Online gaming in the context of social anxiety

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Abstract

In 2014, over 23 million individuals were playing massive multiplayer online role-playing games (MMORPGs). In light of the framework provided by Davis's (2001) cognitive-behavioral model of pathological Internet use, social anxiety, expressions of true self, and perceived in-game and face-to-face social support were examined as predictors of Generalized Problematic Internet Use Scale (GPIUS) scores and hours spent playing MMORPGs per week. Data were collected from adult MMORPG players via an online survey (N = 626). Using structural equation modeling, the hypothesized model was tested on 1 half of the sample (N = 313) and then retested on the other half of the sample. The results indicated that the hypothesized model fit the data well in both samples. Specifically, expressing true self in game, higher levels of social anxiety, larger numbers of in-game social supports, and fewer supportive face-to-face relationships were significant predictors of higher GPIUS scores, and the number of in-game supports was significantly associated with time spent playing. The current study provides clinicians and researchers with a deeper understanding of MMORPG use by being the first to apply, test, and replicate a theory-driven model across 2 samples of MMORPG players. In addition, the present findings suggest that a psychometric measure of MMORPG usage is more indicative of players' psychological and social well-being than is time spent playing these games.

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Keywords: social anxiety, massive multiplayer online role playing games, true self, social support, online gaming.

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Massive Multiplayer Online Role Playing Games

Massive Multiplayer Online Role Playing Games (MMORPGs) are virtual worlds in which players interact with each other and the online gaming universe through one or more avatars (Cole & Griffiths, 2007). In 2014, over 23 million people were actively subscribed to at least one MMORPG (Statista Inc., 2015). While MMORPGs can contribute positively to players' lives (Caplan, Williams, & Yee, 2009; Longman, O'Connor, & Obst, 2009), more intensive use of MMORPGs has been associated with various negative consequences (Peng & Liu, 2010; Peters & Malesky Jr, 2008; Wan & Chiou, 2006) which can subsequently develop into problematic and maladaptive levels of MMORPG usage (Ng & Wiemer-Hastings, 2005; Peters & Malesky Jr, 2008).

Davis' (2001) cognitive-behavioral model of pathological internet use can be applied to understand the factors that may contribute to problematic levels of MMORPG use among players. Davis (2001) proposed that the development of a pathological behavior requires a predisposed vulnerability (i.e. a pre-existing psychopathology) and a life event (e.g. playing MMORPGs) where the individual is psychologically and/or socially reinforced to continue engaging in that activity. MMORPG players may subsequently develop higher levels of play that in turn may render them more vulnerable to excessive and compulsive use, withdrawal symptoms, and other social and occupational consequences (Caplan, 2002; Davis, 2001).

Caplan and colleagues (2009) found that when predicting the intensity of internet usage among MMORPG players, 22% of the variance was explained by players' psychological wellbeing (e.g. depression and loneliness), whereas only 2% of the variance was accounted for by game factors (e.g. motivations to play). This finding supports Davis' model (2001) and research such as Kuss (2013) that emphasize the need to consider players'

unique contexts, such as their psychological vulnerabilities, when conceptualizing MMORPG use.

Social anxiety as a pre-existing psychopathology

The existing literature indicates that players with social anxiety generally play MMORPGs more frequently than their non-anxious counterparts (Cole & Hooley, 2013; Lo, Wang & Fang, 2005). Social anxiety disorder is a debilitating condition experienced by roughly 13% of the population at some point in their lives (Kessler, et al., 1994). It is characterized by the over-estimation of the probability and consequences of negative social evaluation, which often results in avoidance of feared social situations (Rapee & Heimberg, 1997).

Researchers have suggested that individuals with social anxiety perceive the internet as a safer social environment than face-to-face interactions due to the lack of physical and auditory cues, such as blushing and stuttering, which are often the target of this population's anxiety (McKenna, & Bargh, 1999; Ng & Wiemer-Hastings, 2005; Peters & Malesky Jr, 2008). Consistent with this, individuals with higher social anxiety generally report a preference for online over face-to-face interactions (Lee & Stapinski, 2012). Therefore, as proposed in Davis' model (2001), having an underlying psychological vulnerability, such as social anxiety, may predispose individuals to play MMORPGs to receive specific psychological (e.g. relieve distress) and social rewards (e.g. opportunity to more safely interact with others) which could result in higher levels of MMORPG usage.

Factors associated with social anxiety and MMORPG use

Expression of true self. Existing research indicates that those with social anxiety are more likely to hide their true self from others for fear of rejection (Rodebaugh, 2007) which would make this fundamental need difficult to meet. The current study draws on the definition of true self first outlined by Rogers (1951) as the underlying essence of an

individual that needs to be expressed, acknowledged, and understood if that person is to achieve psychological well-being.

The 'Real Me' model proposed by McKenna, Green, and Gleason (2002) suggests that shy and introverted individuals portray their 'real' or 'true' self more often when interacting online than face-to-face (Amichai-Hamburger, Wainapel, & Fox, 2002; McKenna, et al., 2002). MMORPG avatars may similarly provide socially anxious individuals with a mechanism through which to express their true self (Elund, Clayden, & Green, 2010). In one study, nearly 35% of participants reported feeling more comfortable expressing their true self through their MMORPG avatars than face-to-face (Cole & Griffiths, 2007). If a player's need to communicate their true self to others is repeatedly achieved through playing their avatar, this social reward may contribute to more time spent playing MMORPGs (Cole & Griffiths, 2007; Longman, et al., 2009).

In-game and face-to-face support in the context of social anxiety. Data collected from MMORPG players suggest that valuable and trustworthy friendships are formed in-game (Longman, et al., 2009; Williams, Kennedy, & Moore, 2011). Longman and colleagues (2009) found that individuals who played with other guild members reported more in-game social support than those who played on their own. A guild is a group of players who work together to achieve particular goals within an MMORPG (Ng & Wiemer-Hastings, 2005). In addition, 39% of Cole and Griffiths' (2007) sample reported discussing sensitive issues with MMORPG players they would not have mentioned to face-to-face contacts (Cole & Griffiths, 2007). Therefore, these games can provide individuals with the opportunity to develop significant friendships and receive emotional support not otherwise obtained from their face-to-face relationships (Cole & Griffiths, 2007; Utz, Jonas, & Tonkens, 2012; Williams, et al., 2011).

This social benefit of playing MMORPGs is particularly relevant for individuals with social anxiety who, compared to other mental health populations, report the lowest levels of face-to-face social support (Torgrud, et al., 2004). Consequently, researchers have suggested that socially anxious individuals may utilize the MMORPG environment to form a new or larger support network to compensate for their perceived and/or actual low level of social support offline (Wan & Chiou, 2006). However, those who receive social support from other MMORPG players (Charlton & Danforth, 2007; Longman, et al., 2009), and those with larger support networks in-game (Cole & Griffiths, 2007; Utz, et al., 2012) also report playing significantly more hours than those who do not.

The current study

As indicated in the review above, it is important to develop a model that encapsulates the beneficial and detrimental aspects of MMORPGs usage and can be utilized in clinical and research settings. To do this, Davis' cognitive-behavioral model of pathological internet use (2001) was used as a framework where a pre-existing psychological vulnerability (i.e. social anxiety) was examined in conjunction with social rewards gained from playing MMORPGs (i.e. expression of true self and social support) to predict levels of MMORPG use.

Generally researchers have measured problematic MMORPG usage in one of two ways: either utilizing a psychometric measure of pathological play (Charlton & Danforth, 2007; Cole & Griffiths, 2013) or obtaining data concerning the frequency and duration of play (Cole & Griffiths, 2007; Lo, et al., 2005; Longman, et al., 2009; Ng & Weimer-Hastings, 2005). Researchers have recently theorized that large amounts of time spent playing online games reflect players' enjoyment (e.g. a hobby) or as an opportunity for 'flow' (Seok & DaCosta, 2014), rather than being indicative of the consequences associated with problematic MMORPG use per se (Kardefelt-Winther, 2014; Weinstein & Lejoyeux, 2010). It would seem that a psychometric measure such as the Generalized Problematic Internet Use

Scale (GPIUS) and time spent playing may both be useful, however different ways of conceptualizing and measuring MMORPG usage. Therefore, the current authors utilized both forms of problematic MMORPG use assessment to explore both the objective (i.e. time spent playing) and qualitative aspects (i.e. GPIUS) of participants' MMORPG play experiences.

Levels of social anxiety (a pre-existing psychopathology) and expressions of true self in-game (a social reward received from playing) are conceptualized as predictors of problematic levels of MMORPG usage in the present study, as they have been elsewhere (Davis, 2001; Elund, et al., 2010; McKenna, et al., 2002). Empirical studies have demonstrated that in-game social support is associated with time spent playing due to the time required to maintain these relationships (Cole & Griffiths, 2007; Utz, et al., 2012), and thus, not necessarily predictive of problematic usage. Finally, discussions of theory and empirical evidence reported in the literature suggest that levels of face-to-face social support are associated with both problematic MMORPG use (Caplan, et al., 2009; Peng & Liu, 2010; Utz, et al., 2012), and time spent playing these games (Lo, et al., 2005; Longman, et al., 2009).

The following hypotheses were derived: 1) Higher levels of social anxiety and expression of true self in-game will be positively associated with GPIUS scores; 2) Higher numbers of, and satisfaction with, in-game supports will be associated with more time playing MMORPGs; and 3) Lower numbers of, and satisfaction with face-to-face relationships will be associated with both larger GPIUS scores, and more time spent playing MMORPGs.

Method

Participants

A total of 686 players completed the survey. Sixty participants were excluded from further analyses because they were under 18 years of age (n = 39) or had missing data (n = 21), leaving a sample size of 626 with 505 men and 121 women.

Procedure

Adults currently playing at least one MMORPG were invited to participate in a research study examining "how the use of MMORPGs, and the characters played, may affect perceptions of social support both in-game and face-to-face". The advertisement was posted worldwide on various online gaming forums, MMORPG fan sites, Reddit, Facebook, and spread by word of mouth. Respondents were informed that the survey would take 20 to 30 minutes to complete, and that their participation was anonymous and confidential. Participants who did not understand written English or were not currently playing an MMORPG were excluded from the study. Participation was voluntary and respondents were not compensated for their participation.

Measures

Social anxiety. The self-report version of the Liebowitz Social Anxiety Scale (LSAS-SR; Fresco, et al., 2001) was used to measure levels of social anxiety over the past week across two domains: fear and avoidance. Participants responded to 24 statements describing various social situations and were asked to rate their level of fear from 0 (*none*) to 3 (*severe*), as well as how often they generally avoid each activity from 0 (*never*) to 3 (*usually*). The LSAS-SR has acceptable construct validity for the subscales ($r = .62$-$.66$) and total score ($r = .83$; Fresco, et al., 2001). Good internal consistencies for all subscales ($\alpha = .73$-$.84$) and total score ($\alpha = .94$) in a non-clinical sample have been reported (Fresco, et al., 2001). Comparable internal consistencies were demonstrated in the current sample for the subscales ($\alpha = .86$-$.90$) and total score ($\alpha = .96$).

Measure of MMORPG usage. The Generalized Problematic Internet Use Scale (GPIUS) was created by Caplan (2002) to measure levels of problematic internet usage. The GPIUS was modified for the purposes of the current study where the word 'internet' was replaced with the name of the MMORPG that participant reported playing. The original scale was based on Davis' cognitive-behavioral model (2001) and can be used as a unitary or multiple construct (Caplan, et al., 2009; Cole & Hooley, 2013). The GPIUS consists of 28 questions with items such as "I have played _____ to make myself feel better when I was down or anxious," and "I become preoccupied with _____ if I can't play it for some time". Respondents rated their agreement with each statement using a 5 point Likert scale, with larger scores indicating higher levels of problematic MMORPG usage.

Prior research has established the content validity of the original scale with respect to Davis' (2001) model of pathological internet use (Caplan, 2002). The original subscales show good internal consistency (α = .78-.85; Caplan, 2002), and the modified version demonstrated acceptable internal consistency in the current sample for the total score (α = .90).

Time spent playing MMORPGs. The amount of time participants reported playing the specific MMORPG they identified was measured using a single item: "On average, how many hours per week do you spend playing _____ (name of MMORPG identified)?" Participants were provided with 6 ordinal categorical variables to choose from with options ranging from *less than 1 hour* to *more than 40 hours.*

Expression of true self. A 4 item questionnaire was created by McKenna and colleagues (2002) to measure the extent to which individuals express their true self in online rather than offline contexts. For the purposes of the current study, these items were modified where the word 'internet' was replaced with the player's avatar or MMORPG played. In addition, 2 of the 4 items in the original measure required a Yes/No response, which may not capture the degree to which players express their true self in-game rather than face-to-face.

Consequently, the dyadic format was replaced with the 7 point likert scale as utilized by McKenna and colleagues (2002) for the other two items. Thus, the four items were worded as follows: "Do you think you reveal more about yourself to people you know in _____ (the MMORPG you play) than your real life friends?"; "Are there things your _____ friends know about you that you cannot share with your real life friends?"; "Do you express different facets of self when playing _____ (identified avatar) than you do in real life?"; and "If your family members and real life friends saw how you behave/interact when you play _____, to what extent do you think they would be surprised?" Participants were asked to what extent they agree with each statement from 1 (*not at all*) to 7 (*a great deal*). McKenna and colleagues (2002) obtained a reliability coefficient of $\alpha = .83$ for the original measure, with the modified questionnaire used in the current study also producing good internal consistency ($\alpha = .85$).

Perceived social support. The Social Support Questionnaire- 6 item version (SSQ6; Sarason, Sarason, Shearin, & Pierce, 1987) measures perceived levels of social support and consists of two subscales: the number of supportive relationships, and satisfaction with this amount of support. To reduce burden on participants, respondents were asked to estimate the number, rather than provide the initials, of people they could rely on to provide them with specific forms of support, which is consistent with Torgrud and colleagues' (2004) use of the measure. Respondents were then asked to rate how satisfied they were with that amount of support from 1 (*Very Dissatisfied)* to 6 (*Very Satisfied*). This process was repeated across 6 items, each of which portrayed a different aspect of social support (e.g. "How many people in this MMORPG/face-to-face accept you totally, including both your worst and your best points?"). The number and satisfaction subscale scores reflect the average amount of, and perceived satisfaction with, support received across these 6 situations.

The instructions for the MMORPG version of the SSQ6 were modified slightly where the words 'your face-to-face social network' were replaced with 'this MMORPG' to reflect the specific game that participant played. The number and satisfaction domains of the SSQ6 were treated as separate observed variables in the hypothesized model to determine whether the quantitative and qualitative aspects of social support have different influences over MMORPG use. The presentation of the MMORPG and face-to-face versions of the SSQ6 were counterbalanced across participants to eliminate potential order effects.

The SSQ6 demonstrates high construct validity in psychiatric and general samples (Furukawa, Harai, Hirai, Kitamura, & Takahashi, 1999), and has good internal consistency for the number ($\alpha = .90$) and satisfaction ($\alpha = .93$) subscales (Sarason, et al., 1987). This was also demonstrated in the current sample for the face-to-face (number: $\alpha = .95$ and satisfaction: $\alpha = .97$) and MMORPG social support scales (number: $\alpha = .88$ and satisfaction: $\alpha = .97$).

Demographic and MMORPG use information. As part of the data collection, participants also provided basic demographic (e.g. age, gender, marital status) and MMORPG use information (e.g. MMORPGs they currently play).

Results

Data preparation and procedure

Fifteen of the variables in the hypothesized model were significantly skewed. Eleven of these violations were corrected using a Log 10 transformation. The remaining four variables were left unadjusted as findings drawn from large samples using structural equation modeling techniques are likely to be robust despite violations of normality (see Field, 2009, pg. 155 for a discussion). The hypothesized model was tested using the statistical program AMOS v.21.

Although the hypothesized model was derived from a pre-existing model of internet use (Davis, 2001), it is possible that this model would not be applicable to the MMORPG

player population. Thus, the sample (N = 626) was split in half using the 'random sample of cases' function in SPSS v.16. Sample 1 was used to assess the fit of the hypothesized model and derive any recommended modifications. The second sample could then be utilized to assess the fit of any modified model and determine its generalizability to the population of MMORPG players. This method also assisted us to determine which pathways were robust across samples. ANOVA analyses indicated that the two samples did not significantly differ on any demographic or other variable of interest (all ps > .05).

Sample characteristics

The mean age of the sample was 24.80 years (SD = 6.56) and the age range was between 18 and 64 years. Eighty percent of the sample were male, 78% were single, 61% had at least a tertiary education, and 82% were employed (including students) which reflects the demographic profile of MMORPG players reported elsewhere (Schiano, Nardi, Debeauvais, Ducheneaut, & Yee, 2010). Around 73% of the sample reported playing their primary avatar in the MMORPG World of Warcraft.

Basic descriptive data on the variables of interest are presented in Table 1. More specifically, 48% (n = 300) of the sample scored above the recommended diagnostic cut-off for the LSAS-SR (Stein, 2004), whereas only 2 participants 'agreed' or 'strongly agreed' with each item in the modified GPIUS which is indicative of problematic MMORPG use. Time spent playing was distributed across 6 categories with 1.8%, 6.8%, 15.2%, 37.2%, 21.8%, 8.5%, and 8.8% playing less than 1 hour, 1-5 hours, 5-10 hours, 11-20 hours, 21-30 hours, 21-40 hours, and more than 40 hours per week, respectively. This distribution of time spent playing is similar to findings reported elsewhere (Ng & Wiemer-Hastings, 2005).

Preliminary analyses

Bivariate correlations between observed variables. Given the variables of interest were measured utilizing ordinal data, and as some of these variables were significantly

skewed, parametric and non-parametric bivariate analyses were conducted to ensure

parametric analyses do not provide misleading results. The results indicated that both

methods derived similar correlation patterns. Consequently, the Pearson *r* correlations were

reported in the current study (see Table 2). The table indicates that most of the relationships

included in the hypothesized model were statistically significant and in the expected

direction. However contrary to expectations, neither satisfaction with in-game supports nor

number of face-to-face supports were significantly associated with time spent playing.

Assessing the hypothesized model using structural equation modeling

Given bivariate analyses do not control for the variance accounted for by other

variables in the model, a more comprehensive examination of the hypothesized model was

then implemented utilizing structural equation modeling.

Item parceling. Items were parceled with items originating from the same subscale

so that the structure of the psychometric measure used to create each latent variable could be

maintained (Kline, 2011). The only exception to this was the True Self measure which

consisted of 4 items and no subscales. Bivariate correlations indicated that items 1 and 2 had

a strong Pearson r ($r = .81$) and were therefore parceled together.

The hypothesized model. The initial model with uncorrelated errors resulted in a

poor fit to the data in Sample 1 (CMIN= 668.694, *df* = 137, CMIN/*df* = 4.881; NFI=.766,

IFI= .804, TLI=.753, CFI= .802, RMSEA= .112). When bidirectional arrows were added to

correlate common method error, negative covariance occurred between the three True Self

item parcels. Neither analyzing another random split of the sample nor removing correlations

between other error terms eliminated the negative covariance. As a result, the error terms for

the True Self measure were not correlated in the following analyses.

The model with correlated errors was a good fit to the data from Sample 1

(CMIN=275.361, *df* = 119, CMIN/*df* = 2.314; NFI=.903, IFI= .943, TLI=.916, CFI= .942,

RMSEA= .065) and significantly improved the fit of the model (CMIN = 393.333, df = 18, p < .005).

The majority of the hypothesized pathways in the model were significant and in the expected direction (see Figures 1 and 2). However, contrary to expectations, satisfaction with face-to-face support (β = -.07, p > .05; β = .00, p > .05) was not a significant predictor of GPIUS scores and time spent playing, respectively, and the pathway between satisfaction with in-game supports (β = .05, p > .05) and time spent playing was not significant . Pathways with modification indices above 4 were considered for inclusion, however none were recommended. Therefore, the hypothesized model was not altered before being tested on Sample 2.

Replicating the hypothesized model. The hypothesized model was also a good fit in Sample 2 (CMIN = 243.296, df = 119, CMIN/df = 2.045, NFI = .909, IFI = .951, TLI = .928, CFI = .950, RMSEA = .058) and largely consistent with the findings from Sample 1. However, in contrast with Sample 1, number of face-to-face supports was not significantly associated with time spent playing MMORPGs (β = -.09, p > .05).

Testing invariance across the two samples. A final analysis was conducted where all pathways in the hypothesized model were held constant across both samples to determine if the models were invariant between the samples. The results demonstrate that the hypothesized model was invariant across the two samples as indicated by the goodness of fit (NFI = .903; IFI = .947; TLI = .929; CFI = .947; RMSEA = .041).

Discussion

The hypothesized model fitted the data well across both samples. This provides support for the application of Davis' (2001) cognitive-behavioral model of pathological internet use to the study of MMORPG use and the conceptualization of this potential problem behavior in

the context of social anxiety. In light of the design of the present study, only the findings which were replicated across both samples will be discussed.

The current study contributes significantly to the extant literature by incorporating previously supported bivariate relationships (e.g. Cole & Hooley, 2013; Lo, et al., 2005; Longman, et al., 2009; Cole & Griffiths, 2007; Charlton & Danforth, 2007) within a theoretically-derived model of MMORPG use which was then examined utilizing structural equation modelling. In addition, the present study is the first to measure players' perceived tendency to express their true selves to others when playing MMORPGs. Furthermore, the inclusion of two measures of MMORPG use provided the authors with the unique opportunity to explore the effect of each on the other variables included in the model.

The hypothesized model, problematic MMORPG use measure and time spent playing

The current findings suggest that players with higher levels of social anxiety may express their true self in-game more often than face-to-face, and report higher numbers of in-game support and/or lower numbers of face-to-face support which is significantly associated with larger GPIUS scores. It is of interest that the number of, but not satisfaction with, in-game and face-to-face supports predicted both outcome variables. Consequently, it is recommended that future researchers analyze perceived social support as two separate domains so these nuances may be explored. The unexpected non-significant influence of perceived satisfaction with social support within the model may be due to a ceiling effect where a majority of players reported being moderately satisfied or very satisfied with the level of support received. However, an alternative explanation is that satisfaction with social support may be more susceptible to cognitive biases than identifying the number of supportive relationships which is, arguably, a more objective task (Clark & Wells, 1995; Torgrud, et al., 2004).

In addition, the present study indicates that players with social anxiety continue to have difficulty developing supportive relationships in-game, despite the elimination of visual and audio cues thought to exacerbate social fears. While this discovery supports clinical models that suggest the cognitive and perception biases associated with social anxiety are pervasive across a variety of social contexts (Clark & Wells, 1995), it contradicts speculations made by other researchers that the online medium provides socially anxious individuals with a safer environment in which to communicate with others and form new friendships (Cole & Griffiths, 2007; McKenna & Bargh, 1999; Wan & Chiou, 2006).

Finally, number of in-game supports was the only significant pathway to time spent playing MMORPGs, which is consistent with recent suggestions that time spent playing is not indicative of problematic MMORPG usage or the negative consequences that can arise from such pathological behavior (Kardefelt-Winther, 2014). Therefore, consistent with Petry and colleagues' article (2014), it is recommended that time spent playing should be used as a screening, rather than a diagnostic tool in both research and clinical contexts. Consequently, researchers are encouraged to utilize sound psychometric measures of problematic MMORPG use, rather than rely on time spent playing as an indicator of pathology in future investigations.

It is interesting to note that the number of in-game supports was associated with GPIUS scores in addition to time spent playing. This finding may suggest that for some players, maintaining online friendships simply leads to more time spent playing, whereas others, such as those with social anxiety and/or a tendency to express their true selves in-game, may develop problematic behaviors and outcomes as assessed by the GPIUS as a result of engaging with these in-game friends (Charlton & Danforth, 2007; Wan & Chiou, 2006). Another possible explanation could be that the number of MMORPG supports may reflect being a member of a large guild where some players report feeling obligated to play despite

their better judgment, and thus report symptoms of problematic usage (Snodgrass, Lacy, Dengah II, & Fagan, 2011).

Suggestions for future research

It is advised that researchers continue to explore other factors that may contribute to the relationship between social anxiety and MMORPG usage; preference for in-game over face-to-face social interactions (Ng &Weimer-Hastings, 2005), and playing MMORPGs as a way to regulate anxiety or distress (Williams, et al., 2011) may be worth consideration.

Clinical implications

The present findings have various implications for clinicians and researchers who have an interest in social anxiety and/or MMORPG use, three of which will be outlined below. In light of the high co-morbidity between problematic levels of internet use and other psychiatric conditions (Weinstein & Lejoyeux, 2010), the current model provides clinicians with a framework through which MMORPG use can be understood in the context of a psychopathology, in this case, social anxiety. This model can further assist in the development of clinical conceptualizations of, and treatment plans for, clients engaging in potentially problematic levels of MMORPG play. Secondly, based on the findings of the present study, it is recommended that clinicians assess for risk factors in their clients, such as symptoms of social anxiety, tendency to express true self through their avatar rather than face-to-face, and reporting low amounts of face-to-face support. Finally, this study provides empirical evidence that the GPIUS accounts for more variance in associated psychological and social risk factors than time spent playing. It is therefore additionally recommended that clinicians utilize a psychometrically sound measure of problem MMORPG usage, rather than time spent playing to diagnose at-risk clients.

Strengths and Limitations

Although the current study possesses significant strengths, there are a number of limitations that require discussion. First, this study is limited by the use of cross-sectional data where significant pathways within the psychosocial model may not be supported by longitudinal data (Cole & Maxwell, 2003). The authors are currently in the process of collecting longitudinal data to determine whether the supported pathways reflect antecedent and/or bidirectional relationships.

Considering MMORPG use is a relatively new online activity (see Kuss, 2013 for a discussion), there are few validated and reliable measures of pathological MMORPG use. Consequently, the authors modified a pre-existing measure, the GPIUS, to suit the aims of the current study which has not been validated in an MMORPG player sample. Therefore, it is not clear whether this scale measures problematic levels of MMORPG usage. In addition, due to the extremely small proportion of participants who reported experiencing problematic levels of MMORPG usage, the current findings may not generalize to players who experience symptoms and outcomes suggestive of pathological use. Therefore, replication of the current study is encouraged among a clinical sample of problematic MMORPG players.

Furthermore, our decision to ask participants to estimate, rather than provide the initials of, the number of supports they have could have led to an overestimation of the support received. It is therefore possible that the pathways involving either of the number of social support variables were larger than what would be found in the MMORPG population.

Despite these limitations, the current study also has considerable strengths. In particular, the utilization of two samples allowed the authors to determine whether marginally significant pathways in the model were robust and would be replicated across samples. Furthermore, by holding the pathways constant, the current study was able to confirm the hypothesized model was invariant across the two samples as indicated by the goodness of fit.

In addition, the current study is the first to conceptualize and test a model of MMORPG use in the context of a specific psychopathology, in this case, social anxiety. Although researchers have suggested, and empirically explored various ways of understanding MMORPG use (e.g. Peng & Liu, 2010), the current study is the first to empirically test and replicate a pre-existing theory-based model of MMORPG use in a sample of MMORPG players. Finally, the present study provides significant evidence that the GPIUS is a stronger predictor of factors thought to be associated with problematic MMORPG use than time spent playing which provides empirical support for the importance placed on using psychometric measures in recent theoretical papers (Kardefelt-Winther, 2014; Petry et al., 2014).

In conclusion, the present study provides strong evidence that Davis' (2001) cognitive-behavioral model can be effectively used to understand MMORPG use in the context of social anxiety, and demonstrates the importance of considering players' psychological and social contexts when conceptualizing the function of intense MMORPG usage.

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Table 1

Basic descriptive data on the variables of interest

Variable	Mean	SD	Range	Possible range
SA	34.39	25.86	0 - 135	0 - 144
True Self	9.58	6.12	4 - 28	4 - 28
GPIUS Score	65.86	17.27	28 - 122	28 - 140
No. FtF	6.62	9.58	0 - 100	Unlimited
Sat. FtF	4.78	1.41	1 - 6	1- 6
No. MMO	3.69	6.64	0 - 100	Unlimited
Sat. MMO	4.79	1.21	1 - 6	1 - 6

Note. N = 626. SA = social anxiety; GPIUS Score = modified GPIUS total score; Time playing = time spent playing identified MMORPG per week; No. FtF = number of face-to-face social supports; Sat. FtF = satisfaction with amount of face-to-face social support; No. MMO = number of MMORPG social supports; Sat. MMO = satisfaction with amount of support in MMORPG.

Table 2

Bivariate Pearson r correlations for observed variables

Variable	1.	2.	3.	4.	5.	6.	7.	8.
1. SA	-							
2. True Self	.37***	-						
3. No. FtF	-.22***	-.21***	-					
4. No. MMO	-.12**	.08 n.s.	.42***	-				
5. Sat. FtF	-.34***	-.41***	.27***	.05 n.s.	-			
6. Sat. MMO	-.21***	-.09*	.17***	.15***	.41***	-		
7. GPIUS Score	.49***	.54***	-.20***	.03 n.s.	-.40***	-.21***	-	
8. Time spent playing	.17***	.24***	-.07 n.s.	.11**	-.16***	.00 n.s.	.34***	-

Note. * $p < .05$. ** $p < .01$. *** $p < .001$. n.s. $p > .05$. SA = social anxiety; No. FtF = number of face-to-face supports; No. MMO = number of MMORPG supports; Sat. FtF = satisfaction with amount of face-to-face support; Sat. MMO = satisfaction with amount of support in MMORPG; GPIUS Score = modified GPIUS total score; Time spent playing = time spent playing identified MMORPG per week.
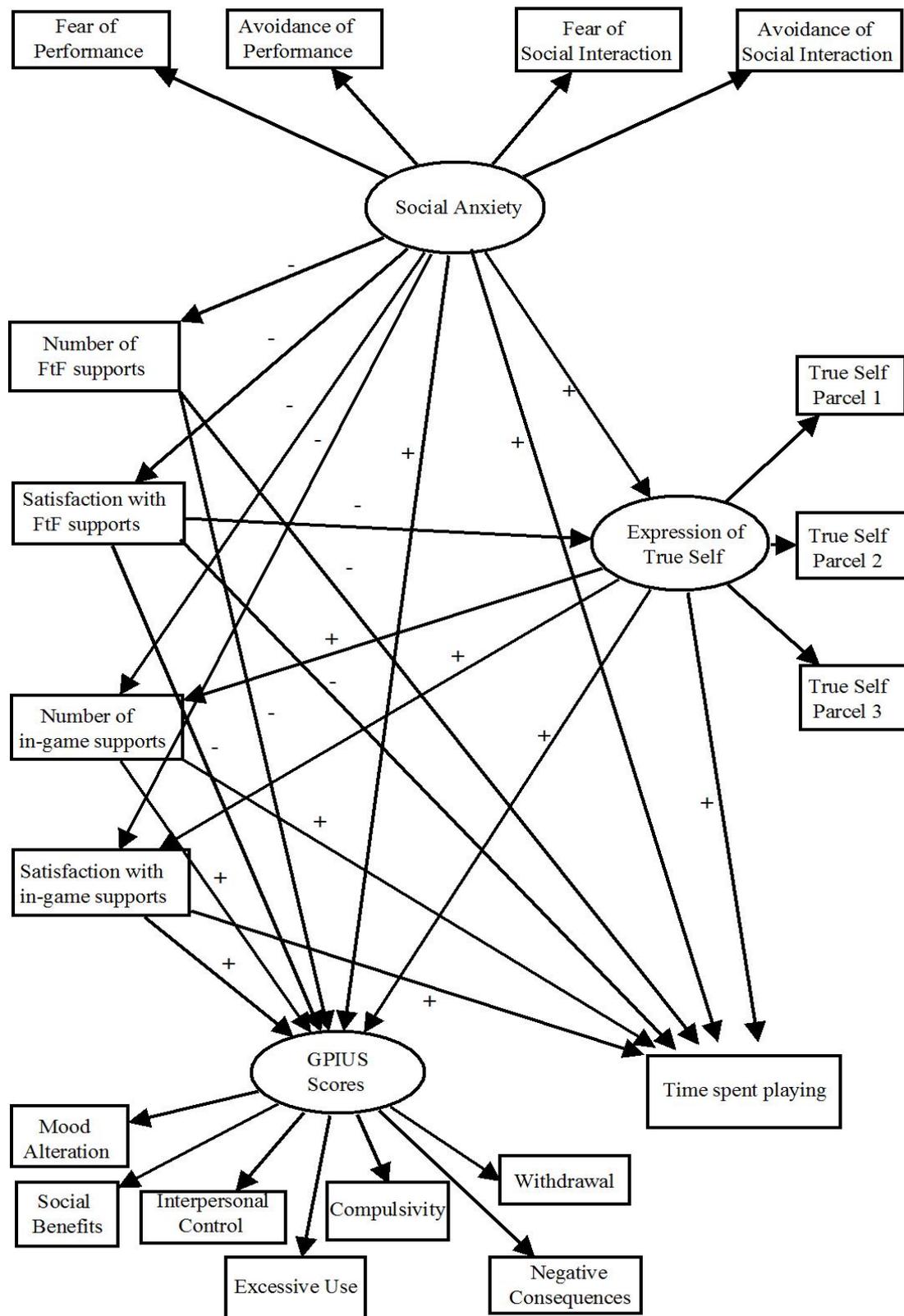
Figure 1. Hypothesized psychosocial model with direction of pathways depicted above the line to which it refers. Latent constructs are shown in circles and observed variables in rectangles.
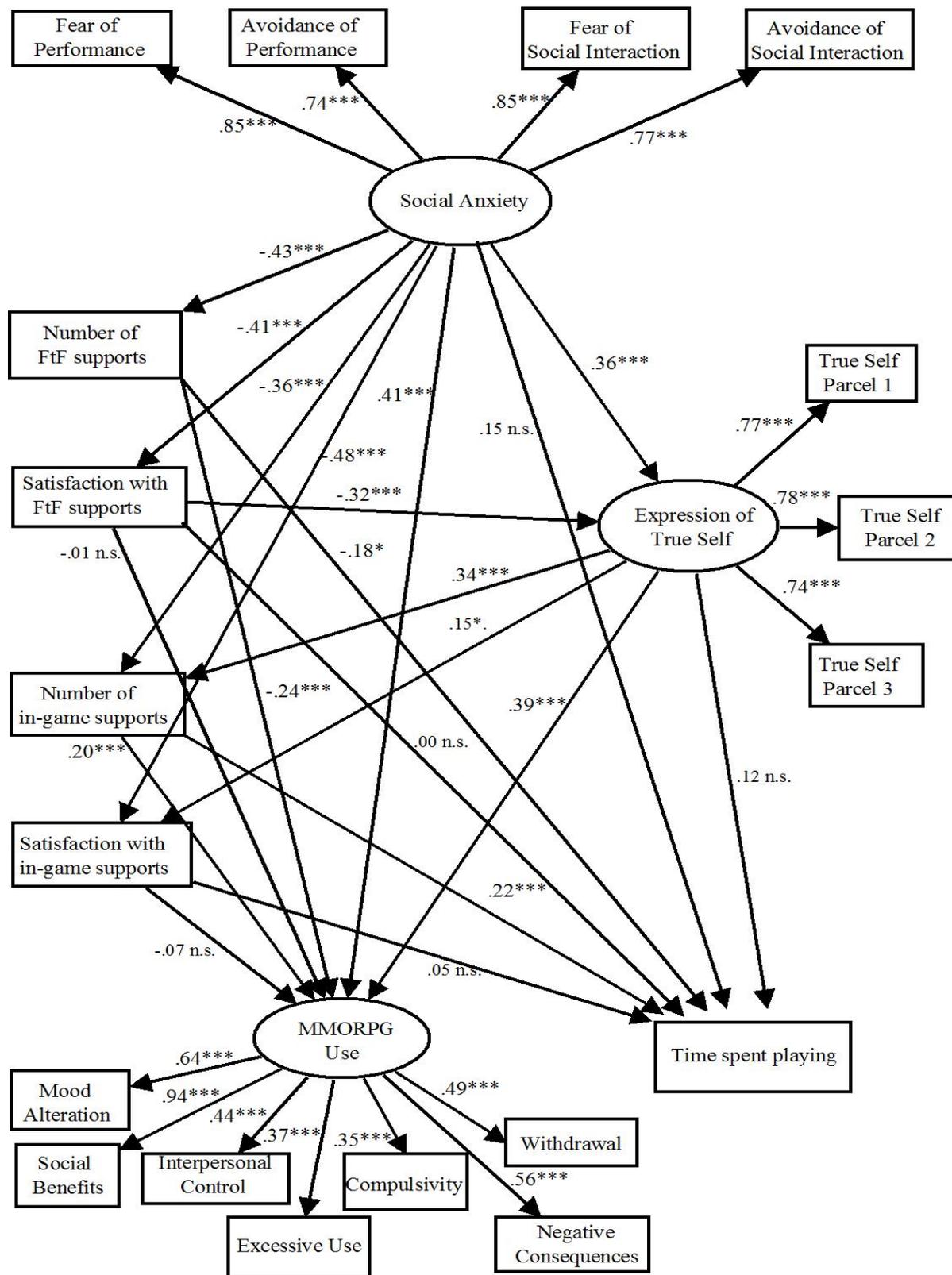
Figure 2. Standardized coefficients for hypothesized model on first half of sample. Latent

constructs are shown in circles and observed variables in rectangles.

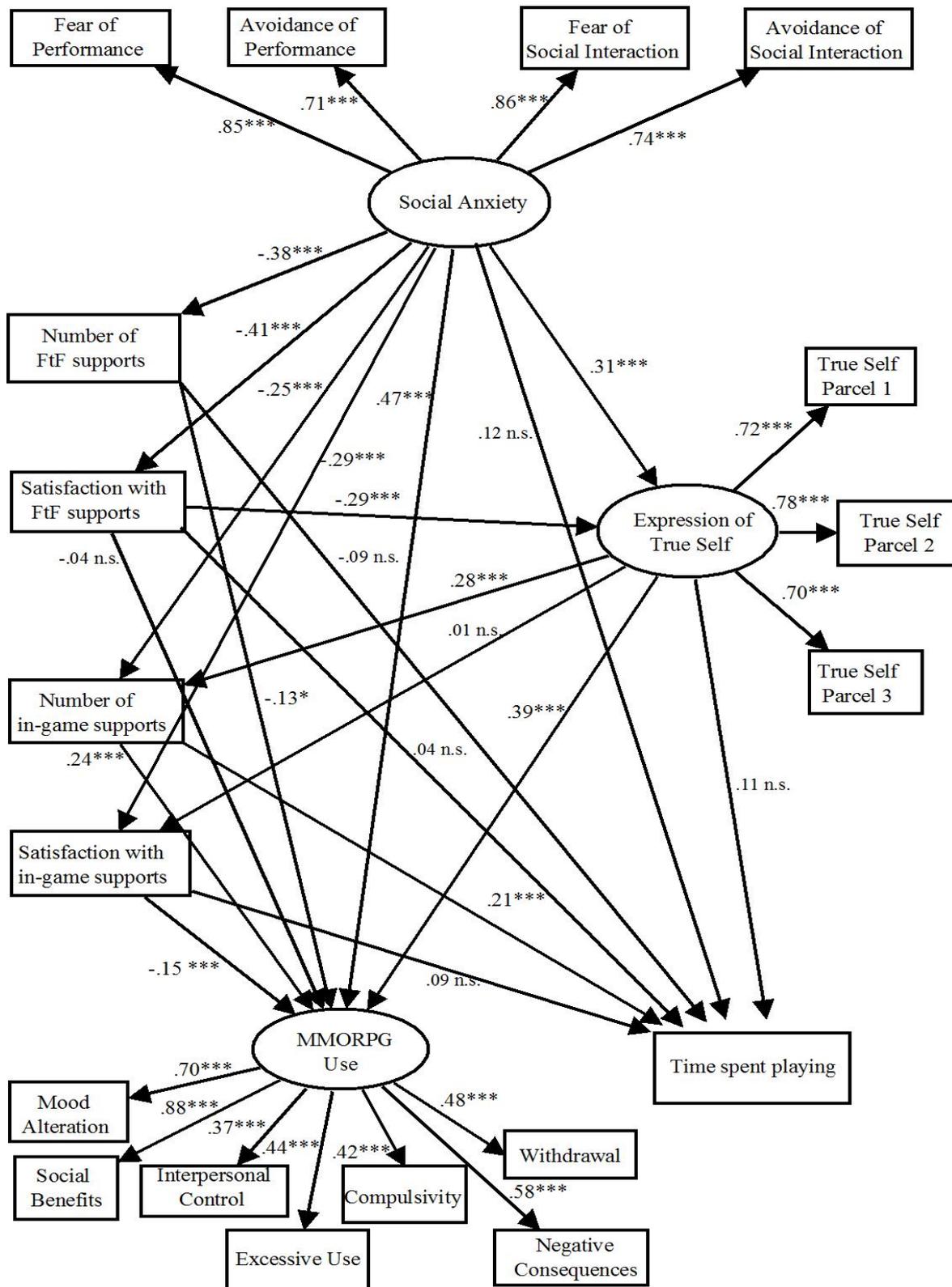* *p* < .05. ** *p* < .01. *** *p* < .001. n.s. *p* > .05.

Figure 3. Standardized coefficients for replication of hypothesized model on second half of

sample. Latent constructs are shown in circles and observed variables in rectangles.

* *p* < .05. ** *p* < .01. *** *p* < .001. n.s. *p* > .05.