Project Massive: Self-Regulation and Problematic Use of Online Gaming

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ABSTRACT

A longitudinal design was employed to collect three waves of survey data over a 14 month period from 2790 online gamers. Respondents were asked questions about their gaming activity, motivations, personality, social and emotional environment, and the effect gaming has had on their lives. Prospective analysis was used to establish causal and temporal linkages among the repeatedly measured factors. While the data provide some indication that a player's reasons for playing do influence the development of problematic usage, these effects are overshadowed by the central importance of self-regulation in managing both the timing and amount of play. An individual's level of self-regulatory activity is shown to be very important in allowing them to avoid negative outcomes like problematic use. The role of depression is also discussed. With responsible use, online gaming appears to be a healthy recreational activity that provides millions of people with hours of social entertainment and adaptive diversion. However, failure to manage play behavior can lead to feelings of dependency.

Author Keywords

Online Games, Addiction, Depression, Social Integration, Self-Regulation, MMORPG, Play Motivation.

ACM Classification Keywords

H.5.0. Information interfaces and presentation (e.g., HCI): General.

INTRODUCTION

In 2003 approximately 430 million people worldwide, or 7% of the world's population, played video games [35]. Over one quarter of these individuals did so online and that number as a percentage of total video gamers continues to grow. In the United States, half of all Americans age six and older play video games [11]. Worldwide gaming hardware and software revenues have more than doubled

since 1996, reaching $31.37 billion in 2003. This compares to $34.2 billion in revenue for the film industry in 2003 [17,15]. The gaming population also continues to diversify. The average age of the video game player in 2004 was 29, and 39% of gamers were female [11]. The average 13 - 24 year old in the United States watches 13.6 hours of television per week compared to 16.7 hours spent using the internet for activities other than email [15]. The average adult spends 28 hours a week watching television compared to average weekly video game play of 7.6 hours [11]. It is reported that people who play massively multiplayer online games do so for an average of 15 hours per week, with weekly play in excess of 30 hours not uncommon [31,33].

One reason for the popularity of online games is that they meld the fun and challenge of video games with the social rewards of an online community. Participation in online communities allows us to stay in touch with old friends, meet new people, learn, and share information [29]. It also enables self-exploration and discovery as users extend and idealize their existing personalities or try out new ways of relating to one another that can positively affect real life relationships [32,4]. On the other hand, some fear that virtual communities detract from social activity and involvement in the real world, replacing real social relationships with less robust online substitutes and causing users to turn away from more traditional media [20,25].

A Question of "Addiction"

It is logical that such a large industry with widening appeal and an expanding rate of use would have some non-uniform effects on its participants. Reports in the popular media continue to suggest that the design and content of certain games are responsible for the detachment, depression, and even addiction that some players experience. Some have estimated that 10% of online game players are addicted to the activity, an extrapolation from the ABCNEWS.com survey finding that 10% of all users of the internet are addicted to it [34,13,16]. An internet search for "gaming addiction" yields lists of physical and psychological symptoms from dry-eyes and carpal tunnel syndrome to "problems with school or work," offered as indicative of problem usage behavior [27]. Some clinicians claim that online game players "don't have normal social relationships anymore" and play online games in order to cover feelings

of anger, depression and low self-esteem [26]. Under increasing public and governmental scrutiny, a major gaming industry group in Korea has laid out a multi-part initiative aimed at combating overuse of online games through education, monitoring software and the establishment of treatment and rehabilitation centers. Anecdotal evidence also continues to mount. Support groups and online communities like EverQuest Widows and Spouses Against EverQuest are available on the web, full of stories about damaged and destroyed relationships. Communications of the ACM published an editorial on the deleterious impact online gaming has on undergraduates, particularly computer science majors, in the United States [23]. In addition, there do exist truly tragic stories, like that of the clinically depressed young man, described by many who knew him as addicted to EverQuest, who killed himself following an extended session of play [24]. Clearly there is something here worthy of study; the first challenge is to determine how to approach it.

A Shift in Terminology

In the popular media, addiction to online games has been likened to pathological gambling, eating disorders and drug dependency [26]. In addition, and in spite of the protestations of leading thinkers in interactive entertainment, both marketing departments and the critical media within the games industry also talk about their games' "addictive" qualities with pride [1]. More often than not, statements made about "addictive gameplay" refer to a desirable quality of the experience marked by incremental reinforcement, perseverance in adversity, and desire to continue; to play "just one more". For most, the experience of an "addictive" game is much the same as that of a "page turner" novel; you don't want to put it down, and it is hard to keep track of time while engaged with it. Clearly, this type of an immersive and rewarding entertainment experience is precisely what the consumer wants and what the developer wants to create. Addiction of this kind could easily be recast as *engagement*, the state of being delightfully attracted to and enwrapped in an experience [7].

In contrast, addiction can also be used to describe the state of powerlessness a person experiences when, despite attempts to stop or reduce their usage, they are unable to walk away from a game (or substance, or behavior) even in the face of persistent and deleterious effects on their life. Given the various pejorative, disputed, and clinically laden connotations of the word "addiction", we have chosen to refer to self-described pre-occupation with and inability to withdraw from gaming as *problematic use* of online games. We do this not to refer to addiction euphemistically, but to dissociate the phenomenon under study from the state of biochemical dependency most closely associated with the word "addiction." For the purposes of the present study, problematic use can be operationalized as consumption of an entertainment product in such amounts or at such times that it causes demonstrable problems in the user's real life

extreme enough to cause an individual to identify and report them [7]. Under this definition, online gaming would become problematic when it dominates and displaces other behaviors, leads to conflict, or when inability to play causes anxiety. Some players, even those spending upwards of 40 hours a week gaming, might have euphoric gaming experiences, play for long periods, and think about gaming even when not doing it, but suffer no ill effects as a result. We hypothesize that such players might actively manage their use of entertainment products, ensuring that gaming remains a positive aspect of their lives. Unfortunately, other players may not be as successful at managing their consumption, and allow persistent involvement in online games to interfere with their everyday life. An individual's management of his or her own behavior through techniques like self-monitoring, evaluation against perceived standards, and self-administration of behavioral consequences is referred to as *self-regulation*.

Rather than presenting a monolithic view that online games are either bad or good, we predict that different levels of self-regulatory activity and motivations for play are likely to yield different consequences for the user. The individual's motivation to play and ability to manage their own behavior promise to be important factors in determining the outcome of use of online games. This document examines the relationship of self-regulation and problematic use, reporting a subset of the findings of a larger inquiry into the social and psychological impact of online gaming.

PROBLEMATIC USE

Problematic use of online gaming can be viewed as a special case of the broader concept of Pathological Internet Use (PIU). The American Psychological Association formally recognized Internet Addiction in the late 1990s and gave it this more clinically precise title. PIU has become the focus of much interest in recent years. The most popular definitions and metrics of PIU are adapted directly from clinical definitions of substance abuse/dependency, pathological gambling, and impulse control disorders found in various editions of the Diagnostic and Statistical Manual of Mental Disorders [12, 5, 34, 13, 14].

Brown referred to problem gambling as a type of behavioral addiction and developed six general criteria to diagnose them: Tolerance, the need to engage in the problem behavior for longer periods of time in order to attain the desired effect; Euphoria, the high brought on by engaging in the behavior; Salience, the ongoing dominance of the behavior in thought and action (sometimes divided into Behavioral and Cognitive Salience); Conflict, the behavior causing both psychological and environmental discord; Withdrawal, negative affect associated with periods of inability to engage in the behavior; and Relapse, resumption of the behavior despite efforts to stop [5]. As LaRose observes, deficient self-regulation is both implicit in the

definition of addiction and explicit in the criteria commonly used to assess it [21].

Charlton discovered that Brown's six criteria did not universally load on a Computer Addiction factor [7]. In fact, only Behavioral Salience, Conflict, Relapse, and Withdrawal loaded on addiction. The others, Tolerance, Euphoria, and Cognitive Salience, loaded on a Computer Engagement factor. This finding suggested that scales based on Brown's six factors did not measure a unitary phenomenon. Instead some of these criteria, commonly viewed as symptomatic only of clinical dependence, were more strongly associated with a non-pathological construct, that of engagement. Engagement can be defined as a state of deep interest in and involvement with a medium. Tolerance, euphoria, and cognitive salience are not inherently pathological in the way that the other four criteria, behavioral salience, conflict, withdrawal, and relapse are.

It is not difficult to argue that few would find any level of the remaining three criteria desirable. Unlike the others, conflict, withdrawal, and relapse are by their very definition, undesirable and pathological entities. Physical and emotional struggle, separation anxiety, and repeated inability to disengage from a behavior offer few adaptive interpretations. It is the stark contrast of these three factors to tolerance and euphoria that drives the bifurcation of Brown's criteria, a distinction mathematically demonstrated by Charlton and shown in Figure 1, below.

Danforth adapted subscales from Charlton's Engagement/Addiction Scale, or EAS, to create the EAS-II, an instrument designed to measure addiction to and engagement with massively multiplayer games [7,8,10]. The EAS-II is a 28 item instrument comprised of 15 items from Charlton's Engagement subscale (e.g. "I feel a sense of power when I play EverQuest 2") and 13 from the Addiction subscale (e.g. "When I am not playing EverQuest 2, I feel agitated"). Deploying the EAS-II with 442 players of Microsoft/Turbine's MMOG Asheron's Call, Danforth's results supported the addiction/engagement dichotomy pointed out by Charlton [10].

Engaged Use	Problematic Use
Tolerance	Behavioral Salience
Euphoria	Conflict
Cognitive Salience	Withdrawal
	Relapse

Figure 1. The bifurcation of Brown's diagnostic criteria for behavioral addiction.

This research employs the full EAS-II instrument, changing only the way in which the "addiction" factor is referenced: as problematic use of online games.

SELF-REGULATION

Bandura's Social Cognitive theory of personality portrays the human individual as a proactive, self-organizing, and self-reflecting agent rather than a reactive organism that is shaped solely by external events and circumstances [2]. Central to this agentic, sociocognitive perspective is the concept of self-regulation, the ability of an individual to manage his own behavior through observation, evaluation, and consequation. Arguments about the design of potentially harmful forms of entertainment focus heavily on the content of these objects, but largely ignore the processes taking place within the consuming individual. Hence, it is important that any study addressing problematic use of online gaming examine the role of an individual's self-regulatory abilities in managing gaming behavior. These self control behaviors are often divided into three interactive classes: self-monitoring, self-evaluation, and self-consequation [18,2,19,3]. The literature in both psychology and communications points to the importance and effectiveness of self-regulation in the identification, assessment and treatment of both behavioral excesses and deficits [19,3,21].

In order to illustrate this self-regulatory framework, let's examine how self-regulation fits into a personal videogame play management paradigm. Self-monitoring, or simple introspective observation of the amount of time one has spent playing, would presumably have an effect on subsequent play in that the individual would recognize that they have been involved in a particular activity for several hours and may want to consider other concerns. The inability to recognize how much time one has spent involved in an activity would be an example of a failure in self-monitoring, e.g. losing track of time. Self–evaluation of play would involve an individual comparing their observed time allotment for gaming to those made to other activities or by other individuals. For example, a player might notice that she has been online twice as often as her in-game friends, suggesting that she may play twice as much as these other people. Alternatively, she might consider that she plays during the day at work, but none of her co-workers or guild mates seem to be online until the evening hours. This kind of self-evaluation through the comparison of one's activities to external standards builds on the self-monitoring process by utilizing information gained from self-monitoring. Self-consequation involves the development of behavioral contingencies that, based on the outcome of the self-evaluative process, lead to the self-administration of reinforcement or punishment. For example, one might deny one's self a trip to the movies given a large amount of time spent playing, or treat play as a reward for the completion of formerly neglected responsibilities.

In the current study, Carey et. al's Short Self-Regulation Questionnaire (SSRQ) was used to empirically measure self-regulatory behavior [6]. Items included in the SSRQ address all three of the dimensions of self-regulatory

Short Self Regulation Questionnaire Sample Items
I usually keep track of my progress toward my goals.
It's hard for me to notice when I've "had enough" (alcohol, food, sweets).
I have personal standards, and try to live up to them.
When I'm trying to change something, I pay a lot of attention to how I'm doing.
I usually only have to make a mistake one time in order to learn from it.

Table 1. Example items from the SSRQ.

behavior discussed above, but measure the construct of self-regulation in a mathematically unitary fashion. The SSRQ contains 31 items that the respondent rates on a 5-point Likert-type scale from Strongly Agree to Strongly Disagree. Example items are presented in Table 1.

Note that these items address usage of the general processes of self-regulation and are not specific to online gaming. It is important to keep in mind that the same self-regulatory functions can and do operate at various levels of a person's behavioral hierarchy at the same time; in several domains at once from pursuit of life goals to more granular behaviors.

Finally, a note on what is being regulated. When one chooses to play is as important as how much, as even a very short session undertaken at an inappropriate time (perhaps to delay a responsibility or escape / avoid a stressful situation) can be problematic. Clearly, avoidance behaviors can be adaptive, but when undertaken at inappropriate times or with excessive frequency they can be harmful. As such, regulation of the impulse to play is just as important as regulation of the amount of play.

HYPOTHESES
Given the preceding discussion of problematic use and self-regulation, we are ready to explore some hypotheses regarding their interrelation.

Hypothesis I – Self-Regulatory deficits will predict the development of problematic use.

This hypothesis makes the simple claim that deficits in self-regulation contribute to the development of addiction to online games. By measuring this relationship longitudinally, we will examine the temporal relationship of these factors.

Hypothesis II - Certain play motivation factors will distinguish players who are more susceptible to problematic use.

The literature on player motivation indicates that certain player motivations, particularly Escapism are cross-sectionally associated with increased levels of problematic use [31,33]. An adaptation of Yee's Facets scale including the Achievement, Escapism, Roleplaying, Manipulation, and Relationship types was employed to determine whether play motivation is predictive of problematic use in the same way that social and personality factors predict susceptibility to depression.

Hypothesis III- The effect of self-regulatory deficits on problematic use will interact with depression.

This hypothesis is designed to evaluate the role of depression in the relationship between self-regulation and problematic use. Specifically, this hypothesis addresses the effect of depression on the self-regulatory processes. It hinges on a significant depression by self-regulation interaction in the presence of a main effect of self-regulation on problematic use. This result would support the claim that the effect of self-regulatory deficits on problematic use may be moderated by depression. In this model, depression is not a cause or necessary precursor of problematic use, but its presence may heighten the effects of deficient self-regulation on the development of problematic use.

It has been suggested that depression could moderate the effect of self-regulatory mechanisms on an individual's behavior [19]. In general, depressive affect is related to self-imposed low expectations and unreasonably high standards for success (e.g. self-doubt about ability to succeed paired with inability to set reasonable and attainable goals). In addition, depressed individuals operate under the illusory belief that other people share these lowered expectations and unrealistic standards for them. Under such a paradigm, self-evaluation and self-consequation can easily break down. Adaptive self-evaluation is predicated on the identification of useful standards of comparison. Further, if one makes some form of reinforcement contingent on meeting an unrealistic standard, the individual will soon identify the goal as unattainable and, where possible, circumvent the contingency, thereby giving up any therapeutic effects it may have had if performed as designed. Even under conditions of success, where the individual negotiates the behavioral contingency as designed, depressed individuals are less likely to view the outcomes as sufficiently reinforcing to merit repetition. Depressed individuals tend to be low in expectancy to achieve goals, and apt to evaluate themselves negatively. Simply, depression lessens one's belief in their ability to manage their own behavior and blunts the capacity to identify success and enjoy its rewards.

With respect to online game play, the effectiveness of self-regulatory activities on amount and timing of play may be reduced for depressed individuals. This suggests a moderation model in which depressive affect interacts with self-regulatory deficits to exacerbate problematic play behavior. Without question, deficient self-regulatory behavior can logically lead to problematic use. However, it is the non-additive effect of higher depression and low self-

regulation that is of principal interest here. Depression was measured by the Center for Epidemiologic Studies Depression Scale (CES-D).

METHOD

During the spring of 2002, contextual inquiries with 15 experienced online gamers were conducted to support the creation of a 69-item web survey. Following a period of analysis and refinement, a new web survey was created and deployed repeatedly between September of 2004 and November of 2005. The three waves of longitudinal data collection lasted 3-4 months each, and were separated by 3-4 month periods. Participants were solicited through posts in popular gaming forums and websites. Most of the respondents played Massively Multiplayer games on the PC platform, but the sample included a large number of players from other genres and platforms (e.g. gaming consoles like Microsoft's XBox and Sony's Playstation 2).

Figure 2. Predictors used in modeling problematic use

Prospective analysis was used to evaluate the longitudinal effects of the factors contained in the predictor blocks above on the dependent variable of interest, problematic use. In prospective analysis, a regression equation is built in which a lagged predictor variables are used to model a future value of the dependent variable of interest [9]. Initially a lagged value of the dependent variable itself is entered into the regression equation alone. For example, a regression equation modeling problematic use for a given time period is created using only the participant's problematic use score from the previous time period, or wave of data collection. Next, each predictor block is added to the regression equation incrementally. If a predictor block adds nothing to the model, that block is removed. It is important to note that the dependent variable is modeled using values of the predictor block variables collected during the previous wave. This technique allows inspection of the unique variance in the dependent variable accounted for by the lagged variables, over and above that accounted

for by the previously measured value of the dependent variable. Prospective analysis exposes those predictors that add explanatory power to the model in excess of that generated by the lagged dependent variable. The values of all predictors are centered so that the size of their effects can be compared to one another.

RESULTS

A total of 4490 unique respondents participated in the Project Massive survey from pilot to final wave. Information on the number of participants by wave and when each wave was conducted is presented in Table 2.

Wave	Participants	Returning	Start	End
Pilot	1836	n/a	Mar-02	Dec-02
1	1503	n/a	Sep-04	Dec-04
2	1089	397	Apr-05	Jul-05
3	790	331	Oct-05	Nov-05

Table 2. Number of participants by wave with collection dates

The cross-sectional results presented in this section are drawn from an aggregate pool of 2790 records containing data from the first time a given participant responded to the survey regardless of wave.

Participants ranged in age from 11 to 70 with an average age of 28 (M=27.98). Males comprised 88% of the sample, with 327 female respondents making up the other 12%. 74.8% of respondents had jobs or were self-employed. 49% of the respondents were single, 41% were married, and 21% of the respondents had children.

The mean number of hours spent playing online games per week was 21.7. As is shown in Figure 3, the distribution is skewed to the right, with a sizable minority of players (~15%) indicating they play more than 54 hours per week.
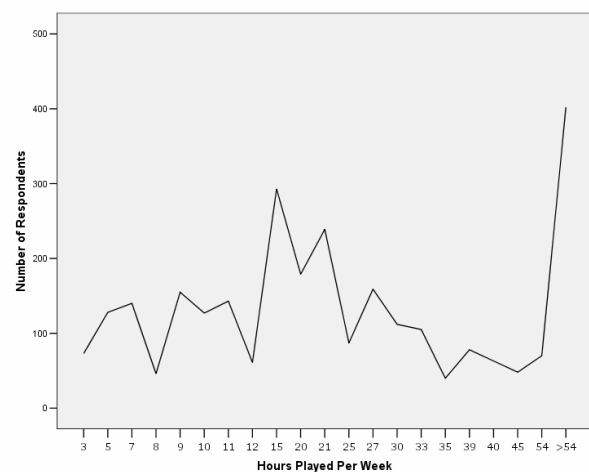

Figure 3. The average hours played per week

On average respondents spent 36% of their weekly online time playing by themselves, 33% of it playing with members of their player organization, 15% playing with online friends not in their guild, 18% playing with

N~2600	Engaged Use	Problematic Use
Play Hours	.263	.318
Depression	.085	.380
Loneliness	.076	.284
Self-Regulation	-.014	-.345
Game Affinity	.404	.086

Table 3. Cross-sectional correlation of certain measures with Engaged and Problematic Use

strangers, and 6% just "hanging out" logged in with no intention to play.

Table 3 offers discriminative statistical evidence in favor of the conceptual distinction between problematic and engaged use. Though both outcomes are associated with hours of play, we see a rather stark contrast in the usage outcomes' associations with the other measures. Only problematic use is associated with depression, loneliness, and self-regulation. Engaged use shows no relationship with these measures, but does show positive correlation with game affinity, a simple measure of how much the player likes the game they play.

Table 4 shows the zero order correlations of problematic use with the player motivation factors. The correlation with self-regulation and hours of play per week are also shown.

	Problematic Use
Escapism	.370 (2669)
Achievement	.297 (2657)
Manipulation	.228 (2656)
Relationship	.102 (2663)
Roleplaying	-.006 (2648)
Hrs of play / week	.318 (2677)
Self-Regulation	-.345 (2489)

Table 4. Correlates of Problematic Use

A Longitudinal Model of Problematic Use

The number of respondents participating in at least two waves of the survey was 499. This is the pool of participants from which we are able to make longitudinal models, since we have at least two waves of data from each of them.

Table 5 shows a longitudinal regression model of change in problematic use over time. This model accounts for roughly 53% of the variance in problematic use (adjusted R^2 (372) =0.525). The relatively strong negative main effect associated of self-regulation demonstrates a longitudinally negative relationship between self–regulation and problematic use. That is, individuals reporting high levels of self regulatory activity at a given time period report lower levels of problematic usage of video games at the next time period.

	Estimate	S.E.	p value
Intercept	2.940	0.045	0.000
Problematic Use (Lagged)	0.677	0.049	0.000
Block 1 - Controls			
Female	-0.011	0.109	0.918
Age	-0.009	0.040	0.822
Intelligence	-0.064	0.039	0.108
Attractiveness	0.071	0.046	0.122
Block 2 – Types of Play			
Achievement	0.039	0.040	0.327
Escapism	0.075	0.044	0.086
Roleplaying	0.046	0.040	0.255
Manipulation	-0.092	0.045	0.044
Relationship	-0.074	0.042	0.080
Hours	0.071	0.050	0.157
Affinity	0.072	0.040	0.072
Block 3 – Types of Use			
Engaged Use	-0.061	0.049	0.210
Self-Regulation	-0.132	0.053	0.013
Block 4 – Social Dimensions			
Play w/ RL Friends	0.011	0.039	0.787
Block 5 - Depression			
Depression	0.077	0.051	0.138
Interactions			
Self-Reg * Depression	0.113	0.032	0.000
Hours * Game Affinity	-0.080	0.038	0.038

Table 5. Regression model predicting Problematic Use

Conversely, it indicates that those individuals reporting lower levels of self-regulatory activity are likely to report increases in problematic use the next time data is collected. This result fully supports the prediction made in Hypothesis I, clearly indicating that individuals who actively monitor and manage their behavior in general are less likely to allow their involvement in online gaming to cause them real life problems.

While there still appear to be near significant trends for a collection of player motivations (Escapism, Manipulation, and Roleplaying), these effects are altered in both size and significance by the introduction of Self-Regulation and the interactions. Overall, Escapism is associated with increases in problematic use while Relationship play and Manipulation are associated with decreases. These effects are changed slightly with the introduction of Self-Regulation into the model.
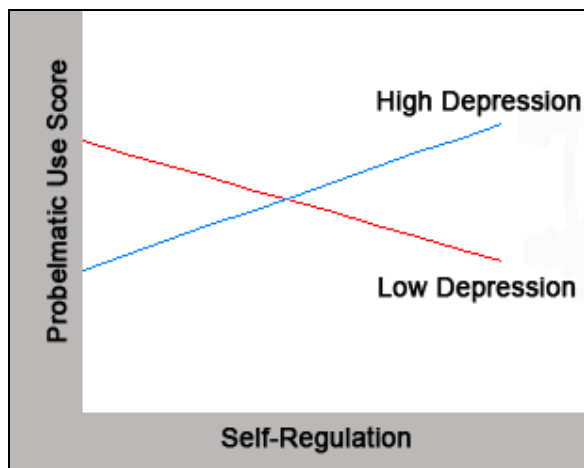
Figure 4. A plot of the Self-Regulation by Depression Interaction on Problematic Use

Figure 5. A plot of the Hours of Play by Game Affinity Interaction on Problematic Use.

The effect of Manipulation remains significant, but the positive effect of Escapism and the negative effect of Relationship play are dampened, becoming only marginally significant. The negative effect of Manipulation play on problematic use indicates that players who are motivated to play by their enjoyment of harassing and annoying others are likely to report lower levels of problematic use at a second time period than those players less inclined to behave in such a manner.

The interaction of self-regulation and depression indicates that depression moderates the effect of self-regulatory behavior on problematic use. At lower levels of depression, self-regulation has the negative effect on problematic use illustrated by its main effect. However, as depression increases above mean levels, the effect of self-regulation on problematic use is eliminated. Simply, depressive affect reduces the effectiveness of the self-regulatory processes, rendering the individual less able to manage their own behavior and more likely to experience problematic use. This result offers specific support for Hypothesis III, which posits the exact moderating relationship obtained here. This interaction is plotted in Figure 4.

The Hours by Affinity interaction is plotted in Figure 5. It illustrates that how much a player likes a game will moderate the effect that hours of weekly play has on problematic use. At low levels of affinity, hours of play has a strong positive effect on problematic use. However, at higher levels of game affinity, increases in hours of play have no effect on problematic use levels. This suggests that players who enjoy and have high regard for the game that they play can play it for many hours each week without feeling that the activity is causing them any problems. However, individuals who continue to play a game that they view negatively or do not like for many hours each week report higher levels of problematic use.
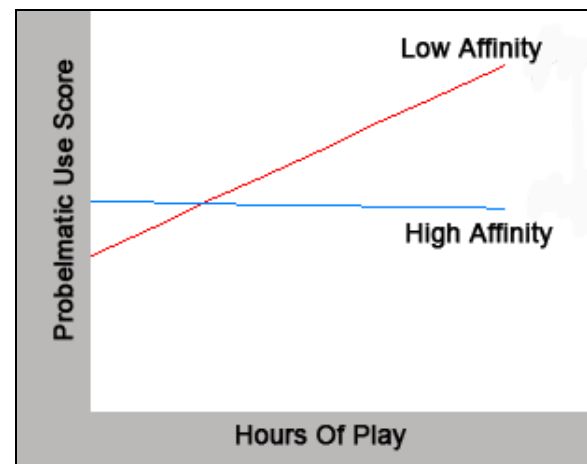
It is important to note that even though cross-sectional analyses show an association between hours of play and problematic use, hours of play (or amount of consumption) in and of itself is not predictive of problematic use. This result further discounts simple "media effects" models in which amount of exposure is determinant of the outcome of use. Along with the zero order correlation described earlier, this indicates that while hours of play may have a positive cross-sectional relationship with reports of problematic use, it does not have longitudinally predictive power. Simply, a large amount of play is certainly associated with problematic use cross-sectionally, but is not predictive of future problematic usage issues, particularly in situations where the player enjoys the game that they are playing (e.g. high game affinity).

As discussed earlier, Danforth used a seven-factor personality inventory, including the Big Five plus Attractiveness and Negative Valence, which showed little predictive value with respect to the development of "addiction" [10]. This result has been replicated in the current study. The final model presented in Table 5 reflects the removal of five of the seven personality factor from the model due to their lack of contribution to the model fit.

DISCUSSION

Hypothesis I
Hypothesis I stated that self-regulatory deficits would predict the development of problematic use. The obtained significant negative effect of self-regulation on changes in problematic use supports the prediction made in Hypothesis I. Those individuals who report low levels of self-regulatory activity tend to go on to report significantly higher levels of future problematic use. On the other hand, those individuals who actively regulate the timing and amount of their play behavior through self-monitoring, self-evaluation and self-consequation report significantly lower levels of future problematic use than their counterparts. Further, the effect of self-regulation on problematic use is

the largest and most robust of all predictive factors measured. Clearly, the self-regulatory processes are essential in allowing online gaming to remain a benign and enjoyable pass-time rather than an obstructive pre-occupation. Active self-regulation appears to be a player's best defense.

Hypothesis II

Hypothesis II predicted that certain play motivation factors would distinguish players who are more susceptible to problematic use. The significant negative effect of Manipulation offers only minimal support for Hypothesis II, as it was expected that Escapism and Achievement would have a significant positive effect.

The significant negative effect of Manipulation on problematic use is an interesting one. In general, we might consider this type of "grief play" to arise from a situation in which the core game mechanic has failed to engage the player and forced him to pursue other avenues of enjoyment within the game's confines. The fact that grief play has a cross-sectionally positive relationship with problematic use suggests that in the near term it offers enough reward to compel some players to over-indulge in its pursuit. However, the longitudinally negative relationship of grief play with problematic use supports this notion that, with time, grief players tend to report lower levels of problematic use, perhaps due to the diminished enjoyment associated with repeated manipulative exploits within the same game or upon the same set of victims and their desire to find a game they find more enjoyable in general. Such diminishing returns would not reward a player for repeated and extended pursuit of manipulation play compared to escapism and achievement play which are more regularly, if not almost continuously, reinforced. Given the age and gender profile of players scoring high on the Manipulation dimension (young males), one can hope that parental supervision plays some role in constraining their usage (if not their in-game behavior) such that it does not become problematic.

The Escapism motivation does have a near significant positive effect on problematic use. This would suggest that players who are high in the Escapism motivation tend to report increases in problematic use. What this means is that the use of online gaming as a curative respite from real world stressors, while adaptive in moderation, can have deleterious effects on those who use it in this manner. The fact that there is no interaction with weekly hours of play means that responsibility for increased levels of problematic use lies with the Escapism motivation and not the hours spent pursuing it. That is, one need not spend many hours "escaping" but rather resort to the escape behavior at inappropriate times or in unsuitable situations in order to feel that the behavior has begun to have negative effects on their real life. This is not to suggest that Escapism is a necessarily insidious and maladaptive way to go about using online games. On the contrary, it is hard to

argue against the relaxing and restorative effects of pursuit of any recreational activity used to release or relieve feelings of stress and anxiety. Again, this effect is not quite significant in the final model, since the variance for which it accounts is more robustly explained by the self-regulation factor and the significant interactions.

Another nearly significant effect is that of the Relationship play motivation. This result suggests that players who use online gaming as a medium in which to meet people and interact with them in meaningful social ways report lower levels of problematic use than those less socially motivated. It seems that those who view playing as an adaptive social activity that rounds out their existing social life are less likely to later report that they feel the activity has been causing real life difficulty for them.

In sum, the fact that the player motivations were less predictive of problematic use than expected is not so much indicative of their descriptive weakness as it is a testament to the centrality of self-regulation. Without self-regulation and its interaction with depression in the model, Manipulation, Escapism, and Relationship all significantly contribute to the model.

Hypothesis III

Hypothesis III specifically predicted that the effect of self-regulatory deficits on problematic use would interact with depression. Explicit support for this hypothesis is provided by the significant Self-Regulation by Depression interaction obtained in the problematic use model. This interaction indicates that depressive affect moderates the effect of the self-regulatory processes on the development of problematic use. At lower levels of depression, the self-regulatory processes work, as indicated by their main effect, to lower problematic use levels. With increased levels of depression the negative effect of the self-regulatory processes are blunted and they become less effective in preventing problematic use. In this model, depression does not cause problematic use, but its presence may catalyze and accelerate the effects of deficient self-regulation on the development of problematic use.

Recall our earlier discussion of depressive affect and its relation to self-imposed lower expectations and unreasonably high standards for success. This can be characterized as a brutal pairing of self-doubt about one's ability to succeed and a tendency to set unreasonable and unattainable goals. Lack of self-belief paired with inability to set and evaluate progress toward reasonable goals undermines the basis of the self-regulatory processes. Specifically, an overarching tendency to view one's self negatively hampers the self-evaluative process. Further, if one is unable to identify and place value upon self-evaluative successes, then self-consequation becomes impossible. Even when one does register a self-evaluative success, depressed individuals are less likely to view the rewards of self-consequation as sufficiently reinforcing to merit repetition [19]. Depression lessens one's belief in

their ability to manage their own behavior and blunts the capacity to identify success and enjoy its rewards. The results obtained in support of Hypothesis III provide empirical evidence in favor of the notion that depression undermines the self-regulatory processes through this mechanism and in doing so makes even those individuals who do self-regulate vulnerable to problematic usage of online games.

Limitations

There are several important limitations to this research that deserve discussion. Foremost among them are the standard caveats associated with survey research of this type. All of the data collected for this study were self-reports. As such, issues of social desirability and accuracy of response need to be taken into account. Further, though we have a good picture of who we did get as respondents, we do not know anything about those people that were not involved or chose not to participate in Project Massive. Every effort was made to ensure that users of a wide number of platforms and games were included in the study, however most came from the massively multiplayer genre.

Only one psychological outcome of gaming was addressed in this study, depression. Though there may be several other possible negative outcomes (e.g. aggression), one should also consider the various positive outcomes of play. Happiness, self-esteem and assertiveness all would make valid additions to a more general inquiry addressing the psychological impact of online gaming.

CONCLUSION

Now that we have reviewed the individual hypotheses, let us turn to what we have learned more broadly. It seems safe to say that the data provide no indication that online gaming is a broadly negative activity. On the contrary, the overwhelming majority of those surveyed indicate no elevation in loneliness, depression, or problematic use. This seems to indicate that, for most, online gaming is an adaptive and enjoyable, or at least benign, activity.

This study has identified and demonstrated the central importance of self-regulation in changing problematic gaming behavior or preventing it from developing altogether. The results clearly indicate that self-regulation is important in shielding the user from problematic use and reducing or eliminating problematic use once it arises.

We are now be able to speak with some confidence about what does not cause problematic use and what helps prevent it, leveraging this information to explain why some players describe themselves as "addicted" while others remain adaptively engaged. The results of Project Massive indicate that self-regulatory activity is essential in addressing problematic usage. These self-regulatory findings can inform the design of informal personal strategies and formal software systems aimed at helping players and developers alike manage play behavior and protect against problematic

use. Further, these findings and their implications are applicable to the more general case of internet dependency.

If they are not already an important part of our present, online communities like those that exist in and around online games will become an immense force in our future. They will come to affect many aspects of our lives; how we communicate, how we learn, how we relax, what we buy, and even whom we trust. Understanding the effects that participation in these digital communities has on the day-to-day lives and well being of those who participate in them is imperative as we strive to ensure that humanity is empowered and not ensnared by the technologies that we create. Project Massive is a small but important step in that direction.

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