffiths, 2009) have reported the sociability and competitive aspects of MMORPGs and the links to addiction. Hussain and Griffiths (2009) reported that social interaction and competition were some of the triggers to addiction that supports the findings of the present study. Seeking novelty in the MMORPG could also lead to addiction, as could wanting to vent aggressive, anti-social, and non-curious elements of one's self. Previous research studies have shown that Internet addiction has been associated with novelty seeking (e.g., June, et al., 2007; Lin & Tsai, 2002) and aggression has been associated with online gaming addiction (e.g., Mehroof & Griffiths, 2010). By contrast, those gamers who derived low intensity levels of enjoyment, were social, discovery-orientated, or social and discovery-orientated at the same time, were much less likely to be in a high risk of addiction class.

It is noteworthy that males were more likely than females to be in an intermediate risk of online game addiction class or to be in a class of gamers who needed their game play to handle unpleasant emotions and to exert emotional control. This trend, particularly around emotion management, echoes with literature that video games provide an arena for the experience of a wide range of emotions and that this could be particularly appealing for males in adolescence and beyond (Jansz, 2005). The problem lies in whether the emotion management is one that is aimed at being cathartic and purging oneself of aggressive, anti-social emotions because, as has been seen with the current study data, this could be linked to higher risk of online gaming addiction.

The present study investigated player motivations and the likelihood of addiction using LCA. The analysis of response patterns in regards to enjoyment motivations showed that the 'social' class comprised the largest number of gamers (21.6%) sampled. These gamers enjoyed exploring the virtual world, getting to know other players and chatting with

other players. They were highly social gamers. These findings support the findings of previous research studies (e.g., Yee, 2006; Yee, Ducheneaut & Nelson, 2012) that have highlighted the importance of the 'social' motivation component of online gaming.

The second largest class (17% of the sample) was the 'discovery-orientated' class. These gamers found enjoyment in exploration and therefore scored highly on items relating to virtual world exploration (e.g., exploring every map and zone in the world) and they enjoyed finding quests and locations that other gamers did not know about. Exploring diverse virtual worlds was clearly an important part of online gaming for these gamers. These findings are similar to the research findings of Billieux, et al. (2012) who reported that *World of Warcraft* players were interested in discovery and exploration of the virtual world. The study by Fuster, et al. (2012) also reported that exploration was one of the prominent motivations for gaming.

The third largest class (15.7% of those surveyed) were called the 'highly social and discovery-orientated' class. These gamers enjoyed collecting distinctive objects, helping other players, being part of a friendly, casual guild and exploring the online world. These findings are consistent with previous research findings (e.g., Griffiths, Davies and Chappell, 2004; Hussain & Griffiths, 2008) that have reported that the social and cooperative elements of MMORPGs are the main reasons people like playing. MMORPGs are designed to encourage socialisation amongst gamers, the discovery aspects of MMORPGs is an important part of the virtual world and can lead to interactions amongst gamers.

The regression analysis revealed that online game enjoyment class membership and gender were significant predictors of online gaming addiction. These findings are interesting and show that specific motivations for playing MMORPGs and gender are important factors that contribute to MMORPG addiction. Previous research (e.g., Liu & Peng, 2009) has shown that MMORPG dependence can be predicted by a cognitive preference for a virtual world. Billieux, et al. (2011) reported that problematic use of MMORPGs is predicted by high urgency and a motivation to play for immersion.

The results of the present study show that the main motivations for playing MMORPGs were similar to those found by previous research (e.g., Fuster, et al., 2012; Yee, 2006;

Yee, et al., 2012). Socialising, exploring, and novelty-seeking are distinct motivations associated with online gaming, and it appears as though these motivations are inherent amongst many gamers. Gamer analytics is an important subject not just in a gaming context. The results from this study may be applicable to other online media to help predict preferences and online behaviour. For instance, motivations for using certain applications on smartphones and social networking sites could be further examined.

4.1. Limitations

The present study has several limitations, namely that the sample was self-selected and might not represent all online gamers. In this sense, online gamers who may have been concerned about their playing behaviour could have been attracted to the study in order to get insights into their own game play. However, there was a sizeable proportion of this sample – almost 45% of respondents – who did not seem to exhibit much of a risk of online gaming addiction, so this may not be a major issue with this sample. The use of a self-report measure in the present study is also something that should be treated with the usual reservations surrounding self-report (e.g., social desirability biases, recall biases, etc.). Complementary data sources, such as those obtained with qualitative measures (e.g., Beard, 2005) or with a case study approach (e.g., Griffiths, 2010) may help to gather insights into the impacts of game play on one's wellbeing. However, a fuller picture may be difficult to achieve when aiming to gather sufficient participants to get population-wide prevalence statistics, while simultaneously gathering more in-depth information on the extent to which online gamers' experiences may be addictive. Additional open-ended questions in an online survey may deter would-be participants and mean that smaller sample sizes are obtained. Finally, it could be argued that the adapted GAS measure could have had its validity and reliability affected by swapping the word 'games' with 'MMORPGs' in the slightly adapted scale. However, this change was made to ensure that the scale had face validity and acceptability to respondents and, in so doing, would mean that respondents were able to stay focused on the MMORPG environment and their behaviour, rather than on their online game play in general.

4.2. Implications and conclusions

Despite these possible limitations, it could be argued that this study has several strengths and can also offer novel ways of conceptualising and measuring risk of online gaming addiction, along with addressing some of the motivations for playing that may prove

problematic. This study has been able to elicit the experiences of online gamers from a relatively large sample of respondents, which has drawn on players of a range of MMORPGs and also among male and female players too, as opposed to some studies that had an over-representation of male players (e.g., Fuster, et al., 2012). The present study has contributed to knowledge by demonstrating that it is not only those who are at high risk of online game addiction that could be targeted but also gamers who are found to be in an intermediate risk class as well. The study has also shown that certain types of gaming motivations could have implications for treatment and intervention. For instance, some MMORPG players who are attracted to the social and competitive elements of the game, its novelty, and the ability to vent aggressive and anti-social feelings may be at higher risk of online game addiction than other players who derive low intensity enjoyment levels from game play.

Knowledge of motivations for playing online is likely to be beneficial to video game developers as games, quests, and other in-game activities could be developed to suit specific player preferences. Clinicians may also benefit from the present research. The study's findings will potentially aid them in developing treatment approaches for gamers who may be at intermediate or high risk of online gaming addiction. Overall, this study has demonstrated the utility of examining gaming addiction along a continuum of addictive-like experiences and the extent to which these experiences can be triggered by certain motivations to play video games such as MMORPGs.

References

- Anestis, M. D., Selby, E. A., & Joiner, T. E. (2007). The role of urgency in maladaptive behaviors. *Behaviour Research and Therapy*, *45*(12), 3018-3029.
- Anthony, E. K., & Robbins, D. E. (2013). A latent class analysis of resilient development among early adolescents living in public housing. *Children and Youth Services Review*, *35*(1), 82-90.
- Beard, K. W. (2005). Internet addiction: a review of current assessment techniques and potential assessment questions. *CyberPsychology & Behavior*, *8*(1), 7-14.
- Billieux, J., Chanal, J., Khazaal, Y., Rochat, L., Gay, P., Zullino, D., & 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), 165-171.
- Billieux, J., Van der Linden, M., Achab, S., Khazaal, Y., Paraskevopoulos, L., Zullino, D., & Thorens, G. (2012). 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), 103-109.
- Billieux, J., Van der Linden, M., d'Acremont, M., Ceschi, G., & Zermatten, A. (2007). Does impulsivity relate to perceived dependence on and actual use of the mobile phone?. *Applied Cognitive Psychology*, 21(4), 527-537.
- Billieux, J., Van der Linden, M., & Rochat, L. (2008). The role of impulsivity in actual and problematic use of the mobile phone. *Applied Cognitive Psychology*, 22(9), 1195-1210.
- Brown, R. I. F. (1993). Some contributions of the study of gambling to the study of other addictions. In: Eadington, W. R. and Cornelius, J. A. (Eds.). *Gambling behavior and problem gambling* (pp.241-272). Reno: University of Nevada Press.
- Carbonell, X., Chamarro, A., Beranuy, M., Griffiths, M. D. Obert, U., Cladellas, R. & Talar, A. (2012). Problematic Internet and cell phone use in Spanish teenagers and young students. *Anales de Psicología*, 28, 789-796.
- Charlton, J. P., & Danforth, I. D. (2007). Distinguishing addiction and high engagement in the context of online game playing. *Computers in Human Behavior*, 23(3), 1531-1548.
- Chen, C.H., Sun, C.T., & Hsieh, J. (2008). Player guild dynamics and evolution in massively multiplayer online games. *CyberPsychology & Behavior*, 11(3), 293-301.
- Cole, H., & Griffiths, M. D. (2007). Social interactions in massively multiplayer online role-playing gamers. *CyberPsychology & Behavior*, 10(4), 575-583.
- Ducheneaut, N., Yee, N., Nickell, E., & Moore, R. J. (2006, April). Alone together?: exploring the social dynamics of massively multiplayer online games. In *Proceedings of the SIGCHI conference on Human Factors in computing systems* (pp. 407-416). ACM.
- Ferguson, C.J., Coulson, M., & Barnett, J. (2011) A meta-analysis of pathological gaming prevalence and comorbidity with mental health, academic and social problems. *Journal of Psychiatric Research*, 45, 1573-1578.
- Fuster, H., Oberst, U., Griffiths, M., Carbonell, X., Chamarro, A., & Talar, A. (2012). Psychological motivation in online role-playing games: A study of Spanish World of Warcraft players. *Anales de Psicología*, 28(1), 274-280.

- Gentile, D. A., Choo, H., Liau, A., Sim, T., Li, D. D., Fung, D., & Khoo, A. (2011). Pathological video game use among youths: A two-year longitudinal study. *Pediatrics*, *127*(2), E319-E329.
- Griffiths, M. D. (1996). Nicotine, tobacco and addiction. *Nature*, *384*, 18.
- Griffiths, M. D. (1997). Computer game playing in early adolescence. *Youth and Society*, *29*, 223-237.
- Griffiths, M. D. (2005). A 'components' model of addiction within a biopsychosocial framework. *Journal of Substance Use*, *10*, 191-197.
- Griffiths, M. D. (2010) The role of context in online gaming excess and addiction: Some case study evidence. *International Journal of Mental Health & Addiction*, *8*, 119–125.
- Griffiths, M. D., Davies, M. N., & Chappell, D. (2003). Breaking the stereotype: The case of online gaming. *CyberPsychology and Behavior*, *6*, 81-91.
- Griffiths, M. D., Davies, M. N., & Chappell, D. (2004). Demographic factors and playing variables in online computer gaming. *CyberPsychology and Behavior*, *7*, 479-487.
- Griffiths, M. D. & Hunt, N. (1995). Computer game playing in adolescence: Prevalence and demographic indicators. *Journal of Community and Applied Social Psychology*, *5*, 189-193.
- Griffiths, M. D. & Hunt, N. (1998). Dependence on computer games by adolescents. *Psychological Reports*, *82*, 475-480.
- Hussain, Z., & Griffiths, M. D. (2008). Gender swapping and socializing in cyberspace: An exploratory study. *CyberPsychology & Behavior*, *11*(1), 47-53.
- Hussain, Z., & Griffiths, M. D. (2009). The Attitudes, Feelings, and Experiences of Online Gamers: A Qualitative Analysis. *CyberPsychology & Behavior*, *12*(9), 747-753.
- Hussain, Z., Griffiths, M. D., & Baguley, T. (2012). Online gaming addiction: Classification, prediction and associated risk factors. *Addiction Research & Theory*, *20*(5), 359-371.
- Jansz, J. (2005). The Emotional Appeal of Violent Video Games for Adolescent Males. *Communication Theory*, *15*, 219–241
- June, K.J., Sohn, S.Y., So, A.Y., Yi, G.M., & Park, S.H. (2007). A study of factors that influence Internet addiction, smoking, and drinking in high school students. *Taehan Kanbo Hakhoe Chi*, *37*(6), 872-882.
- King, D.L., Haagsma, M. C., Delfabbro, P. H., Gradisar, M. S., Griffiths, M. D. (2013). Toward a consensus definition of pathological video-gaming: A systematic review of psychometric assessment tools. *Clinical Psychology Review*, *33*, 331-342.

- Kuss, D.J. & Griffiths, M.D. (2012). Internet gaming addiction: A systematic review of empirical research. *International Journal of Mental Health and Addiction*, 10 (2), 278-296.
- Kuss, D. J., Griffiths, M. D., & Binder, J. F. (2013). Internet addiction in students: Prevalence and risk factors. *Computers in Human Behavior*, 29, 959-966.
- Kuss, D. J., van Rooij, A. J., Shorter, G. W., Griffiths, M. D., & van de Mheen, D. (2013). Internet addiction in adolescents: prevalence and risk factors. *Computers in Human Behavior*, 29(5), 1987-1996.
- Kuss, D. J., Griffiths, M. D., Karila, L., & Billieux, J. (2014). Internet Addiction: A Systematic Review of Epidemiological Research for the Last Decade. *Current Pharmaceutical Design*, 20, 4026-4052.
- Lemmens, J. S., Valkenburg, P. M., & Peter, J. (2009). Development and validation of a game addiction scale for adolescents. *Media Psychology*, 12(1), 77–95.
- Lin, S.S., & Tsai, C.C. (2002). Sensation seeking and internet dependence of Taiwanese high school adolescents. *Computers in Human Behavior*, 18(4), 411-426.
- Liu, M., & 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), 1306-1311.
- Lopez-Fernandez, O., Honrubia-Serrano, M. L., Gibson, W., & Griffiths, M. D. (2014). Problematic Internet use in British adolescents: An exploration of the addictive symptomatology. *Computers in Human Behavior*, 35, 224-233.
- Marlatt, G. A., Baer, J.S., Donovan, D. M. & Kivlahan, D. R. (1988). Addictive behaviors: Etiology and treatment. *Annual Review of Psychology*, 39, 223-252.
- Martins, S. S., Carlson, R. G., Alexandre, P. K., & Falck, R. S. (2011). Perceived risk associated with ecstasy use: A latent class analysis approach. *Addictive Behaviors*, 36(5), 551-554.
- Mehroof, M., & Griffiths, M. D. (2010). Online gaming addiction: The role of sensation seeking, self-control, neuroticism, aggression, state anxiety, and trait anxiety. *Cyberpsychology, Behavior, and Social Networking*, 13(3), 313-316.
- Murphy, J., Houston, J.E., & Shevlin, M. (2008) The utility of latent class analysis in contemporary psychological research. *Irish Journal of Psychology*, 8, 26-38.
- Nagygyörgy, K., Urbán, R., Farkas, J., Griffiths, M. D., Zilahy, D., Kökönyei, G., ... & Demetrovics, Z. (2013). Typology and sociodemographic characteristics of massively multiplayer online game players. *International Journal of Human-Computer Interaction*, 29(3), 192-200.

- Ng, B.D. & Wiemer-Hastings, P. (2005) Addiction to the Internet and Online Gaming. *CyberPsychology & Behavior*, 8 (2), 110-113.
- Nylund, K. L., Asparouhov, T., & Muthén, B. O. (2007). Deciding on the number of classes in latent class analysis and growth mixture modeling: A Monte Carlo simulation study. *Structural Equation Modeling*, 14 (4), 535-569.
- Odrowska, A.M., & Massar, K. (2014). Predicting guild commitment in World of Warcraft with the investment model of commitment. *Computers in Human Behavior*, 34, 235-240.
- Ryan, R. M., Rigby, C. S., & Przybylski, A. (2006). The motivational pull of video games: A self-determination theory approach. *Motivation and Emotion*, 30(4), 344-360.
- Rosato, N. S. & Baer, J. C. (2012). Latent class analysis: A method for capturing heterogeneity. *Social Work Research*, 36(1), 61-69.
- Sherry, J. L., Lucas, K., Greenberg, B. S., & Lachlan, K. (2006). Video game uses and gratifications as predictors of use and game preference. In P. Vorderer and J. Bryant (Eds.), *Playing computer games: Motives, responses, and consequences* (pp. 213-224). Mahwah, NJ: Lawrence Erlbaum.
- Smith, G.T., Fischer, S., Cyders, M.A., Annus, A.M., Spillane, N.S., & McCarthy, D.M. (2007). On the validity and utility of discriminating among impulsivity-like traits. *Assessment*, 14(2), 155-170.
- Spekman, M.L., Konijn, E.A., Roelofsma, P.H., & Griffiths, M.D. (2013). Gaming addiction, definition and measurement: A large-scale empirical study. *Computers in Human Behavior*, 29(6), 2150-2155.
- Sussman, S., & Moran, M. B. (2013). Hidden addiction: Television. *Journal of Behavioral Addictions*, 2(3), 125-132.
- Verdejo-García, A., Bechara, A., Recknor, E. C., & Pérez-García, M. (2007). Negative emotion-driven impulsivity predicts substance dependence problems. *Drug and Alcohol Dependence*, 91(2), 213-219.
- Wang, W. (2001). Internet dependency and psychosocial maturity among college students. *International Journal of Human-Computer Studies*, 55(6), 919-938.
- Wu, J. H., Wang, S. C., & Tsai, H. H. (2010). Falling in love with online games: The uses and gratifications perspective. *Computers in Human Behavior*, 26(6), 1862-1871.
- Yee, N. (2006). The demographics, motivations, and derived experiences of users of massively multi-user online graphical environments. *Presence: Teleoperators and virtual environments*, 15(3), 309-329.

- Yee, N. (2006). Motivations for play in online games. *CyberPsychology & Behavior*, 9(6), 772-775.
- Yee, N., Ducheneaut, N., & Nelson, L. (2012, May). Online gaming motivations scale: development and validation. In *Proceedings of the 2012 ACM annual conference on Human Factors in Computing Systems* (pp. 2803-2806). ACM.
- Young, K. S. (1998). *Caught in the net: How to recognize the signs of internet addiction – and a winning strategy for recovery*. Chichester: Wiley.
- Young, K. S. (1999). Internet addictions: Symptoms, evaluation and treatment. In L. Vande Creek and T. Jackson (Eds.), *Innovations in clinical practice: A source book* (pp. 19–31). Sarasota: Professional Resource Press.

Appendix 1.

Indicative content of the adapted version of the 21-item Game Addiction Scale

1. Did you think about playing a MMORPG all day long?
2. Did you spend a large amount of free time on MMORPGs?
3. Have you felt addicted to a MMORPG?
4. Did you play longer than intended?
5. Did you spend increasing amounts of time on MMORPGs?
6. Were you unable to stop once you started playing a MMORPG?
7. Did you play MMORPGs to forget about real life?
8. Have you played MMORPGs to release stress?
9. Have you played MMORPGs to feel better?
10. Were you unable to reduce your game time?
11. Have others unsuccessfully tried to reduce your MMORPG use?
12. Have you failed when trying to reduce game time?
13. Have you felt bad when you were unable to play?
14. Have you become angry when unable to play?
15. Have you become stressed when unable to play?
16. Did you have fights with others (e.g., family, friends) over your time spent on MMORPGs?
17. Have you neglected others (e.g., family, friends) because you were playing MMORPGs?
18. Have you lied about time spent on MMORPGs?
19. Has your time on MMORPGs caused sleep deprivation?
20. Have you neglected other important activities (e.g., school, work, sports) to play MMORPGs?
21. Did you feel bad after playing for a long time?

Appendix 2. Indicative content of the 14 enjoyment-related items from The Motivation to play Online Games Questionnaire (MPOGQ)

1. How much do you enjoy working with others in a group?
2. How much do you enjoy exploring the world just for the sake of exploring it?
3. How much do you enjoy finding quests, NPCs or locations that most people do not know about?
4. How much do you enjoy collecting distinctive objects or clothing that have no functional value in the game?

The following were scored from '1' = Not 'enjoyable at all' to '5' = 'Tremendously enjoyable':

5. Helping other players.
6. Getting to know other players.
7. Chatting with other players.
8. Competing with other players.
9. Dominating/killing other players.
10. Exploring every map or zone in the world.
11. Being part of a friendly, casual guild.
12. Being part of a serious, raid/loot-oriented guild.
13. Trying out new roles and personalities with your characters.
14. Doing things that annoy other players.

TABLES AND FIGURES

Table 1. Frequency of Gaming Addiction Scale Endorsements (in descending order)

Item	No. (%)
2. Did you spend a large amount of free time on MMORPGs?	691 (59.2)
8. Have you played MMORPGs to release stress?	505 (43.3)
4. Did you play longer than intended?	477 (40.9)
9. Have you played MMORPGs to feel better?	375 (32.1)
3. Have you felt addicted to a MMORPG?	311 (26.6)
5. Did you spend increasing amounts of time on MMORPGs?	306 (26.2)
1. Did you think about playing a MMORPG all day long?	266 (22.8)
6. Were you unable to stop once you started playing a MMORPG?	216 (18.5)
19. Has your time on MMORPGs caused sleep deprivation?	191 (16.4)
7. Did you play MMORPGs to forget about real life?	190 (16.3)
20. Have you neglected other important activities?	173 (14.8)
10. Were you unable to reduce your game time?	158 (13.5)
11. Have others unsuccessfully tried to reduce your MMORPG use?	131 (11.2)
13. Have you felt bad when you were unable to play?	121 (10.4)
18. Have you lied about time spent on MMORPGs?	120 (10.3)
17. Have you neglected others because you were playing MMORPGs?	118 (10.1)
21. Did you feel bad after playing for a long time?	117 (10.0)
12. Have you failed when trying to reduce game time?	90 (7.7)
14. Have you become angry when unable to play?	83 (7.1)
15. Have you become stressed when unable to play?	81 (6.9)
16. Did you have fights with others over your time spent on MMORPGs?	75 (6.4)

Table 2. Fit statistics for the Gaming Addiction Scale

Class	Log Likelihood	No. of free parameters	LR χ^2 (d.f.) p	AIC	BIC	SSABIC	LRT (p)	Entropy
1	-10770.325	21	3539.285 (2096900) 1.0000	21582.649	21688.955	21622.252	-	-
2	-9061.888	43	1928.946 (2096846) 1.0000	18209.777	18427.451	18290.868	3395.021 (0.0000)	.91
3	-8736.977	65	1945.901 (2096855) 1.0000	17603.955	17932.997	17726.535	645.667 (0.0128)	.86
4	-8568.442	87	1710.870 (2096842) 1.0000	17310.884	177651.295	17474.953	334.915 (0.0002)	.86
5	-8467.697	109	1760.422 (2096838) 1.0000	17153.393	17705.172	17385.951	200.202 (0.0100)	.84
6	-8395.257	131	1549.599 (2096809) 1.0000	17052.514	17715.661	17299.560	143.953 (0.4024)	.83

Key. LR χ^2 = likelihood ratio chi-square, AIC = Akaike information criterion, BIC = Bayesian information criterion, SSABIC = sample size adjusted Bayesian information criterion, LRT = Lo-Mendell-Rubin's adjusted likelihood ratio test.

Table 3. Frequency of Gaming Motivation Endorsements (in descending order)

Item	No. (%)
11. Being part of a friendly, casual guild.	757 (64.9)
1. How much do you enjoy working with others in a group?	718 (61.5)
7. Chatting with other players.	667 (57.2)
6. Getting to know other players.	664 (56.9)
3. How much do you enjoy finding quests, NPCs or locations that most people do not know about?	621 (53.2)
2. How much do you enjoy exploring the world just for the sake of exploring it?	610 (52.3)
5. Helping other players.	608 (52.1)
8. Competing with other players.	451 (38.6)
10. Exploring every map or zone in the world.	446 (38.2)
4. How much do you enjoy collecting distinctive objects or clothing that have no functional value in the game?	397 (34.0)
9. Dominating/killing other players.	390 (33.4)
13. Trying out new roles and personalities with your characters.	363 (31.1)
12. Being part of a serious, raid/loot-oriented guild.	324 (27.8)
14. Doing things that annoy other players.	153 (13.1)

Table 4. Fit statistics for Latent Class Analysis on video gaming items relating to Enjoyment motivations

Class	Log Likelihood	No. of free parameters	LR χ^2 (d.f.) p	AIC	BIC	SSABIC	LRT (p)	Entropy
1	-10463.549	14	5644.066 (16331) 1.0000	20955.099	21025.970	20981.501	-	-
2	-9735.703	29	4221.952 (16310) 1.0000	19529.405	19676.209	19584.095	1442.080 (0.0000)	0.857
3	-9453.845	44	3674.724 (16295) 1.0000	18995.691	19218.427	19078.668	558.443 (0.0000)	0.827
4	-9274.092	59	3318.810 (16281) 1.0000	18666.185	18964.854	18777.450	356.144 (0.0000)	0.824
5	-9137.484	74	3135.712 (16272) 1.0000	18422.968	18797.570	18562.521	270.662 (0.0723)	0.811
6	-9018.927	89	2932.791 (16261)	18215.854	18666.389	18383.695	234.896 (0.0495)	0.820

			1.0000					
7	-8963.490	104	2780.645 (16242)	18134.979	18661.447	18331.108	109.838 (0.2450)	0.823
			1.0000					
8	-8919.888	119	2783.817 (16235)	18077.777	18680.178	18302.193	86.387 (0.2913)	0.824
			1.0000					

Key. LR χ^2 = likelihood ratio chi-square, AIC = Akaike information criterion, BIC = Bayesian information criterion, SSABIC = sample size adjusted Bayesian information criterion, LRT = Lo-Mendell-Rubin's adjusted likelihood ratio test.

Table 5. Likelihood ratio tests for multinomial logistic regression for video game motivation class membership and demographic background to sample

Effect	-2 log likelihood	Chi-square	d.f.	Sig.
Intercept	850.085	.000	0	-
Motivation class	952.389	102.304	24	.000
Gender	866.623	16.537	4	.002
Relationship status	853.436	3.351	4	.501
Age	865.107	15.022	12	.240

Table 6. Multinomial logistic regression with motivation and demographic variables predicting video game addiction latent class membership

	Associations (OR, 95% CI ^a) with:			
	Class 1 High Risk	Class 2 Time-Affected	Class 3 Intermediate Risk	Class 4 Emotional Control
<i>Motivation Class</i>				
1.Novelty	9.08 (2.94-28.05)	3.08 (1.57-6.04)	5.92 (2.48-14.15)	4.67 (2.25-9.71)
2.Social and discovery-orientated	.61 (.11-3.43)	1.54 (.76-3.15)	3.63 (1.55-8.50)	5.09 (2.58-10.03)
3.Aggressive, anti-social, non-curious	4.78 (1.43-15.99)	2.16 (1.06-4.39)	3.09 (1.17-8.15)	2.26 (.98-5.22)
4.Highly social and competitive	14.40 (4.32-47.99)	5.25 (2.45-11.25)	9.15 (3.44-24.36)	5.61 (2.34-13.44)
5.Social	2.96 (.95-9.25)	1.72 (.92-3.22)	2.39 (1.02-5.58)	3.33 (1.71-6.48)
6.Discovery-orientated	3.16 (.99-10.10)	1.25 (.62-2.49)	2.96 (1.28-6.86)	2.57 (1.28-5.14)
7. Low intensity enjoyment ^b	-	-	-	-
<i>Gender</i>				
Female	1.59 (.83-3.05)	.81 (.49-1.34)	1.82 (1.15-2.86)	1.78 (1.21-2.60)
Male ^b	-	-	-	-
<i>Relationship Status</i>				
Single	1.39 (.78-2.47)	1.18 (.79-1.76)	.84 (.55-1.28)	1.12 (.78-1.61)
In a relationship ^b	-	-	-	-
<i>Age</i>				
17 years or younger	2.47 (.95-6.42)	2.49 (1.26-4.94)	1.32 (.69-2.54)	1.42 (.82-2.46)

18-25 years	1.71 (.70-4.15)	2.31 (1.25-4.29)	1.18 (.69-2.02)	1.18 (.75-1.87)
26-30 years	1.27 (.40-4.03)	1.62 (.73-3.60)	.95 (.45-1.96)	1.55 (.88-2.73)
31 years or older ^b	-	-	-	-
<i>Intercept</i>	-4.01	-2.46	-2.68	-2.46

a Confidence intervals not including unity indicate statistical significance

b Comparison level

Figure 1. Posterior probabilities profile plot: Latent Class Analysis of the Gaming Addiction Scale

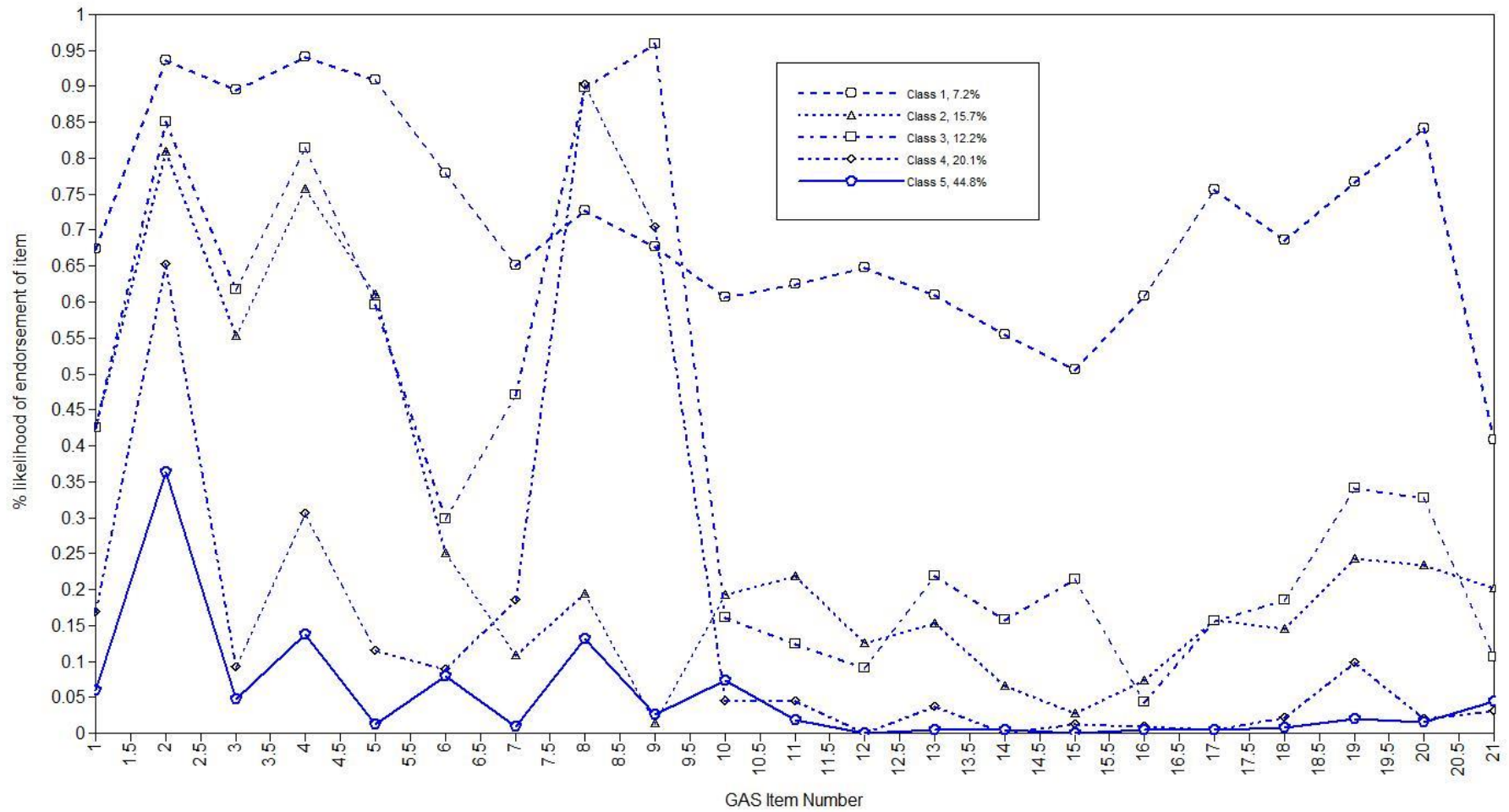


Figure 2. Posterior probabilities profile plot: Latent Class Analysis of the enjoyment motivations for playing an MMORPG

