Gaming Motivation and Problematic Video Gaming:

The Role of Needs Frustration

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Abstract

Motivation is often used as a predictor of a problematic style of video game engagement, implying that individuals' gaming undermines optimal functioning. Drawing from recent advances in Self-Determination Theory (SDT), the present study explores the links between gaming motivations, the daily frustration of basic psychological needs, and reports of problematic video gaming (PVG). A sample of 1,029 participants (72.8% male; M = 22.96 years; SD = 4.13 years) completed items regarding their gaming engagement and gaming motivation as well as their experience of needs frustration and PVG symptoms. Results revealed positive associations between gaming motivations and PVG, and between daily needs frustration and PVG. Finally, after comparing several competing models, a mediational model whereby needs frustration explained the association between individuals' gaming motivation and PVG emerged as best fitting the data. The discussion addresses the theoretical and practical implications of these findings in the context of recent research.

Keywords: *Gaming Disorder; Gaming; Motivation; Basic Needs; Self-Determination Theory*

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Self-Determination Theory (SDT; Ryan & Deci, 2000, 2017) is a widely used theory of human motivation that emphasizes the quality versus the quantity of motivation in explaining consequences from activity engagement. SDT proposes more adaptive outcomes will occur when activity engagement is freely chosen and based solely on the pleasure and enjoyment of the activity itself (i.e., intrinsic motivation). Studies have shown less intrinsic motivation toward gambling- or exercise-related activities is associated with reports of greater gambling disorder and exercise dependence, respectively (Clarke, 2004; González-Cutre & Sicilia, 2012). Intrinsic motivation is assumed to stem from greater satisfaction of three basic psychological needs (competence, autonomy, and relatedness) during engagement in the activity, which implies that gambling disorder and exercise dependence are associated with lower needs satisfaction during engagement in related activities. However, active impediments to needs satisfaction, or needs frustration, within domains unrelated to the activity may ultimately cultivate a problematic pattern of activity engagement, as individuals become more reliant upon the activity to satisfy these needs (Vansteenkiste & Ryan, 2013). To date, no study has explored the contributions of both activity motivation and the experience of needs frustration in predicting problematic activity engagement. Therefore, within the quickly growing area of video games, the present study explores the unique roles gaming motivation and experiences of needs frustration in explaining problematic video gaming.

Self-Determination Theory (SDT; Ryan & Deci, 2000, 2017) proposes three interrelated types of motivation underlying activity engagement that are easily applied to video games. An *intrinsic motivation* is guided by the pleasure and enjoyment from video games. An a*motivation* indicates that video games are perceived to add little value to life resulting in a lack of personal intention to engage in them. Existing between an intrinsic motivation and an amotivation lies four subtypes of *extrinsic motivation*. The first, integrated regulation, is guided by the personal expression of self through video game engagement (Ryan & Deci, 2017). The second, identified regulation, is characterized by the alignment of video game engagement with one's values and goals (Ryan, 1995). The third, introjected regulation, indicates experiencing strong internal pressures to engage in video games that are beyond the control of the individual (Ryan & Deci, 2000). Finally, the fourth, external regulation, is driven by the desire to earn rewards through gaming (Ryan, 1995). In line with assumptions of SDT, the abovementioned motivations toward gaming have been found to be positively associated with time spent gaming except for an amotivation toward gaming (Lafrenière, Verner-Filion, & Vallerand, 2012).

Interwoven within SDT's perspective on motivation is the role of three basic psychological needs. The three needs include competence (i.e., perceiving one's abilities are well-matched with the activity), autonomy (i.e., perceiving actions while engaging in the activity are under one's own volition), and relatedness (i.e., perceiving a sense of connectedness with others through engagement in the activity) (Ryan & Deci, 2000, 2017). Reporting greater satisfaction of these needs during activity engagement is expected to concomitantly occur with a stronger intrinsic motivation (Ryan, 1995). Consistent with this assumption, Lafrenière, Verner-Filion, and Vallerand (2012) observed that a stronger intrinsic motivation toward gaming was associated with perceiving higher needs satisfaction during gaming. Other research has demonstrated that higher game enjoyment, stronger intentions to play, and greater time spent gaming are further predicted by greater needs satisfaction during video game engagement (Johnson, Gardner, & Sweetser, 2016; Ryan, Rigby, & Przybylski, 2006; Tamborini, Bowman, Eden, Grizzard, & Organ, 2010).

Therefore, needs satisfaction while gaming appears to explain the appeal of video games (see review by Przybylski, Rigby, & Ryan, 2010), but, as shown within a recent study, does not meaningfully explain problematic video gaming (PVG; Mills, Mettler, & Heath, 2017).

PVG is a pattern of video game engagement that contributes to maladaptive functioning in daily life (King, Haagsma, Delfabbro, Gradisar, & Griffiths, 2013; Petry et al., 2014). PVG is conceptually similar to other behavioral addictions such as gambling disorder and exercise dependence (Hausenblas & Symons Downs, 2002), which have been found to be most strongly associated with an introjected regulation and amotivation. Demographically, PVG is more commonly reported by males than females, and by those spending large amounts of time playing video games (Jeromin, Rief, & Barke, 2016; Lemmens, Valkenburg, & Gentile, 2015). Research has demonstrated that various measures of PVG are associated maladaptive outcomes including depression, impulsivity, conduct disorder, anxiety, and other psychological disorders (Bargeron & Hormes, 2017; Strittmatter et al., 2015; Vadlin, Åslund, Hellström, & Nilsson, 2016). Although beyond the scope of this paper to discuss in detail, it is important to note that a consensus has not been reached regarding the criteria of PVG or the weight that should be given to PVG as a potential disorder (Aarseth et al., 2016; Griffiths et al., 2016; Przybylski, Weinstein, & Murayama, 2017). Nonetheless, PVG represents an area in which to build upon previous applications of SDT to the study of gaming.

Recent developments in SDT suggest *needs frustration,* or the extent to which individuals feel obstructed in their pursuit of satisfying their needs in daily life (Vansteenkiste & Ryan, 2013), may be a more robust predictor of behavioral addictions such as PVG. Studies show the active obstruction component that defines needs frustration is essential to predicting maladaptive outcomes (e.g., depression, interpersonal sensitivity), whereas low needs satisfaction that is void of any obstruction will weakly predict adaptive outcomes (e.g., life satisfaction, vitality) (Chen et al., 2015; Costa, Ntoumanis, & Bartholomew, 2015; Gunnell, Crocker, Wilson, Mack, & Zumbo, 2013). Previous research has also shown that needs frustration during participation in a mandatory (e.g., school) or loved activity (e.g., sport) is associated with less intrinsic motivation toward the activity as well as maladaptive outcomes (Costa, Coppolino, & Oliva, 2016; Haerens, Aelterman, Vansteenkiste, Soenens, & Van Petegem, 2015). However, in line with Vansteenkiste and Ryan (2013), needs frustration across life domains may cultivate a dependence on one activity for needs satisfaction, alluding to a problematic style of engagement.

The present study has two objectives. The first objective sought to assess the associations among gaming motivations, daily needs frustration, and PVG. It was hypothesized that introjected regulation, external regulation, and amotivation would be positively correlated with competence, autonomy, and relatedness frustration. PVG was hypothesized to be positively associated with all six gaming motivations as well as reports of competence, autonomy, and relatedness frustration.

The second objective sought to assess *how* gaming motivations, daily needs frustration, and PVG were related. At present, theory and previous research offer at least three potential models explaining how these constructs are related. The first model (Model A in Figure 1) suggests gaming motivations and daily needs frustration are best viewed as separate predictors of PVG. This model is supported by the theoretical and empirical evidence reviewed above. Alternatively, gaming motivations may explain the link between needs frustration and PVG. The second model (Model B in Figure 1) draws upon recent results from Lalande and colleagues (2017) who provided evidence that deficits in needs satisfaction are associated with lower life satisfaction through a stronger extrinsic motivation toward a loved activity. The deficits in needs satisfaction, per Lalande and colleagues (2017), bring about an overreliance toward one activity to satisfy basic needs, which over time undermines the potential of an intrinsic motivation toward an activity. However, it is possible that experiences of needs frustration explain the link between gaming motivations and PVG. This final model (Model C in Figure 1) suggests gaming motivations contribute to reports of PVG through increased experiences of needs frustration. Although this model does not have as much empirical support as Model A or Model B, recent research in a tangentially related area of study demonstrated that perfectionism contributes to the presence of eating disorders through an increase in daily needs frustration (Boone, Vansteenkiste, Soenens, Van der Kaap-Deeder, & Verstuyf, 2014). Conceptualizations of perfectionism do parallel some of the broad qualities of introjected regulation including an inability to control internal pressures. As such, perfectionist individuals demonstrate a unique interaction with their environment that may cultivate a greater susceptibility for experiencing needs frustration. Therefore, with regard to gaming motivation, Model C suggests that the internalization of a strong extrinsic motivation may also contribute to the experience of daily needs frustration because it represents how individuals might interact with their environment similar to reports of perfectionism.

Other models beyond the three outlined above were considered, but were not found to have justification in existing theory or available evidence resulting in their exclusion. Given the previously mentioned links to PVG, gender and time spent gaming were included as covariates.

Methods

Participants

Ethical approval from McGill University was given prior to recruitment, and all participants provided their informed consent before to beginning the online questionnaire. In total, 1,802 participants were recruited through online social networks (e.g., *Facebook*, *Reddit*) and research forums (e.g., *Psychological Research on the Net*), email invitations, and flyers. The dataset was reviewed for duplicate IP addresses in which the earliest response was retained with the latter responses excluded (*n* = 59). Further, participants less than 18 years (*n* = 43) or over 35 years (*n* = 61) were excluded, as this range corresponded with significant portion of video game users (Entertainment Software Association, 2016). Additionally, 251 participants did not complete the online survey and were thus excluded. Finally, 359 participants were excluded for responding to an attention item incorrectly, or responding "No" to the question, "Do you play video games most days of the week", suggesting they are not frequent video game users. Comparisons of gender, age, and time spent gaming were conducted between those included and those excluded, which did not reveal any significant differences ($p > .05$).

The final sample included 1,029 participants (72.8% male; M = 22.96 years; SD = 4.13 years). On average, participants spend 19.70 hours (SD = 15.34 hours) per week gaming. Participants were from the United States (46.4%), Canada (33.1%), as well as various European (12.2%) and Asian (3.4%) countries. Most participants (64%) reported they were presently enrolled at a post-secondary institution.

Measures

Problematic Video Gaming. The 9-item Internet Gaming Disorder Scale (IDGS; Lemmens et al., 2015) was used to assess PVG. Participants rated the frequency they experienced each item over the last year using an altered 6-point scale ranging from *almost never* (1) to *almost always* (6). Internal consistency was acceptable ($\alpha = .85$).

Needs Frustration. Bartholomew, Ntoumanis, Ryan, and Thøgersen-Ntoumani's (2011) Psychological Need Thwarting Scale (PNTS) was adapted to assess needs frustration in daily life. The original scale consists of three 4-item subscales assessing the frustration of each psychological need. An item from the relatedness subscale (REL2) was not included in the questionnaire due to a previous study finding it was confusing and ultimately did not load highly onto its respective factor (Mills, Milyavskaya, Mettler, & Heath, 2017). Participants used the same 6-point scale as the IDGS to rate how frequently they experience each item in their life. Internal consistency was acceptable for the competence (α = .82), autonomy (α = .88), and relatedness (α = .89) frustration subscales.

Gaming Motivation Scale. Lafrenière and colleagues (2012) developed the 18-item Gaming Motivation Scale (GAMS) to assess users' motivation toward gaming. The scale includes 6 three-item subscales that assess intrinsic motivation, amotivation, and each of the four subtypes of extrinsic motivation toward gaming (i.e., integrated regulation, identified regulation, introjected regulation, external regulation). Each item was rated on a 7-point scale ranging from *not agree at all* (1) to *very strongly agree* (7). Internal consistencies were all above .70 for each subscale, except for the intrinsic motivation subscale (α = .60).

Analytical Strategy

Statistical analyses were conducted using MPlus version 7.4 with missing values estimated by full information maximum likelihood (Muthén & Muthén, 2015). Bivariate correlations with a Bonferroni modified alpha (p < .001) were conducted to assess the associations among gaming motivations, daily needs frustration, and PVG (Objective 1). Fit indices were calculated to assess the fit of the present data to each of the proposed models within Figure 1 (Objective 2). Goodness-of-fit was determined by values of .08 or lower for root mean square error of approximation (RMSEA), near or above .95 for both comparative fit index (CFI) and Tucker-Lewis Index (TLI), and less than .06 for standardized root mean squared residual (SRMR) (Hu & Bentler, 1999; Kline, 2016). Additionally, Akaike's information criterion (AIC) and Bayesian information criterion (BIC) were used to compare models with lower values suggesting greater parsimony (Kline, 2016;

Wagenmakers, 2007). Prior to conducting these analyses, the underlying factor structure of each measure was confirmed with the present data. The input and output of the preliminary and primary analyses as well as the individual items for each of the measures are provided as online supplemental material.

Results

Preliminary Analyses

A complete description of the steps taken to confirm each of the measures is provided in the online supplemental material. Although only minor modifications were made to IGDS to confirm a single factor solution, both the PNTS and the GAMS required further steps. First, an item from the competence subscale of the PNTS was excluded due to loading poorly onto its respective factor. Following its removal, the present data were found to fit the expected 3-factor solution. The revised 3-item competence subscale was found to have adequate internal consistency ($\alpha = .89$). Second, following several steps that resulted in not confirming the 6-factor solution for the GAMS, the entire intrinsic motivation subscale was excluded. Several steps were taken including an exploratory factor analysis with Promax rotation as well as confirmatory factor analysis with the remaining 15 items. In the end, four unique factors were identified with adequate internal consistency: Integrated-Identified Regulation ($\alpha = .88$), Introjected Regulation ($\alpha = .74$), External Regulation ($\alpha = .70$), and Amotivation ($\alpha = .87$). The interested reader is encouraged to review the online supplemental material for further explanation of these steps. Not surprisingly, participants recruited from a gaming-specific Reddit streams reported greater time spent gaming, stronger motivations toward gaming, and higher PVG than participants recruited using other methods ($p < .05$). Table 1 presents the means and standard deviations of the included instruments.

Primary Analyses

The first objective was to assess the associations among gaming motivations, daily needs frustration, and PVG. Bivariate correlations (see Table 1) largely supported expected associations. Specifically, PVG was positively associated with each of the four gaming motivations as well as competence, autonomy, and relatedness frustration. Furthermore, competence, autonomy, and relatedness frustration were positively associated with introjected regulation and amotivation, however, external regulation was not associated with needs frustration.

The second objective assessed how gaming motivations, daily needs frustration, and PVG were related. Average scores for the four gaming motivations, daily frustration of each basic need, and PVG were included as observed variables within the planned path analyses. Time gaming and gender were included as covariates, however several paths were excluded given the non-significant associations observed in Table 1. First, the pathways from time gaming to competence, autonomy, and relatedness frustration were excluded from the proposed models. Second, the pathways from gender to PVG, introjected regulation, external regulation, and amotivation were excluded from the proposed models.

An acceptable fit was found for each model (see Table 2), however, Model C was found to have the lowest AIC, which suggested it is the preferred model (Kline, 2016). Moreover, using an equation the provided by Wagenmakers (2007), the differences in BIC revealed “strong” evidence that Model C is a more parsimonious model compared to Model A and Model B. In fact, according to Wagenmakers’ equation, Model C is 30.4 times more likely than Model A and 28.2 times more likely than Model B. As shown in Figure 2, the results of this model show all four gaming motivations are directly associated with PVG. In addition to these direct effects, positive indirect effects for introjected regulation and amotivation were found through autonomy frustration

(Introjected Regulation: $\beta = .03$, $p = .01$, 95CI[.01, .05]; Amotivation: $\beta = .02$, $p = .01$, 95CI[.01, .04]). All other effects are included in the online supplemental material.

Discussion

The present study investigated the roles of both gaming motivations and daily needs frustration in explaining PVG. As expected, gaming motivations and daily needs frustration are positively associated with PVG. These associations are consistent with work in other areas of study (Boone et al., 2014; Clarke, 2004; Costa et al., 2016; González-Cutre & Sicilia, 2012; Symons Downs, Savage, & DiNallo, 2013). However, in building upon previous research, the present findings are the first to show that the experience of daily autonomy frustration partially mediates the association between both introjected regulation of and amotivation toward gaming and PVG. The discussion focuses on these two specific motivations to help explain PVG.

Introjected regulation implies that the drive to engage in video games is facilitated by uncontrollable internal pressures, which resemble withdrawal-like symptoms such as anxiety or irritability when unable to play (Ryan, 1995). Per SDT, these pressures stem from a contingent self-worth that is strongly attached to the activity indicating engagement in the activity is an attempt to prove oneself. A recent study demonstrated that although each of the four types of extrinsic motivation as well as amotivation were positively correlated with a strong attachment of self-esteem to video game engagement, introjected regulation of gaming engagement correlated highly ($r > .70$) with the pursuit of individual validation through gaming (Beard & Wickham, 2016). As such, introjected regulated video game users are compelled to play video games problematically due to the role gaming has on their perception of self, implying a larger issue surrounding problematic gaming cognitions (see work by King & Delfabbro, 2014, 2016).

On the other hand, amotivation represents a perception that gaming does not provide value to one’s life culminating in a lack of personal intention in gaming engagement (Ryan, 1995). Although further research is needed, helplessness within the present context likely refers to an awareness of the negative consequences of gaming engagement, but an inability to stop or manage gaming engagement. As such, the link between amotivation toward gaming and PVG parallels the link between feeling “addicted” to gaming and PVG (Männikkö, Billieux, Nordström, Koivisto, & Kääriäinen, 2017; Rehbein, Kliem, Baier, Mößle, & Petry, 2015). Further, the strong correlation between introjected regulation and amotivation suggests the helplessness in effectively managing gaming engagement may stem from strong internal pressures to engage in gaming, which are coming into conflict with a heightened awareness that gaming no longer adds value to other life domains and may even be undermining quality of life (Ryan & Deci, 2017).

Importantly, both introjected regulation and amotivation predicted increased frustration of all three basic needs; however, current theory does not explicitly address *how* these motivations might facilitate greater needs frustration. Only two studies have shown a mediational role of needs frustration in explaining the presence of a problematic behavior, and both used reports of perfectionism as a predictor of needs frustration within a sport-specific context (Costa et al., 2016) or in daily life (Boone et al., 2014). Results demonstrated that perfectionism contributed to a problematic behavior (e.g., binge eating, exercise dependence) through an increase in needs frustration. Although the strong uncontrolled internal pressures to engage in video games parallels some of broad elements of perfectionism, the overlap with amotivation is less clear. It is possible that perfectionistic individuals feel “addicted” to behaving a specific way and helpless to change their behavior. This overlap between introjected regulation and amotivation with perfectionism does not explain *how* needs frustration is facilitated.

One possible way in which introjected regulation and amotivation facilitate greater daily needs frustration is through a strong disengagement in environments unrelated to gaming resulting in an active avoidance of such environments. PVG is strongly related to the perception that the online gaming community is the only place in which one is valued and appreciated (Liu & Peng, 2009). Indeed, these perceptions speak to a key component embedded within the introjected regulation of gaming engagement as well as the control gaming has over amotivated individuals. Strong beliefs that one is only valued within a gaming community will result in disengagement as well as greater aggression in both gaming as well as non-gaming environments. This increased aggression may bring about an exclusionary response from non-gaming environments. Future research is needed to assess for a recursive association, whereby perceptions of being valued only online stem from experiences of needs frustration. An important implication of Liu and Peng's (2009) finding is that enthusiastic, but otherwise healthy users likely feel valued and appreciated in other areas of their life beyond gaming (e.g., work, school, friendships) limiting the control gaming has on their life. As shown in another study using adolescents, it is likely this stems from a lack of daily needs frustration experienced within a key domain (Yu, Li, & Zhang, 2015).

An interesting finding within the present study was that only autonomy frustration mediated the links introjected regulation and amotivation toward gaming and PVG. Autonomy frustration is critical in facilitating the development of a contingent or fragile self-esteem (Deci & Ryan, 1995). Caution should be taken in interpreting the present results as suggesting that competence and relatedness frustration do not contribute to PVG. Rather, competence and relatedness frustration were found to contribute to PVG through a decline in subjective well-being (Mills et al., 2017). As such, these findings highlight the unique role motivations toward gaming may play undermining daily autonomy satisfaction, which contributes to a strong attachment of self-esteem onto gaming engagement resulting in greater PVG.

Finally, it should be noted that both integrated-identified regulation and external regulation predicted PVG, but were not associated with needs frustration. This suggests that enthusiastic, but otherwise healthy video game users who perceive gaming (1) provides personal expression (i.e., integrated regulation) and (2) is in alignment with values and goals (i.e., identified regulation) are likely to report some symptoms of PVG (Charlton & Danforth, 2007), which is similar to the conceptualization of a harmonious passion (Vallerand, 2010). On the other hand, external regulation, which relates to being motivated to collect various rewards (e.g., levelling up, in-game awards), is not surprisingly related to PVG, as these elements will often relate to directly to a surface-level appeal of gaming. However, these characteristics by themselves will likely not facilitate a sustained PVG.

Several limitations should be noted. First, the use of self-report data assumes participants correctly interpreted each item and responded truthfully; however, careful steps were taken in reviewing the measures as well as participants' responses to each item to ensure accuracy and validity. Second, because the present data did not confirm the original six-factor structure of the GAMS, the present findings are based upon a slightly incomplete picture of gaming motivation from the perspective of SDT. Future research is needed to revalidate the scale and its ability to adequately measure all six gaming motivations. Finally, due to the crossectional design, the present study is not able to infer causality. However, the data-driven approach taken is a strength of the present study as it compared a set of theoretically-derived models, which ultimately revealed strong evidence of the likely relation among gaming motivations, needs frustration, and PVG.

Notwithstanding these limitations, the present study offers original contributions to both the SDT and PVG literature. Specifically, introjected regulation and amotivation play a role in explaining PVG through in part their effect on the experience of needs frustration. Although speculative, it is possible that clinicians might see changes in individuals' gaming patterns by directly addressing their motivations toward gaming through motivational interviewing (Miller & Rollnick, 2013). Further, a recent study has shown a small but significant reduction of the association between needs frustration and ill-being for those reporting higher dispositional mindfulness (Schultz, Ryan, Niemiec, Legate, & Williams, 2015), a quality of consciousness that may be increased through targeted training during interventions (Brown & Ryan, 2003; Carmody & Baer, 2008). As these are speculative suggestions, research is needed to provide evidence of their merits within a clinical study. Furthermore, research should explore whether the link between needs frustration and PVG depends on the type of video games one primarily plays.

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Table 1.

Correlation Matrix Presenting the Associations Among Gender, Hours Spent Gaming, Problematic Video Gaming, Gaming Motivations, and Needs Frustration

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1. Gender (Males = 1; Females = 2)	-									
2. Hours Gaming	-.26***	-								
3. Problematic Video Gaming	-.04	.24***	-							
4. Integrated-Identified	-.10***	.36***	.38***	-						
5. Introjected	-.02	.24***	.65***	.47***	-					
6. External	-.07	.19***	.36***	.38	.42***	-				
7. Amotivation	-.03	.12***	.48***	.04***	.50***	.13	-			
8. Competence Frustration	.20***	.03	.36***	.12***	.35***	.09	.29***	-		
9. Autonomy Frustration	.15***	.04	.37***	.11***	.33***	.10	.31***	.73***	-	
10. Relatedness Frustration	.20***	.01	.28***	.08	.28***	.03	.27***	.76***	.67***	-
Mean	-	19.71	2.19	3.15	1.93	3.52	1.94	2.71	2.63	2.48
Standard Deviation	-	15.33	0.84	1.44	1.14	1.51	1.33	1.28	1.62	1.32

$^{***}p < .001$ (Bonferroni adjusted alpha)

Table 2.

Fit Statistics for the Proposed Models Presented in Figure 1 Explaining the Roles of Gaming Motivations and the Frustration of Basic Needs in Explaining Problematic Gaming

	χ^2	*df*	*CFI*	*TLI*	*SRMR*	*RMSEA [90CI]*	*AIC*	*BIC*
Model A	42.51	11	.99	.96	.04	.05 [.04, .07]	32569.42	32835.98
Model B	40.13	11	.99	.96	.04	.05 [.03, .07]	32567.79	32834.35
Model C$^{*\wedge\#}$	20.72	11	1.00	.99	.01	.03 [.01, .05]	32547.07	32813.63

[*] Indicates the lowest AIC of all the models

[^] Indicates the lowest BIC of all the models

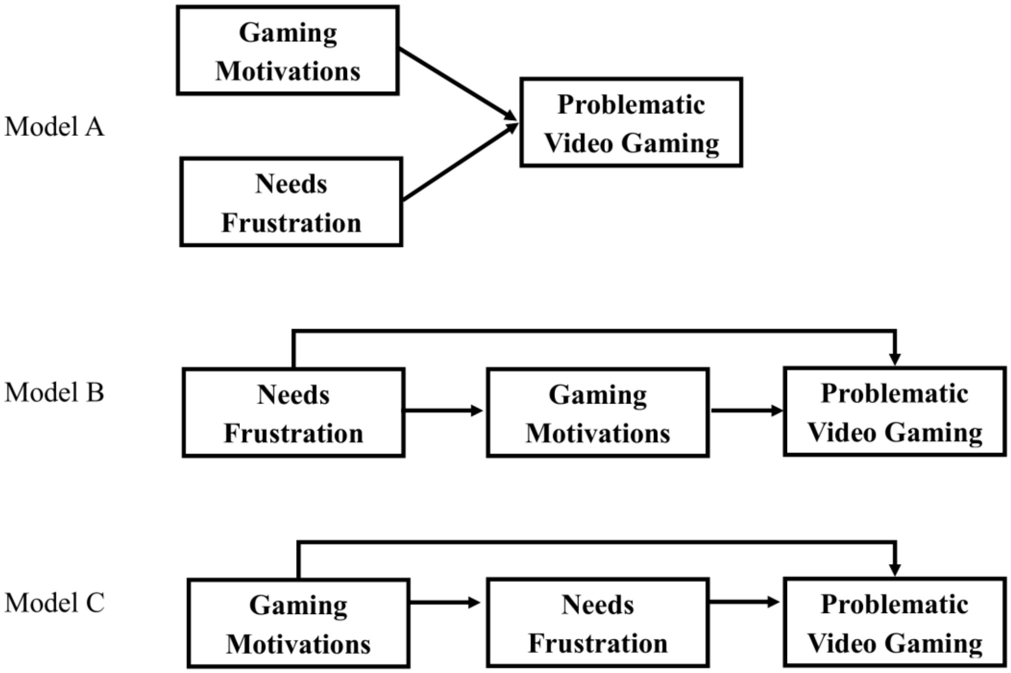

Figure 1. Proposed models depicting the associations among gaming motivations, needs frustration, and problematic gaming.

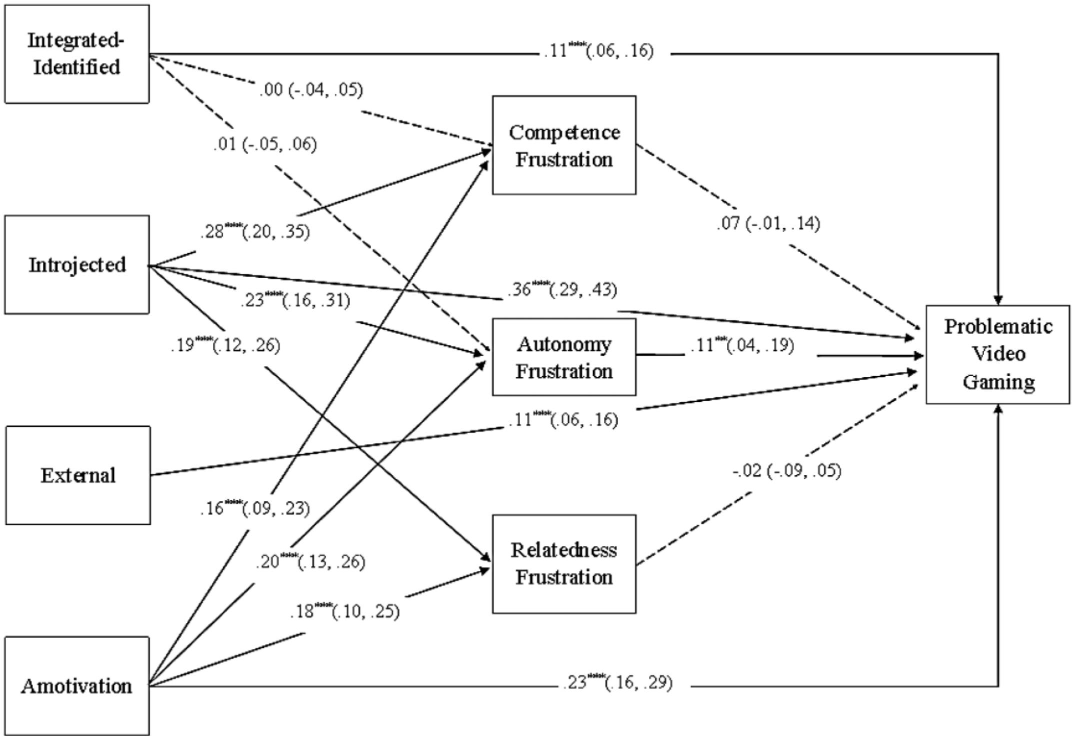

Figure 2. Path estimates for Model C. Correlations among the four gaming motivations as well as the frustration of each basic psychological need were not included for simplicity. Dash lines represent nonsignificant estimates. Significant estimates are indicated by a solid line and an (*). Confidence intervals (95%) are provided in parentheses.

* $p < .05$; ** $p < .01$; *** $p < .001$

Supplemental Material for the Article Titled:

Gaming motivation and problematic gaming: The role of needs frustration

Online Publication Only

Notes: Below are codes for each latent variable. The code followed by a number indicates individual items, which are presented on the following page.

Needs Frustration Coding:

COMP = Competence Frustration Subscale

AUT = Autonomy Frustration Subscale

REL = Relatedness Frustration Subscale

Gaming Motivation Coding:

INTG_ID = Integrated & Identified Regulation Subscales

INTRO = Introjected Regulation Subscale

EXT = External Regulation Subscale

AM = Amotivation Subscale

Problematic Gaming Coding:

PVGU = Problematic Gaming

Items from the measures that were included in the present study

AUT1	I feel forced to follow decisions made for me
AUT2	I feel pushed to behave in certain ways
AUT3	I feel prevented from making choices
AUT4	I feel under pressure to follow another's plan for me
COMP1	There are situations where I am made to feel inadequate
COMP2	There are times when I am told things that make me feel incompetent
COMP3	Situations occur in which I am made to feel incapable
*COMP4	I feel inadequate because I am not given opportunities to fulfill my potential
REL1	I feel others can be dismissive of me
**REL2	I feel that other people are envious when I achieve success
REL3	I feel other people dislike me
REL4	I feel I am rejected by those around me
PVGU1	During the last year, how often have you been feeling miserable when you were unable to play a game?
PVGU2	During the last year, how often have there been periods when all you could think of was the moment that you could play a game?
PVGU3	During the last year, how often have you felt unsatisfied because you wanted to play more?
PVGU4	During the last year, how often have you lost interest in hobbies or other activities because gaming is all you wanted to do?
PVGU5	During the last year, how often have you experienced serious conflicts with family, friends or partner because of gaming?
PVGU6	During the last year, how often have you hidden the time you spend on games from others?
PVGU7	During the last year, how often have you had arguments with others about the consequences of your gaming behavior?
PVGU8	During the last year, how often were you unable to reduce your time playing games, after others had repeatedly told you to play less?
PVGU9	During the last year, how often have you played games so that you would not have to think about annoying things?
*IM1	Because it is stimulating to play.

*IM2	For the pleasure of trying/experiencing new game options (e.g., classes, characters, teams, races, equipment)
*IM3	For the feeling of efficacy I experience when I play
INTG1	Because it is an extension of Me
INTG2	Because it is an integral part of my life
INTG3	Because it is aligned with my personal values
ID1	Because it is a good way to develop important aspects of myself
ID2	Because it is a good way to develop social and intellectual abilities that are useful to me
ID3	Because it has personal significance to me
INTR1	Because I feel that I must play regularly
INTR2	Because I must play to feel good about myself
INTR3	Because otherwise I would feel bad about myself
EXT1	To acquire powerful and rare items (e.g., armors, weapons) and virtual currency (e.g., gold pieces, gems) or to unlock hidden/restricted elements of the game (e.g., new characters, equipment, maps)
EXT2	For the prestige of being a good player
EXT3	To gain in-game awards and trophies or character/avatar's levels and experiences points
AM1	It is not clear anymore; I sometimes ask myself if it is good for me
AM2	I used to have good reasons, but now I am asking myself if I should continue
AM3	Honestly, I don't know; I have the impression that I'm wasting my time

* Included in the study, but excluded following a confirmation of the factor structure
** An original item in the PNTS that was not included in present study.

Preliminary Analyses

Initial model fit of Internet Gaming Disorder Scale:

χ^2(82) = 417.91, p = < .001
RMSEA = .12, 90CI [.11, .13]
CFI = .84
TLI = .78
SRMR = .06

Internet Gaming Disorder Scale: Confirmatory Factor Analysis Following Modifications

Notes: The inclusion of the highlighted (in yellow) correlations was suggested based on the provided modification indices. Each of these items hint at the affect their gaming engagement has had upon their relationships, specifically confrontations (e.g., arguments friends, family, or partners; being told to cut back in gaming). The input and output of the final model is provided below.

MODEL INPUT:

```
Analysis:
        ESTIMATOR = MLR

Model:
        PVGU BY PVGU6 PVGU2 PVGU3 PVGU4 PVGU5 PVGU1 PVGU7 PVGU8 PVGU9;
        PVGU8     WITH PVGU5;
        PVGU8     WITH PVGU7;
        PVGU7     WITH PVGU5;
```

MODEL FIT INFORMATION: FOLLOWING APPLICATION OF MODIFICATIONS

```
Chi-Square Test of Model Fit

        Value                        113.741*
        Degrees of Freedom                24
        P-Value                       0.0000
        Scaling Correction Factor     1.2887
          for MLR

*   The chi-square value for MLM, MLMV, MLR, ULSMV, WLSM and WLSMV cannot be
used for chi-square difference testing in the regular way.  MLM, MLR and WLSM chi-square
difference testing is described on the Mplus website.  MLMV, WLSMV, and ULSMV difference
testing is done using the DIFFTEST option.
```

```
RMSEA (Root Mean Square Error Of Approximation)

          Estimate                         0.060
          90 Percent C.I.                    0.049  0.072
          Probability RMSEA <= .05           0.059

CFI/TLI

          CFI                            0.963
          TLI                            0.944

Chi-Square Test of Model Fit for the Baseline Model

          Value                        2450.575
          Degrees of Freedom                 36
          P-Value                        0.0000

SRMR (Standardized Root Mean Square Residual)

          Value                          0.036

STANDARDIZED MODEL RESULTS:  STDYX Standardization

                                                Two-Tailed
                    Estimate       S.E.  Est./S.E.    P-Value

 PVGU       BY
    PVGU6              0.690      0.020     33.890      0.000
    PVGU2              0.738      0.021     34.476      0.000
    PVGU3              0.514      0.028     18.557      0.000
    PVGU4              0.521      0.031     16.883      0.000
    PVGU5              0.621      0.029     21.760      0.000
    PVGU1              0.689      0.022     30.692      0.000
    PVGU7              0.509      0.032     15.811      0.000
    PVGU8              0.575      0.029     19.636      0.000
    PVGU9              0.671      0.023     28.885      0.000


 PVGU8      WITH
    PVGU5              0.580      0.037     15.569      0.000
    PVGU7              0.370      0.038      9.630      0.000
```

```
 PVGU7    WITH
    PVGU5          0.256      0.040      6.474      0.000

 Intercepts
    PVGU1          2.043      0.039     52.548      0.000
    PVGU2          1.791      0.033     53.936      0.000
    PVGU3          2.417      0.054     44.948      0.000
    PVGU4          1.523      0.024     62.929      0.000
    PVGU5          1.564      0.032     49.152      0.000
    PVGU6          1.967      0.036     54.776      0.000
    PVGU7          1.368      0.021     64.161      0.000
    PVGU8          1.491      0.029     50.727      0.000
    PVGU9          1.599      0.025     63.929      0.000

 Variances
    PVGU           1.000      0.000    999.000    999.000

 Residual Variances
    PVGU1          0.526      0.031     17.006      0.000
    PVGU2          0.456      0.032     14.450      0.000
    PVGU3          0.736      0.028     25.830      0.000
    PVGU4          0.729      0.032     22.667      0.000
    PVGU5          0.615      0.035     17.348      0.000
    PVGU6          0.524      0.028     18.628      0.000
    PVGU7          0.741      0.033     22.622      0.000
    PVGU8          0.669      0.034     19.830      0.000
    PVGU9          0.549      0.031     17.613      0.000
```

Initial model fit of Psychological Need Thwarting Scale:

$\chi^2(82) = 319.21$, $p = < .001$
RMSEA = .08, 90CI [.07, .09]
CFI = .95
TLI = .93
SRMR = .04

Psychological Need Thwarting Scale: Confirmatory Factor Analysis Following Modifications

Notes: Although initially adequate, the RMSEA was concerning requiring a review of the individual loadings. COMP4 was found to load poorly (.11) in the initial CFA alluding to its exclusion (as shown in red). The inclusion of the highlighted (in yellow) correlation was suggested based on provided modification indices. The input and output of the final model is provided below.

MODEL INPUT:

Analysis:
ESTIMATOR = MLR

Model:
COMP BY COMP1 COMP2 COMP3 ~~COMP4~~;
AUT BY AUT1 AUT4 AUT2 AUT3;
REL BY REL1 REL2 REL3;
AUT4 WITH AUT1;

MODEL FIT INFORMATION: FOLLOWING APPLICATION OF MODIFICATIONS

Chi-Square Test of Model Fit

```
Value                       214.283*
Degrees of Freedom               40
P-Value                      0.0000
Scaling Correction Factor     1.3415
  for MLR
```

* The chi-square value for MLM, MLMV, MLR, ULSMV, WLSM and WLSMV cannot be used for chi-square difference testing in the regular way. MLM, MLR and WLSM chi-square difference testing is described on the Mplus website. MLMV, WLSMV, and ULSMV difference testing is done using the DIFFTEST option.

```
RMSEA (Root Mean Square Error Of Approximation)

          Estimate                        0.066
          90 Percent C.I.                   0.058  0.075
          Probability RMSEA <= .05          0.001

CFI/TLI

          CFI                             0.968
          TLI                             0.956

Chi-Square Test of Model Fit for the Baseline Model

          Value                        5551.988
          Degrees of Freedom                 55
          P-Value                        0.0000

SRMR (Standardized Root Mean Square Residual)

          Value                           0.030

STANDARDIZED MODEL RESULTS:  STDYX Standardization

                                            Two-Tailed
                   Estimate       S.E.  Est./S.E.    P-Value

 COMP     BY
    COMP1             0.895      0.015     56.897      0.000
    COMP2             0.828      0.013     61.869      0.000
    COMP3             0.831      0.010     88.570      0.000

 AUT      BY
    AUT1              0.843      0.020     36.472      0.000
    AUT2              0.754      0.020     37.276      0.000
    AUT3              0.743      0.014     59.489      0.000
    AUT4              0.790      0.016     48.042      0.000


 REL      BY
    REL1              0.866      0.012     72.632      0.000
    REL3              0.840      0.016     52.877      0.000
    REL4              0.853      0.014     62.309      0.000
```

```
AUT      WITH
   COMP             0.850      0.018     46.567      0.000

REL      WITH
   COMP             0.861      0.018     47.704      0.000
   AUT              0.794      0.022     36.178      0.000

AUT4     WITH
   AUT1             0.429      0.043      9.948      0.000

Intercepts
   COMP1            1.978      0.037     53.211      0.000
   COMP2            1.927      0.036     53.877      0.000
   COMP3            1.833      0.033     55.289      0.000
   AUT1             1.777      0.031     56.625      0.000
   AUT2             1.817      0.032     56.702      0.000
   AUT3             1.761      0.031     56.163      0.000
   AUT4             1.953      0.037     52.569      0.000
   REL1             1.643      0.028     58.923      0.000
   REL3             1.792      0.032     55.362      0.000
   REL4             1.904      0.036     53.045      0.000

Variances
   COMP             1.000      0.000    999.000    999.000
   AUT              1.000      0.000    999.000    999.000
   REL              1.000      0.000    999.000    999.000

Residual Variances
   COMP1            0.312      0.024     12.920      0.000
   COMP2            0.310      0.022     13.878      0.000
   COMP3            0.195      0.018     10.711      0.000
   AUT1             0.448      0.030     14.806      0.000
   AUT2             0.431      0.031     14.143      0.000
   AUT3             0.290      0.024     12.147      0.000
   AUT4             0.376      0.026     14.450      0.000
   REL1             0.250      0.021     12.097      0.000
   REL3             0.294      0.027     11.029      0.000
   REL4             0.272      0.023     11.661      0.000
```

Initial model fit of Gaming Motivation Scale:

$\chi^2(82) = 81781$, $p = < .001$
RMSEA = .08, 90CI [.07, .08]
CFI = .90
TLI = .87
SRMR = .07

Gaming Motivation Scale: Confirmatory Factor Analysis Following Modifications

Notes: Several modifications were made to the initial model, however, the fit indices did not ever reach a satisfactory level. Moreover, the inclusion of these modifications resulted in issues with the model becoming not positive definite. Therefore, given the low Cronbach alpha observed for the intrinsic motivation subscale (α = .60), it was possible that the items were not loading on to their correct factors. Thus, the data was included in an exploratory factor analysis (EFA) with a Promax rotation in order to assess factor loadings.

Two issues were identified immediately within the results of the EFA. First, only three factors provided eigenvalues greater than 1. Second, the intrinsic motivation items loaded poorly onto a common factor with one item (IM2) loading more highly onto a factor with items representing external regulation. Therefore, the intrinsic motivation subscale was excluded completely, and the EFA was conducted again with the remaining 15 items.

Results from the second EFA once again suggested only three factors provided eigenvalues greater than 1 within items from the integrated regulation and identified regulation loading on a common factor and external regulation and amotivation loading on unique factors. Items from the introjected regulation subscale weakly crossloaded onto factors representing integrated-identified regulation and amotivation. Therefore, it was not possible to confirm this model.

Although the eigenvalue was under 1, including the fourth factor allowed for introjected regulation to load onto its own factor. Moreover, it significantly reduced item loading residuals.

As such, the four-factor solution was confirmed using a CFA. At first, the data did not fit the model well (χ2(82) = 626.59, p = < .001; RMSEA = .08, 90CI [.07, .09]; CFI = .90; TLI = .88; SRMR = .08), however, the inclusion of the highlighted (in yellow) correlations, as suggested based on modification indices, adequate fit was obtained. The input and output of the final model is provided below.

MODEL INPUT:

```
Analysis:
      ESTIMATOR = MLR

 Model:
      INTG_ID BY INTG1 INTG2 INTG3 ID1 ID2 ID3;
      INTROJ BY INTR1 INTR2 INTR3;
      EXT BY EXT2 EXT1 EXT3;
      AM BY AM1 AM2 AM3;
      ID2 WITH ID1;
      EXT3 WITH EXT1;
      INTR3 WITH INTR2;
```

MODEL FIT INFORMATION: FOLLOWING APPLICATION OF MODIFICATIONS

```
Chi-Square Test of Model Fit

     Value                        307.072*
     Degrees of Freedom                 81
     P-Value                        0.0000
     Scaling Correction Factor      1.2152
       for MLR

*   The chi-square value for MLM, MLMV, MLR, ULSMV, WLSM and WLSMV cannot be
used for chi-square difference testing in the regular way.  MLM, MLR and WLSM chi-square
difference testing is described on the Mplus website.  MLMV, WLSMV, and ULSMV difference
testing is done using the DIFFTEST option.

RMSEA (Root Mean Square Error Of Approximation)

     Estimate                       0.052
     90 Percent C.I.                  0.046  0.058
     Probability RMSEA <= .05                0.280

CFI/TLI

     CFI                          0.959
     TLI                          0.947

Chi-Square Test of Model Fit for the Baseline Model
```

```
          Value                   5647.377
          Degrees of Freedom            105
          P-Value                   0.0000

SRMR (Standardized Root Mean Square Residual)

          Value                      0.048

STANDARDIZED MODEL RESULTS:  STDYX Standardization

                                     Two-Tailed
               Estimate      S.E.  Est./S.E.    P-Value

 INTG_ID  BY
    INTG1           0.819      0.015     53.475      0.000
    INTG2           0.826      0.015     54.886      0.000
    INTG3           0.787      0.017     45.670      0.000
    ID1           0.662      0.023     29.286      0.000
    ID2           0.556      0.027     20.917      0.000
    ID3           0.760      0.017     44.160      0.000


 INTROJ   BY
    INTR1           0.725      0.025     28.594      0.000
    INTR2           0.661      0.026     25.057      0.000
    INTR3           0.583      0.034     17.058      0.000

 EXT   BY
    EXT2            0.668      0.037     17.973      0.000
    EXT1            0.452      0.037     12.294      0.000
    EXT3            0.476      0.037     12.695      0.000

 AM       BY
    AM1             0.872      0.017     50.972      0.000
    AM2             0.860      0.020     42.101      0.000
    AM3             0.765      0.025     30.263      0.000

 INTROJ   WITH
    INTG_ID          0.648      0.032     20.306      0.000

 EXT   WITH
    INTG_ID          0.629      0.041     15.433      0.000
    INTROJ          0.768      0.049     15.811      0.000
```

```
AM       WITH
   INTG_ID          0.112      0.037      3.025      0.002
   INTROJ           0.653      0.040     16.421      0.000
   EXT              0.200      0.049      4.115      0.000

ID2      WITH
   ID1              0.422      0.034     12.509      0.000

EXT3     WITH
   EXT1             0.606      0.027     22.212      0.000

INTR3    WITH
   INTR2            0.321      0.049      6.490      0.000

Intercepts
   INTG1            1.650      0.030     55.546      0.000
   INTG2            1.713      0.032     54.334      0.000
   INTG3            1.628      0.029     55.846      0.000
   ID1              1.741      0.031     55.292      0.000
   ID2              1.773      0.033     53.284      0.000
   ID3              1.871      0.038     49.379      0.000
   INTR1            1.493      0.026     56.996      0.000
   INTR2            1.299      0.020     64.053      0.000
   INTR3            1.340      0.035     38.624      0.000
   EXT1             1.892      0.037     50.661      0.000
   EXT2             1.774      0.035     50.567      0.000
   EXT3             1.845      0.037     50.146      0.000
   AM1              1.303      0.021     61.180      0.000
   AM2              1.279      0.024     52.830      0.000
   AM3              1.306      0.022     59.658      0.000

Variances
   INTG_ID          1.000      0.000    999.000    999.000
   INTROJ           1.000      0.000    999.000    999.000
   EXT              1.000      0.000    999.000    999.000
   AM               1.000      0.000    999.000    999.000

Residual Variances
   INTG1            0.330      0.025     13.140      0.000
   INTG2            0.318      0.025     12.806      0.000
   INTG3            0.381      0.027     14.039      0.000
   ID1              0.562      0.030     18.818      0.000
```

ID2	0.691	0.030	23.401	0.000
ID3	0.422	0.026	16.130	0.000
INTR1	0.474	0.037	12.872	0.000
INTR2	0.563	0.035	16.115	0.000
INTR3	0.660	0.040	16.568	0.000
EXT1	0.795	0.033	23.889	0.000
EXT2	0.554	0.050	11.143	0.000
EXT3	0.773	0.036	21.675	0.000
AM1	0.239	0.030	8.014	0.000
AM2	0.260	0.035	7.381	0.000
AM3	0.415	0.039	10.752	0.000

Primary Analyses

Model A: Path Analysis

MODEL INPUT:

```
Analysis:
      ESTIMATOR = MLR

Model:
      COMP WITH REL AUT INTG_ID INTRO AM;
      AUT WITH REL INTG_ID INTRO AM;
      REL WITH INTRO AM;
      INTG_ID WITH INTRO EXT AM;
      INTRO WITH EXT AM;
      EXT WITH AM;
      GENDER WITH HOURS;
      COMP ON GENDER;
      AUT ON GENDER;
      REL ON GENDER;
      INTG_ID ON HOURS GENDER;
      INTRO ON HOURS;
      EXT ON HOURS;
      AM ON HOURS;
      PVGU ON COMP REL AUT INTG_ID INTRO EXT AM HOURS;
```

MODEL FIT INFORMATION:

```
Number of Free Parameters                54

Loglikelihood

     H0 Value                  -16230.710
     H0 Scaling Correction Factor      1.2168
      for MLR
     H1 Value                  -16208.904
     H1 Scaling Correction Factor      1.1844
      for MLR
```

```
Information Criteria

          Akaike (AIC)                    32569.419
          Bayesian (BIC)                  32835.982
          Sample-Size Adjusted BIC        32664.472
            (n* = (n + 2) / 24)

Chi-Square Test of Model Fit

          Value                              42.513*
          Degrees of Freedom                     11
          P-Value                            0.0000
          Scaling Correction Factor          1.0258
            for MLR

*   The chi-square value for MLM, MLMV, MLR, ULSMV, WLSM and WLSMV cannot be
used for chi-square difference testing in the regular way.  MLM, MLR and WLSM chi-square
difference testing is described on the Mplus website.  MLMV, WLSMV, and ULSMV difference
testing is done using the DIFFTEST option.

RMSEA (Root Mean Square Error Of Approximation)

          Estimate                           0.053
          90 Percent C.I.                    0.037  0.070
          Probability RMSEA <= .05           0.363

CFI/TLI

          CFI                                0.990
          TLI                                0.958

Chi-Square Test of Model Fit for the Baseline Model

          Value                           3051.935
          Degrees of Freedom                     44
          P-Value                            0.0000

SRMR (Standardized Root Mean Square Residual)

          Value                              0.042
```

```
STANDARDIZED MODEL RESULTS:  STDYX Standardization

                                          Two-Tailed
                Estimate       S.E.  Est./S.E.    P-Value

 COMP     ON
    GENDER          0.195      0.031      6.338      0.000

 AUT      ON
    GENDER          0.145      0.030      4.791      0.000

 REL      ON
    GENDER          0.189      0.031      6.105      0.000

 INTG_ID  ON
    HOURS           0.355      0.028     12.564      0.000
    GENDER         -0.027      0.026     -1.052      0.293

 INTRO    ON
    HOURS           0.215      0.032      6.741      0.000

 EXT      ON
    HOURS           0.193      0.032      6.079      0.000

 AM       ON
    HOURS           0.088      0.032      2.710      0.007

 PVGU     ON
    COMP            0.068      0.040      1.685      0.092
    REL            -0.019      0.035     -0.546      0.585
    AUT             0.117      0.038      3.040      0.002
    INTG_ID         0.117      0.028      4.199      0.000
    INTRO           0.362      0.035     10.247      0.000
    EXT             0.113      0.026      4.297      0.000
    AM              0.232      0.034      6.771      0.000
    HOURS           0.057      0.027      2.055      0.040

 COMP     WITH
    REL             0.748      0.018     40.867      0.000
    AUT             0.723      0.019     38.930      0.000
    INTG_ID         0.042      0.022      1.889      0.059
    INTRO           0.312      0.029     10.746      0.000
    AM              0.290      0.032      9.048      0.000
```

```
AUT      WITH
   REL              0.664      0.022     30.008      0.000
   INTG_ID          0.035      0.025      1.381      0.167
   INTRO            0.286      0.029      9.896      0.000
   AM               0.304      0.030     10.072      0.000

REL      WITH
   INTRO            0.248      0.028      8.831      0.000
   AM               0.270      0.033      8.277      0.000

INTG_ID  WITH
   INTRO            0.406      0.029     13.891      0.000
   EXT              0.334      0.030     11.141      0.000
   AM              -0.026      0.032     -0.805      0.421

INTRO    WITH
   EXT              0.366      0.026     13.923      0.000
   AM               0.477      0.032     15.130      0.000

EXT      WITH
   AM               0.078      0.031      2.485      0.013

GENDER   WITH
   HOURS           -0.255      0.027     -9.492      0.000

Means
   GENDER           2.852      0.016    175.643      0.000
   HOURS            1.285      0.049     26.258      0.000

Intercepts
   PVGU             0.739      0.085      8.649      0.000
   COMP             1.561      0.096     16.251      0.000
   REL              1.337      0.095     14.052      0.000
   AUT              1.726      0.095     18.098      0.000
   INTG_ID          1.814      0.102     17.751      0.000
   INTRO            1.453      0.054     26.785      0.000
   EXT              2.081      0.064     32.586      0.000
   AM               1.346      0.052     25.889      0.000
```

```
Variances
   GENDER          1.000     0.000    999.000    999.000
   HOURS           1.000     0.000    999.000    999.000

 Residual Variances
   PVGU            0.520     0.027     19.172      0.000
   COMP            0.962     0.012     80.310      0.000
   REL             0.964     0.012     82.240      0.000
   AUT             0.979     0.009    111.261      0.000
   INTG_ID         0.868     0.020     43.519      0.000
   INTRO           0.954     0.014     69.610      0.000
   EXT             0.963     0.012     78.357      0.000
   AM              0.992     0.006    174.941      0.000


R-SQUARE

   Observed                                        Two-Tailed
   Variable        Estimate       S.E.  Est./S.E.    P-Value

   PVGU            0.480     0.027     17.719      0.000
   COMP            0.038     0.012      3.169      0.002
   REL             0.036     0.012      3.053      0.002
   AUT             0.021     0.009      2.395      0.017
   INTG_ID         0.132     0.020      6.594      0.000
   INTRO           0.046     0.014      3.371      0.001
   EXT             0.037     0.012      3.039      0.002
   AM              0.008     0.006      1.355      0.175
```

Model B: Path Analysis with Indirect Effects

```
MODEL INPUT:

Analysis:
      ESTIMATOR = MLR

Model:
      COMP WITH REL AUT;
      AUT WITH REL;
      GENDER WITH HOURS;
      COMP ON GENDER;
      AUT ON GENDER;
      REL ON GENDER;
      INTG_ID ON COMP AUT HOURS GENDER;
      INTRO ON COMP REL AUT HOURS;
      EXT ON HOURS;
      AM ON COMP REL AUT HOURS;
      INTG_ID WITH INTRO EXT AM;
      INTRO WITH EXT AM;
      EXT WITH AM;
      PVGU ON COMP REL AUT INTG_ID INTRO EXT AM HOURS;

MODEL INDIRECT:
      PVGU IND COMP;
      PVGU IND AUT;
      PVGU IND REL;


MODEL FIT INFORMATION

Number of Free Parameters               54

Loglikelihood

     H0 Value                 -16229.892
     H0 Scaling Correction Factor      1.2126
      for MLR
     H1 Value                 -16208.904
     H1 Scaling Correction Factor      1.1844
      for MLR
```

```
Information Criteria

          Akaike (AIC)                   32567.785
          Bayesian (BIC)                 32834.347
          Sample-Size Adjusted BIC       32662.837
            (n* = (n + 2) / 24)

Chi-Square Test of Model Fit

          Value                             40.125*
          Degrees of Freedom                    11
          P-Value                           0.0000
          Scaling Correction Factor         1.0461
            for MLR

*   The chi-square value for MLM, MLMV, MLR, ULSMV, WLSM and WLSMV cannot be used
    for chi-square difference testing in the regular way.  MLM, MLR and WLSM
    chi-square difference testing is described on the Mplus website.  MLMV, WLSMV,
    and ULSMV difference testing is done using the DIFFTEST option.

RMSEA (Root Mean Square Error Of Approximation)

          Estimate                           0.051
          90 Percent C.I.                    0.034  0.068
          Probability RMSEA <= .05           0.440

CFI/TLI

          CFI                                0.990
          TLI                                0.961

Chi-Square Test of Model Fit for the Baseline Model

          Value                           3051.935
          Degrees of Freedom                    44
          P-Value                           0.0000

SRMR (Standardized Root Mean Square Residual)

          Value                              0.037
```

```
STANDARDIZED MODEL RESULTS:  STDYX Standardization

                                           Two-Tailed
                Estimate       S.E.  Est./S.E.    P-Value

 COMP     ON
    GENDER           0.201      0.032      6.300      0.000

 AUT      ON
    GENDER           0.149      0.032      4.673      0.000

 REL      ON
    GENDER           0.192      0.032      5.961      0.000

 INTG_ID  ON
    COMP             0.070      0.045      1.565      0.118
    AUT              0.024      0.043      0.574      0.566
    HOURS            0.352      0.029     12.326      0.000
    GENDER          -0.032      0.027     -1.182      0.237

 INTRO    ON
    COMP             0.211      0.044      4.772      0.000
    REL              0.018      0.038      0.476      0.634
    AUT              0.127      0.040      3.202      0.001
    HOURS            0.229      0.032      7.207      0.000

 EXT      ON
    HOURS            0.193      0.032      6.080      0.000

 AM       ON
    COMP             0.099      0.058      1.714      0.086
    REL              0.057      0.052      1.101      0.271
    AUT              0.182      0.047      3.881      0.000
    HOURS            0.105      0.032      3.230      0.001

 PVGU     ON
    COMP             0.068      0.040      1.687      0.092
    REL             -0.019      0.035     -0.550      0.583
    AUT              0.116      0.038      3.037      0.002
    INTG_ID          0.115      0.028      4.179      0.000
    INTRO            0.363      0.035     10.264      0.000
    EXT              0.113      0.026      4.303      0.000
    AM               0.231      0.034      6.761      0.000
```

```
    HOURS              0.056      0.027      2.056      0.040

 COMP     WITH
    REL                0.749      0.018     41.269      0.000
    AUT                0.724      0.018     39.148      0.000

 AUT      WITH
    REL                0.665      0.022     30.355      0.000

 GENDER   WITH
    HOURS             -0.255      0.027     -9.514      0.000

 INTG_ID  WITH
    INTRO              0.413      0.030     13.804      0.000
    EXT                0.336      0.030     11.266      0.000
    AM                -0.040      0.034     -1.162      0.245

 INTRO    WITH
    EXT                0.389      0.027     14.657      0.000
    AM                 0.422      0.036     11.783      0.000

 EXT      WITH
    AM                 0.085      0.033      2.559      0.010

 Means
    GENDER             2.852      0.016    178.481      0.000
    HOURS              1.285      0.049     26.258      0.000

 Intercepts
    PVGU               0.738      0.085      8.645      0.000
    COMP               1.537      0.101     15.278      0.000
    REL                1.328      0.100     13.303      0.000
    AUT                1.710      0.100     17.049      0.000
    INTG_ID            1.637      0.112     14.559      0.000
    INTRO              0.678      0.075      9.077      0.000
    EXT                2.081      0.064     32.583      0.000
    AM                 0.620      0.084      7.367      0.000

 Variances
    GENDER             1.000      0.000    999.000    999.000
    HOURS              1.000      0.000    999.000    999.000
```

```
Residual Variances
   PVGU           0.516     0.027    18.997     0.000
   COMP           0.960     0.013    75.039     0.000
   REL            0.963     0.012    77.845     0.000
   AUT            0.978     0.010   102.896     0.000
   INTG_ID        0.866     0.020    43.695     0.000
   INTRO          0.846     0.022    38.750     0.000
   EXT            0.963     0.012    78.353     0.000
   AM             0.897     0.019    47.245     0.000

R-SQUARE

   Observed                                Two-Tailed
   Variable        Estimate       S.E.  Est./S.E.    P-Value

   PVGU           0.484     0.027    17.791     0.000
   COMP           0.040     0.013     3.150     0.002
   REL            0.037     0.012     2.981     0.003
   AUT            0.022     0.010     2.337     0.019
   INTG_ID        0.134     0.020     6.780     0.000
   INTRO          0.154     0.022     7.043     0.000
   EXT            0.037     0.012     3.040     0.002
   AM             0.103     0.019     5.437     0.000

STANDARDIZED TOTAL, TOTAL INDIRECT, SPECIFIC INDIRECT, AND DIRECT
EFFECTS:  STDYX Standardization


                                       Two-Tailed
                 Estimate       S.E.  Est./S.E.    P-Value

Effects from COMP to PVGU

  Total               0.176     0.047     3.736     0.000
  Total indirect      0.108     0.026     4.144     0.000

  Specific indirect

   PVGU
   INTG_ID
   COMP           0.008     0.006     1.475     0.140
```

```
    PVGU
    INTRO
    COMP              0.077      0.017      4.484      0.000

    PVGU
    AM
    COMP              0.023      0.014      1.629      0.103

  Direct
    PVGU
    COMP              0.068      0.040      1.687      0.092


Effects from AUT to PVGU

  Total             0.207      0.045      4.647      0.000
  Total indirect      0.091      0.023      3.984      0.000

  Specific indirect

    PVGU
    INTG_ID
    AUT             0.003      0.005      0.568      0.570

    PVGU
    INTRO
    AUT             0.046      0.015      2.982      0.003

    PVGU
    AM
    AUT             0.042      0.012      3.449      0.001

  Direct
    PVGU
    AUT             0.116      0.038      3.037      0.002


Effects from REL to PVGU

  Total             0.000      0.043      0.007      0.994
  Total indirect      0.020      0.022      0.883      0.377
```

Specific indirect				
PVGU				
INTRO				
REL	0.007	0.014	0.475	0.635
PVGU				
AM				
REL	0.013	0.012	1.102	0.271
Direct				
PVGU				
REL	-0.019	0.035	-0.550	0.583

Model C: Path Analysis with Indirect Effects

```
MODEL INPUT:

Analysis:
        ESTIMATOR = MLR

Model:
        INTG_ID WITH INTRO EXT AM;
        INTRO WITH EXT AM;
        EXT WITH AM;
        GENDER WITH HOURS;
        COMP ON INTG_ID INTRO AM GENDER;
        AUT ON INTG_ID INTRO AM GENDER;
        REL ON INTRO AM GENDER;
        COMP WITH REL AUT ;
        AUT WITH REL;
        INTG_ID ON HOURS GENDER;
        INTRO ON HOURS;
        EXT ON HOURS;
        AM ON HOURS;
        PVGU ON COMP REL AUT INTG_ID INTRO EXT AM HOURS;

MODEL INDIRECT:
        PVGU IND INTG_ID;
        PVGU IND INTRO;
        PVGU IND AM;

MODEL FIT INFORMATION:

Number of Free Parameters                54

Loglikelihood

      H0 Value                  -16219.535
      H0 Scaling Correction Factor       1.2167
        for MLR
      H1 Value                  -16208.904
      H1 Scaling Correction Factor       1.1844
        for MLR
```

```
Information Criteria

          Akaike (AIC)                32547.069
          Bayesian (BIC)              32813.632
          Sample-Size Adjusted BIC    32642.122
            (n* = (n + 2) / 24)

Chi-Square Test of Model Fit

          Value                          20.716*
          Degrees of Freedom                  11
          P-Value                         0.0364
          Scaling Correction Factor       1.0263
            for MLR

*   The chi-square value for MLM, MLMV, MLR, ULSMV, WLSM and WLSMV cannot be
used for chi-square difference testing in the regular way.  MLM, MLR and WLSM chi-square
difference testing is described on the Mplus website.  MLMV, WLSMV, and ULSMV difference
testing is done using the DIFFTEST option.

RMSEA (Root Mean Square Error Of Approximation)

          Estimate                         0.029
          90 Percent C.I.                  0.007  0.048
          Probability RMSEA <= .05         0.963

CFI/TLI

          CFI                              0.997
          TLI                              0.987

Chi-Square Test of Model Fit for the Baseline Model

          Value                         3051.935
          Degrees of Freedom                  44
          P-Value                         0.0000

SRMR (Standardized Root Mean Square Residual)

          Value                            0.014
```

```
STANDARDIZED MODEL RESULTS:  STDYX Standardization

                                        Two-Tailed
               Estimate      S.E.  Est./S.E.    P-Value

 COMP     ON
   INTG_ID         0.004      0.023      0.179      0.858
   INTRO           0.275      0.038      7.203      0.000
   AM              0.160      0.037      4.336      0.000
   GENDER          0.215      0.030      7.093      0.000

 AUT      ON
   INTG_ID         0.005      0.028      0.171      0.864
   INTRO           0.234      0.040      5.806      0.000
   AM              0.195      0.036      5.461      0.000
   GENDER          0.163      0.030      5.458      0.000

 REL      ON
   INTRO           0.194      0.036      5.461      0.000
   AM              0.175      0.037      4.689      0.000
   GENDER          0.205      0.031      6.626      0.000

 INTG_ID  ON
   HOURS           0.355      0.028     12.587      0.000
   GENDER         -0.028      0.026     -1.090      0.276

 INTRO    ON
   HOURS           0.239      0.035      6.866      0.000

 EXT      ON
   HOURS           0.193      0.032      6.071      0.000

 AM       ON
   HOURS           0.117      0.034      3.434      0.001

 PVGU     ON
   COMP            0.067      0.040      1.680      0.093
   REL            -0.019      0.035     -0.553      0.580
   AUT             0.114      0.038      3.040      0.002
   INTG_ID         0.114      0.027      4.183      0.000
   INTRO           0.363      0.035     10.249      0.000
   EXT             0.110      0.026      4.263      0.000
   AM              0.228      0.034      6.739      0.000
```

```
    HOURS              0.055      0.027      2.052      0.040

 INTG_ID  WITH
    INTRO              0.426      0.029     14.590      0.000
    EXT                0.342      0.030     11.556      0.000
    AM                 0.000      0.033     -0.010      0.992

 INTRO    WITH
    EXT                0.391      0.026     15.006      0.000
    AM                 0.485      0.032     15.325      0.000

 EXT      WITH
    AM                 0.106      0.032      3.273      0.001

 GENDER   WITH
    HOURS             -0.256      0.027     -9.468      0.000

 COMP     WITH
    REL                0.716      0.020     35.036      0.000
    AUT                0.677      0.022     31.063      0.000

 AUT      WITH
    REL                0.619      0.024     25.294      0.000

 Means
    GENDER             2.851      0.017    171.945      0.000
    HOURS              1.285      0.049     26.258      0.000

 Intercepts
    PVGU               0.728      0.085      8.609      0.000
    COMP               0.795      0.119      6.669      0.000
    REL                0.711      0.112      6.330      0.000
    AUT                0.983      0.116      8.498      0.000
    INTG_ID            1.811      0.101     17.858      0.000
    INTRO              1.385      0.057     24.268      0.000
    EXT                2.082      0.064     32.600      0.000
    AM                 1.302      0.055     23.798      0.000

 Variances
    GENDER             1.000      0.000    999.000    999.000
    HOURS              1.000      0.000    999.000    999.000
```

```
Residual Variances
   PVGU            0.500      0.027     18.282      0.000
   COMP            0.818      0.024     33.853      0.000
   REL             0.863      0.022     39.104      0.000
   AUT             0.841      0.022     38.414      0.000
   INTG_ID         0.868      0.020     43.572      0.000
   INTRO           0.943      0.017     56.513      0.000
   EXT             0.963      0.012     78.440      0.000
   AM              0.986      0.008    122.820      0.000

R-SQUARE

   Observed                                        Two-Tailed
   Variable        Estimate       S.E.  Est./S.E.    P-Value

   PVGU            0.500      0.027     18.298      0.000
   COMP            0.182      0.024      7.557      0.000
   REL             0.137      0.022      6.207      0.000
   AUT             0.159      0.022      7.243      0.000
   INTG_ID         0.132      0.020      6.612      0.000
   INTRO           0.057      0.017      3.433      0.001
   EXT             0.037      0.012      3.035      0.002
   AM              0.014      0.008      1.717      0.086

STANDARDIZED TOTAL, TOTAL INDIRECT, SPECIFIC INDIRECT, AND DIRECT
EFFECTS

STDYX Standardization

                                                   Two-Tailed
                   Estimate       S.E.  Est./S.E.    P-Value

Effects from INTG_ID to PVGU

  Total                0.115      0.028      4.183      0.000
  Total indirect       0.001      0.004      0.198      0.843

  Specific indirect

   PVGU
   COMP
   INTG_ID             0.000      0.002      0.178      0.859
```

```
    PVGU
    AUT
    INTG_ID           0.001      0.003      0.170      0.865

  Direct
    PVGU
    INTG_ID           0.114      0.027      4.183      0.000


Effects from INTRO to PVGU

  Total               0.405      0.036     11.338      0.000
  Total indirect      0.041      0.010      4.261      0.000

  Specific indirect

    PVGU
    COMP
    INTRO             0.018      0.011      1.617      0.106

    PVGU
    REL
    INTRO            -0.004      0.007     -0.554      0.580

    PVGU
    AUT
    INTRO             0.027      0.010      2.723      0.006

  Direct
    PVGU
    INTRO             0.363      0.035     10.249      0.000


Effects from AM to PVGU

  Total               0.258      0.033      7.778      0.000
  Total indirect      0.030      0.008      3.818      0.000

  Specific indirect

    PVGU
    COMP
    AM                0.011      0.007      1.587      0.113
```

PVGU				
REL				
AM	-0.003	0.006	-0.546	0.585
PVGU				
AUT				
AM	0.022	0.009	2.614	0.009
Direct				
PVGU				
AM	0.228	0.034	6.739	0.000