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# The cross-cultural expression of internet gaming distress in North America, Europe, and China

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## ABSTRACT

We compare the forms online gaming-related distress takes cross-culturally, and examine how much such distress resembles the World Health Organization's (WHO) "Gaming disorder," understood to be an "addiction." Our preliminary exploratory factor analysis (EFA) in North America (n = 2025), Europe (n = 1198), and China (n = 841) revealed a constant four-factor structure across the three regions, with classic "addiction" symptoms always clustering together on the first and most important factor, though with some variability in regional factors' exact item composition. In the present study, we use second-order confirmatory factor analysis (CFA) to further examine this factor structure and the cultural similarities and differences. Specifically, we focus on confirming the regional structure and composition of an ethnographically developed 21-item gaming distress scale, which contains a wider symptoms pool than typical gaming disorder scales, and thus allows us to better separate generalized gaming distress's "addictive" from other culturally-influenced "problem" experiences and behaviors in each regional case. We use propensity score matching to separate the impact on gaming-related distress of regional culture from demographic variables (North America/Europe: n = 1043 pairs; North America/China: n = 535 pairs). Although our results support current WHO formulations of gaming-related distress as an addictive disorder, we show how cultural forces can shape how "addictive" and "problem" gaming are experienced and thus psychiatrically presented in different parts of the world. In particular, generalized gaming distress's addictive and problematic dimensions seem to be shaped by culture-specific expressions of achievement motivations, social connection and disconnection, and unique psychosomatic experiences.

## 1. Introduction

On June 18th, 2018, the WHO officially recognized "Gaming disorder" as a mental health condition warranting formal inclusion in the latest edition of its diagnostic manual, the International Classification of Diseases, 11th ed. (ICD-11):

Gaming disorder is characterized by a pattern of persistent or recurrent gaming behaviour ('digital gaming' or 'video-gaming'), which may be online (i.e., over the internet) or offline, manifested by: 1) impaired control over gaming (e.g., onset, frequency, intensity, duration, termination, context); 2) increasing priority given to gaming to the extent that gaming takes precedence over other life interests and daily activities; and 3) continuation or escalation of gaming despite the occurrence of negative consequences (World

Health Organization, 2018).

This follows the American Psychiatric Association's (APA) introduction in 2013 of "Internet Gaming Disorder" (IGD) in its emerging measures appendix (Section III) of the fifth edition of its Diagnostic and Statistical Manual of Mental Disorders (DSM-5), where it still resides as "a condition warranting more clinical research and experience," not yet formally included in the manual's main book (American Psychiatric Association, 2013). Both the WHO and APA classify their gaming disorders with other addictions: for WHO, Gaming disorder is classified under "Disorders due to addictive behaviors"; for the APA, Internet Gaming Disorder is tentatively classed alongside "Substance-related and addictive disorders," akin to gambling, with the latter currently the only formally recognized behavioral addiction in the DSM-5 (American Psychiatric Association, 2013; World Health Organization, 2018).

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The proposed diagnostic categories from the APA and WHO match researcher agreement that a small percentage of videogame players (~2–5%) experience serious gaming-related problems (Pontes, Kiraly, Demetrovics, & Griffiths, 2014), which can produce functional impairment and psychological distress (Aarseth et al., 2016; Petry et al., 2014). But scholars and clinicians disagree about the utility of treating problematic internet gaming as an *addictive* disorder resembling substance abuse and problem gambling (Griffiths et al., 2016), as currently described in both the ICD-11 and DSM-5. Some argue that the addiction formulation brings clarity to a contested field of research and clinical practice, with potential therapeutic benefits to individuals suffering from gaming-related distress (Griffiths, Kuss, Lopez-Fernandez, & Pontes, 2017; Higuchi et al., 2017; Király & Demetrovics, 2017; Petry et al., 2014; Saunders et al., 2017). But others say that problem gaming is not dominated by addiction symptomology such as cognitive preoccupation, withdrawal, and tolerance (Aarseth et al., 2016; Griffiths et al., 2016; Kaptsis, King, Delfabbro, & Gradisar, 2016; Van Rooij & Prause, 2014). Instead, they show that gaming-related distress can better be assessed by attending to internet gamers' experiences of loneliness (Kim, Larose, & Peng, 2009; Nowland, Necka, & Cacioppo, 2017; Snodgrass et al., 2018), sense of personal failure (Snodgrass, Dengah, & Lacy, 2014; Yee, 2006), low life satisfaction (Cao, Sun, Wan, Hao, & Tao, 2011), need for psychosocial escape from offline stress and life problems (Kardefelt-Winther, 2014; Snodgrass et al., 2014), anger and frustration (Snodgrass et al., 2017), unhealthy "toxic" online social interactions (Consalvo, 2012; Massanari, 2017), and preexisting mental health problems related to depression and anxiety (Ko, Yen, Yen, Chen, & Chen, 2012; Kraut et al., 2002). For these researchers, "problem" online gaming represents a family of diverse responses to complex life problems, a perspective that is lost with a too narrow focus on classic addiction symptomology (Caplan, Williams, & Yee, 2009). This latter view is more generally reinforced by other work showing how common life difficulties and experiences vary across cultures, including feelings of loneliness (Putnam, 2000; Triandis, Bontempo, Villareal, Asai, & Lucca, 1988; Turkle, 2012), definitions of success and failure in life (D'Andrade, 1995; D'Andrade, 2008; D'Andrade & Strauss, 1992; Dressler, 2017; Strauss & Quinn, 1997), the proper expression of emotion (Abu-Lughod, 1986; Rosaldo, Shweder, & LeVine, 1984), ideal models of social interaction (Dressler, 2017; Roland, 1987), and even the expression of serious mental disorder (Haroz et al., 2017; Kirmayer, Gomez-Carrillo, & Veissière, 2017; Kleinman, 1988; Luhmann, Padmavati, Tharoor, & Osei, 2015a; Luhmann, Padmavati, Tharoor, & Osei, 2015b). This means that gaming distress symptoms should present differently according to sociocultural locale (Nardi, 2010; Schiano, Nardi, Debeauvais, Ducheneaut, & Yee, 2014; Snodgrass et al., 2016a), as anthropologists have shown in studies of various other forms of addiction (Lende, 2005; Raikhel & Garriott, 2013; Room, 2003; Schüll, 2012; Singer, 2012; Spradley, 1999), rather than presenting as a universal addictive gaming symptomology. As a potential way to resolve this debate, psychiatric anthropologists, cultural psychiatrists, and others have begun to explore the idea that mental disorders, including internet-related ones, are semi-coherent across cultures, possessing simultaneously both relatively constant "core" features and also culturally variable "peripheral" ones, with the two sets of symptoms and experiences potentially closely intertwined (Charlton & Danforth, 2007; King, Haagsma, Delfabbro, Gradisar, & Griffiths, 2013; Luhmann, 2011; Luhmann et al., 2015a; Snodgrass, Zhao, Lacy, Zhang, & Tate, 2018).

In the context of this general questioning of the cross-cultural similarities or differences in the expression of emotional distress, we examine the extent to which internet gaming-related problems take a similar form cross-culturally, and how much gaming-related distress resembles "addiction" in its core symptomology, as currently framed by WHO and APA. To the extent that internet game distress fits that psychiatric model, classic symptoms such as loss of control, preoccupation, withdrawal, tolerance, and conflict should both be most salient and also

cluster together in a relatively constant way across cultural settings, rooted as they have shown to be in an underlying evolved neurobiology (Lende & Smith, 2002; Leshner, 1997; Panksepp, Knutson, & Burgdorf, 2002; Sivy & Panksepp, 2011; Volkow, Fowler, & Wang, 2003). By contrast, if gaming-related distress was better conceived as a "problematic" response to culturally variable life problems and expectations, then alternate symptoms—such as loneliness, sense of failure, anger and frustration, "toxic" social interactions, and the like—might predominate over classic "addiction" symptoms in ways that produced uniquely discernible forms of suffering according to the cultural setting, as has been described by anthropologists for other forms of mental distress (Kaiser et al., 2015; Kirmayer et al., 2017; Kleinman, 1988; Kohrt & Mendenhall, 2015; Luhmann et al., 2015b; Snodgrass, Lacy, & Upadhyay, 2017; Weaver, 2017). Even if "addictive" and "problem" gaming symptoms might be empirically demonstrated to be closely intertwined with each other, as many argue (Billieux et al., 2017; Billieux, Schimmenti, Khazaal, Maurage, & Heeren, 2015; Charlton & Danforth, 2007; Griffiths et al., 2017; Kardefelt-Winther, 2014; King et al., 2013; Snodgrass et al., 2017; Snodgrass, Zhao, et al., 2018; Van Rooij & Prause, 2014), it would still be important to confirm, as we aim to do here, which sets of symptoms appear relatively constantly in different cultures and are thus "core," and which are more variable and thus in some sense "peripheral" (Charlton & Danforth, 2007; King et al., 2013; Snodgrass, Zhao, et al., 2018).

In an earlier preliminary analysis, we examined internet gaming-related distress in North America, Europe, and China, using survey data from gamers in those culture regions (North America (n = 2025), Europe (n = 1198), and China (n = 841)) (Snodgrass, Zhao, et al., 2018). Specifically, we described the three regional samples, including regional variability in responses to a 21-item scale measuring gaming-related distress, which we developed from prior ethnographic, interview, and survey analysis conducted largely in the United States (see Appendix 1 for this measure's items) (Snodgrass et al., 2017). The 21-item scale includes eight classic IGD symptoms commonly featured in existing scales (Cho et al., 2014; Petry et al., 2014; Petry & O'Brien, 2013; Pontes et al., 2014; Pontes & Griffiths, 2015), which represent validated operationalizations of WHO and APA formulations of addictive gaming, as well as 13 additional items emerging from our extensive ethnography (Snodgrass et al., 2014; Snodgrass et al., 2016a, 2016b; Snodgrass et al., 2017; Snodgrass et al., 2018; Snodgrass, Dengah, & Lacy, 2014). The traditional IGD items included: negative cognitive salience (preoccupation), withdrawal, continue to play despite problems, loss of control/relapse (reduce/stop), loss of interest in other activities, avoidance/mood modification (escape adverse moods), tolerance, and conflict (risk/lose relationships/opportunities). The additional 13 items featured experiences related to social isolation, excessive achievement motivations, playing out of social obligation in ways that compromised gaming pleasure, experiencing gaming as mentally and socially "toxic," feeling mentally and physically "drained" after long gaming sessions, experiencing gaming more like work than play, and other themes that emerged in our earlier ethnography. An exploratory factor analysis (EFA) of those 21 items, showed that in all three regions, a central feature of gamers' experiences of problem play entailed something resembling a standard conceptualization of "addictive" gaming (Aarseth et al., 2016; Cho et al., 2014; Petry et al., 2014; Pontes et al., 2014; Pontes & Griffiths, 2015). We thus argued that classic Addiction formed the "core" factor of a set of distressful gaming experiences, with other "problem" forms of play existing more peripherally in three additional factors, which we identified as, Loss of Pleasure, Regret, and Toxic Mood (Snodgrass, Zhao, et al., 2018).

We further postulated in that earlier work that achievement motivations, social connection/disconnection, and the experience that gaming leaves one feeling psychosomatically "drained" colored in culture-specific ways both "addictive" and "problem" play. The achievement motivations results resonated both with the North American emphasis on individual achievement and competition (D'Andrade,

2008), as well as with gaming studies showing links between high achievement motivations and problem play in China (Caplan et al., 2009; Snodgrass et al., 2012; Snodgrass, Dengah, Lacy, & Fagan, 2013; Yee, 2006). Those findings also suggested the importance of loneliness and social isolation in addictive and problem gaming, which echoed a now substantial body of literature (Kim et al., 2009; Nowland et al., 2017; Snodgrass et al., 2018), as well as specific descriptions of North America (Ducheneaut, Yee, Nickell, & Moore, 2006; Putnam, 2000; Turkle, 2012) and China (Qian, Hua, & Yongxi, 2016) in particular. Too, those findings echoed important relationships in China between concerns over work and life prospects, avoidance of social and other life obligations, and the feeling of being mentally and physically drained, which parallels work by medical anthropologist Arthur Kleinman and others on the embodied, somaticized, and neurasthenia-like features of Chinese “mental” suffering in the context of felt social duties (Kleinman, 1980; Kleinman, 1988; Lee, 1999; Ryder et al., 2008; Zhang & Wu, 2005).

In the current study, we go beyond that earlier study by using confirmatory factor analysis (CFA) to further examine and confirm the similarities and differences in the factor structure patterns found in different culture regions. Specifically, we posit a second-order CFA model (Reise, Moore, & Haviland, 2010; Rindskopf & Rose, 1988), with a unifying Gaming Distress primary factor at the model's highest level, and our four-factor structure proposed through original exploratory factor analysis (Snodgrass, Zhao, et al., 2018)—Addiction, Loss of Pleasure, Regret, and Toxic Mood—as separate dimensions of more generalized general gaming-related distress. Further, we seek to also confirm in our CFA whether each region's four gaming distress dimensions can be understood to be influenced by culture-specific experiences related to achievement motivation, social connection and disconnection, and psychosomatic experience, as revealed in our prior exploratory study. Based on both the literature cited above and our earlier EFA findings, we anticipate, for example, that we will confirm that North American and Chinese “addiction” experiences will be shaped by particularly strong achievement motivations and also the experience of loneliness, in ways that we don't see as much in Europe. Further, based on anthropological work by Kleinman and others, we expect to again see in China in this confirmatory factor analysis distinctive experience clusters related to feeling psychosomatically “drained,” which would differ from North American and European idioms for expressing mental and other forms of distress (Snodgrass, Dengah, Polzer, & Else, 2018). Such results would, if identified, point simultaneously to important cultural similarities—in the four identified dimensions and their key item components—and also differences—in the way, for example, each region's secondary factors or dimensions might relate somewhat differently to experiences related to achievement, loneliness, and distinctive psychosomatic states.

Another contribution of the current work is to adjust for the possible influence of demographic and other differences across culture regions, which was not done in that other work (Snodgrass, Zhao, et al., 2018). For example, differences across region in the distribution of respondents' gender or preferred game type could have influenced those previous findings, as results in Appendix 2 show. To separate the impact on gaming experiences of regional culture from a substantial number of correlated demographic variables, the current analysis compares results using samples of individuals from different cultures matched on background variables via “propensity scoring” (Caliendo & Kopeinig, 2008; Dehejia & Wahba, 2002). That is, we compare factor analysis results for a sample of North American gamers pair-matched to a sample from Europe, and similarly for a sample of North Americans matched to Chinese. Because not all individuals had a good match in another region, results featured in the current analysis are for sub-samples of our original sample: so,  $n = 1043$  pairs in the North American/Europeans matched sample, and  $n = 535$  pairs for the North Americans matched with Chinese.

Overall, the key contribution of the analysis presented here, as

compared to attempts to analyze or validate a more conventional IGD scale, is that our 21-item negative gaming experiences encompass a wider “symptoms pool” (Kirmayer & Pedersen, 2014; Kleinman, 1988; Snodgrass, Lacy, & Upadhyay, 2017; Watters, 2010) than the typical short IGD scale of nine or so items (Pontes & Griffiths, 2015). Further, our items derive from extensive ethnographic interviewing of internet gamers, and so should better characterize their experience than would items developed by modifying standard substance abuse questionnaires, as is typical of other internet distress measures. Thus, our data allowed us to measure both conventional IGD addictive symptoms, as well as problem gaming experiences of other kinds. To the extent that we could confirm that IGD (“addictive”) symptoms tended to cluster coherently together on one gaming distress dimension in similar ways irrespective of the cultural setting, this would support the predominance of “addictive” symptoms in shaping gaming-related distress. By contrast, if we were unable to confirm via CFA that the classic addiction symptoms relate to one dimension in a relatively constant way across cultural settings, we would read this as supporting the utility of the “problem gaming” approach to this form of internet-related distress. Also, the dominance—i.e., high factor loadings—of “addiction” symptoms compared to other “problem” experiences on other Gaming Distress secondary factors (which we also call “dimensions”) would provide additional support for gaming-related distress being justifiably framed as a form of behavioral addiction. Thus, with the variety of types of negative gaming experience items present in our analysis, a comparison of the response structures confirmed by our factor analysis should illuminate the cultural constancy of experience of internet gaming distress, and hence the prominence of addictive symptomatology within such distress. Though aiming to confirm the relative importance and centrality of “addictive” compared to “problem” gaming experiences, we nevertheless expect the two sets of symptoms and experiences to be potentially closely intertwined, in what is described elsewhere as a “core” and “peripheral” symptom structure (Luhmann, 2011; Luhmann et al., 2015a; Snodgrass, Zhao, et al., 2018), which explains our use in the present study of second-order CFA modeling that posits primary and secondary levels of gaming-related distress.

## 2. Methods

### 2.1. Data collection

Data were collected through an online questionnaire to which a link was posted on Reddit and various gaming forums frequented by North American and European online gamers playing a variety of game genres, as described in our earlier published work (Snodgrass et al., 2017). We also distributed this link via our own play networks. In both North American and European forums, we used an English-language version of the survey instrument, which we believe was appropriate given widespread English fluency even in the European populations of interest. Given the importance to our goals of obtaining good data from Chinese players, we made special efforts toward that end. For Chinese players, though, we used a translated version of the questionnaire, prepared by author four (a native Mandarin speaker) in discussion with author one. Our Mandarin translation was cross-checked with the original English version by two MMORPG players, who have themselves done extensive research among player communities in the U.S. and China, and back-translated from Chinese to English to ensure accuracy of key survey items (Brislin & Walter, 1973; Smith, Fischer, Vignoles, & Bond, 2013). A pre-test of the scale was carried out by two ordinary MMORPG players in China for their feedback. The finalized Mandarin version of the questionnaire was posted on one of the most popular online survey platforms in China, [www.sojump.com](http://www.sojump.com) (renamed as [www.wjx.cn](http://www.wjx.cn) late 2017). In order to reach a more diverse sample of Chinese game players, we also posted the survey link and invited participants on two popular Chinese gaming forums, and on several Weibo accounts (similar to Twitter in the U.S.), some of them gaming-related and others

**Table 1**  
Demographic, gaming, and social support variables. North America/Europe matched samples (n = 1043) and North America/China matched samples (n = 535).

Variable	Level	North America	Europe	p-Value for difference	North America	China	p-Value for difference
Gender	Male	995 (95.4%)	1003 (96.2%)	0.38	391 (73.1%)	392 (73.3%)	0.94
	Female	48 (4.6%)	40 (3.8%)		144 (26.9%)	143 (26.7%)	
Age, mean (SD)		20.64 (6.02)	20.34 (4.68)	0.19	24.29 (7.53)	24.29 (5.46)	0.99
Student status	Student	724 (69.4%)	723 (69.3%)	0.96	280 (52.3%)	276 (51.6%)	0.81
	Non-student	319 (30.6%)	320 (30.7%)		255 (47.7%)	259 (48.4%)	
Employment status	Employed, full-time	211 (20.2%)	204 (19.6%)	0.19	213 (39.8%)	232 (43.4%)	0.60
	Employed, part-time	212 (20.3%)	181 (17.4%)		80 (15.0%)	69 (12.9%)	
	Unemployed	519 (49.8%)	536 (51.4%)		196 (36.6%)	192 (35.9%)	
Relationship status	Other	101 (9.7%)	122 (11.7%)	0.48	46 (8.6%)	42 (7.9%)	0.53
	Married	44 (4.2%)	32 (3.1%)		77 (14.4%)	80 (15.0%)	
	Committed relationship	188 (18.0%)	178 (17.1%)		127 (23.7%)	117 (21.9%)	
Education	Single	794 (76.1%)	815 (78.1%)	0.63	316 (59.1%)	329 (61.5%)	0.56
	Other	17 (1.6%)	18 (1.7%)		15 (2.8%)	9 (1.7%)	
	Less than high school	96 (9.2%)	92 (8.8%)		20 (3.7%)	9 (1.7%)	
	High school degree	431 (41.3%)	442 (42.4%)		90 (16.8%)	89 (16.6%)	
	Some college	255 (24.4%)	226 (21.7%)		150 (28.0%)	148 (27.7%)	
	College degree	149 (14.3%)	150 (14.4%)		180 (33.6%)	191 (35.7%)	
Hours gamed per week (0–8; 0 = 0–9 h, 1 = 10–19 h, etc.), mean (SD)	Some post-grad study	30 (2.9%)	34 (3.3%)	0.29	26 (4.9%)	26 (4.9%)	0.60
	Post-grad degree	36 (3.5%)	38 (3.6%)		46 (8.6%)	51 (9.5%)	
	Other	46 (4.4%)	61 (5.8%)		23 (4.3%)	21 (3.9%)	
Online gaming involvement (1: “Casual”-10: “Hardcore”), mean (SD)		7.74 (1.82)	7.79 (1.56)	0.46	6.48 (2.59)	6.44 (2.13)	0.75
Main online game played	FPSs	534 (51.2%)	582 (55.8%)	0.19	88 (16.4%)	65 (12.1%)	0.18
	MMORPGs	143 (13.7%)	130 (12.5%)		142 (26.5%)	143 (26.7%)	
	MOBAs	85 (8.1%)	83 (8.0%)		63 (11.8%)	76 (14.2%)	
	Cross-platform	281 (26.9%)	248 (23.8%)		242 (45.2%)	251 (46.9%)	
Offline loneliness (3-item scale: min: 3-max: 9), mean (SD)		5.28 (1.97)	5.26 (1.97)	0.83	5.22 (2.05)	5.22 (2.00)	1.00
Online social support (4-item scale: min: 4-max: 20), mean (SD)		14.55 (4.43)	14.60 (3.95)	0.81	13.33 (4.96)	13.28 (4.29)	0.84
N		1043	1043		535	535	

\*For all group tests, p-values are from Pearson's chi-squared (categorical variables) and ANOVA (continuous variables).

not. A total of 4064 responses were collected, including complete responses suitable for the current analysis from 2025 North American gamers, 1198 Europeans, and 841 Chinese, which was analyzed preliminarily in other work (Snodgrass, Zhao, et al., 2018).

### 2.2. Measures

Combining classic behavioral addiction symptoms with locally idiomatic ways of expressing gaming-related distress, the 21 items analyzed here describe various potential negative experiences in relation to internet game play, to which respondents were asked to answer via a 5-point Likert format (“strongly disagree” to “strongly agree”) indicating whether they recently had experienced each of these consequences. Overall, these items (see Appendix 1) encompass behavioral consequences questions (such as the game producing boring and potentially compulsive routine), social outcomes (e.g., feelings of social isolation related to gaming), and achievement-oriented items (such as online play potentially promoting or interfering with one's career and life course). Though ethnographically-driven in its development and intent, these items resonate with Yee's well-established understanding of online gaming experience, with *achievement*, *social*, and *immersion* motivations shaping in this context online play's perils (Yee, 2006).

We also collected socio-demographic information including age, gender, student status, employment status, relationship status, education, hours gamed per week, level of self-assessed online gaming involvement, and offline/online social support. In addition, we asked about main online games played, which included: first-person shooters (FPSs, including *Tom Clancy's Rainbow Six Siege* and *Counterstrike Global Offensive*), massively multiplayer online role-playing games (MMORPGs

such as *World of Warcraft*), multiplayer online battle arenas (MOBA like *League of Legends* and *Dota 2*), and also a variety of other games, which “cross-platform” gamers alternated between. (These additional variables feature in supplementary regression analysis reported in Appendix 2.)

### 2.3. Statistical analysis

Preliminary analysis reported elsewhere (Snodgrass, Zhao, et al., 2018) revealed distinct differences in demographic, play, and other variables across the three regional respondent pools. In further analysis reported here (Appendix 2, Supplementary Table 1), we examined a regression model with the negative gaming scale score as the response variable in relation to demographic and game-play predictors, including: gender, age, student, employment, and relationship statuses, education, hours gamed per week, self-assessed online gaming involvement, primary games played (i.e., FPS, MMORPG, MOBA, and cross-platform), offline loneliness, and online social support.

Given the way that regression analysis revealed clear associations between demographic and other predictor variables and our primary outcome of interest, negative gaming experiences, some kind of adjustment was necessary to understand to what extent factor structures truly reflected cultural as opposed to demographic differences. As a means to such an adjustment, we have used a matching procedure in connection with our confirmatory factor analysis. We first derived 1) A sample of North Americans pair-matched with European respondents, and 2) A sample of North Americans pair-matched to Chinese respondents. We derived these matched pairs by adapting propensity scoring methods (Caliendo & Kopeinig, 2008; Dehejia & Wahba, 2002;

Guo & Fraser, 2014). A propensity score summarizes, on a 0/1 scale, the extent to which a person with one value of a binary variable (“treatment”) is similar to persons with another value of that variable (“control”) across a range of background covariates. Such scores are used variously with matching and other adjustments in quasi-experimental studies to help make comparable members of treatment and control groups. Here, we apply that method by regarding a respondent from North America as being in a “treatment” group, and the European and Chinese respondents as members of “control” groups. North America was chosen as the treatment group largely because our 21-item scale measure was developed via ethnographic observations and interviews in that region, thus serving as a useful analytical reference point. We used a logistic regression model to predict North American vs. European/Chinese membership as a function of the demographic and game variables described above. From this equation, each respondent was then given a predicted probability (“propensity score”), reflecting their “North Americaness” with respect to all the background variables. Then, for each North American respondent, we selected a European/Chinese respondent who matched her/him on propensity score within a stipulated range, for which we used  $\pm 0.05$ . While finding a European/Chinese match for each North American was not possible, this procedure gave a sample with  $n = 1043$  matched persons from North America/Europe, and  $n = 535$  persons from North America/China, and statistical results for these matched groups are relatively comparable with respect to the distributions of background variables (see Table 1).

We then conducted confirmatory second-order factor analyses (CFA) (Rindskopf & Rose, 1988) on each matched sample, regarding differences in results across groups as relatively free of their individual background characteristics, thus showing differences more purely due to culture location. Thus, when we refer to a factor analysis of the North American/European matched pairs, we mean a CFA of the collection of 1043 North American respondents who had a propensity-score matched European respondent, and the same CFA performed on the Europeans who had a matched North American. The same prevails for the North American/Chinese analysis. Note that some of the North Americans who had European matches also had Chinese matches, so some of the North Americans were used in both analyses. Another point of note here is that the individuals in the matched samples are not representative of other persons in the sample who come from the same culture region. We based the paths in our CFA model on the earlier EFA on the entire sample ( $n = 4064$ ), reported elsewhere (Snodgrass, Zhao, et al., 2018). We eliminated items with cross-loadings issues across factors, and also added covariance across items, but only where such modifications matched reasonable expectations based on our theoretically- and ethnographically-informed understandings.

To verify whether the matched factor structure could acceptably model each regional sample, goodness-of-fit indices included  $\chi^2$ ,  $\chi^2/df$ , CFI (comparative fit index), TLI (Tucker-and-Lewis index), SRMR (standardized root mean square residual), and RMSEA (root mean square error of approximation). Our ideal model fit criteria were:  $\chi^2/df$  should be between 2 and 5; RMSEA acceptable fit:  $< 0.06$ – $0.08$ , with confidence interval; CFI:  $> 0.90$ ; TLI:  $> 0.90$ ; SRMR:  $< 0.08$  (Acock, 2013; Hooper, Coughlan, & Mullen, 2008).

### 3. Results

Table 1 shows demographic information for our matched samples, which show a close demographical resemblance in each case.

Figs. 1 and 2 present SEM diagrams for the second-order confirmatory factor analysis results of the North America and Europe matched samples (each with  $n = 1043$ ). Note that each of the four gaming-related distress dimensions (Addiction, Loss of Pleasure, Regret, Toxic Mood, also referred to in our analysis as “secondary factors”) load high on the overarching Gaming Distress primary factor in both North America (Addiction = 0.92, Loss of Pleasure = 0.78, Regret = 0.71, Toxic Mood = 0.71), and also in Europe (Addiction = 0.96, Loss of

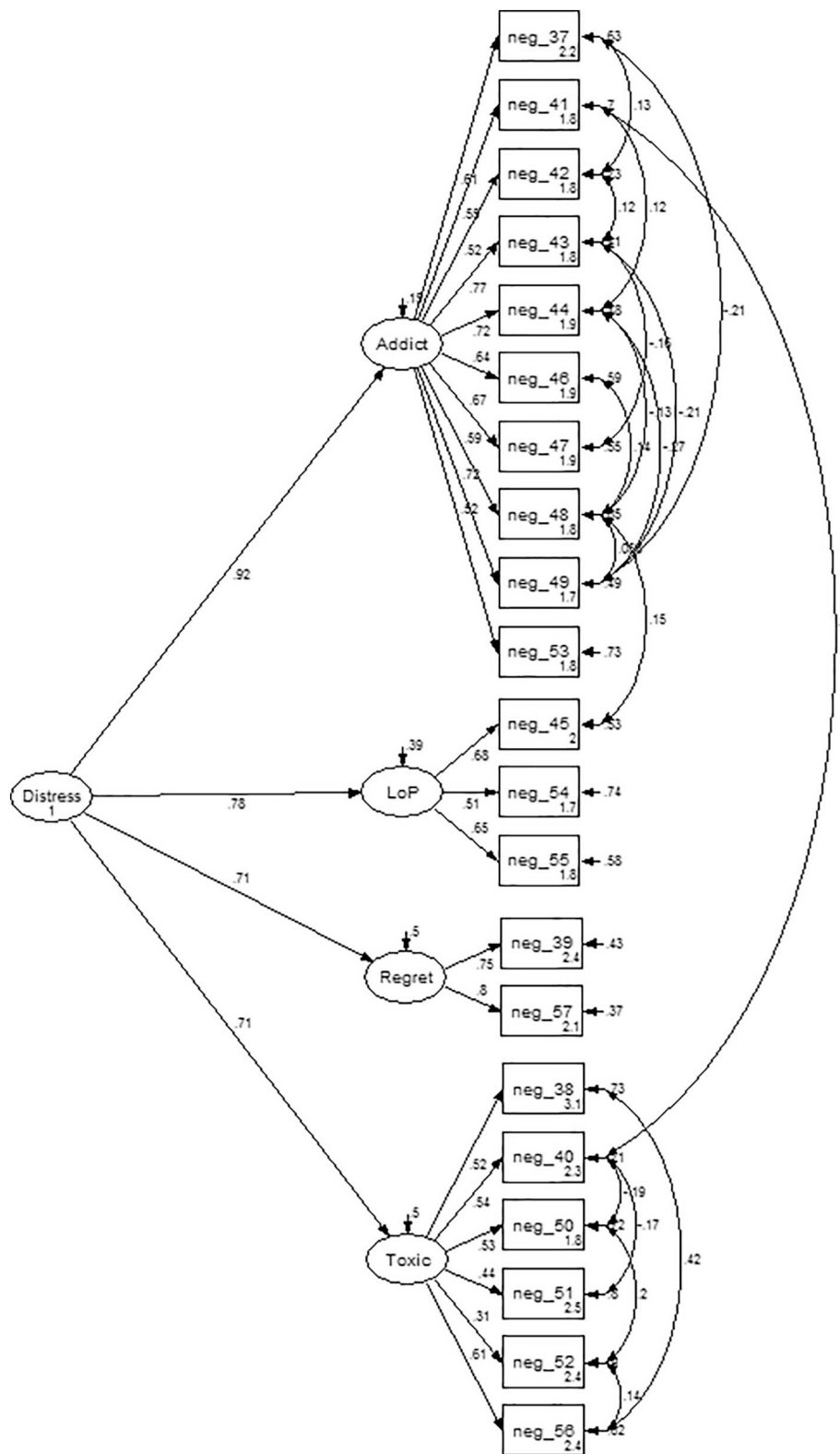
Pleasure = 0.90, Regret = 0.70, Toxic Mood = 0.55). However, compared to the other secondary factors, Toxic Mood loads somewhat lower on Gaming Distress in Europe (0.55), suggesting it is less tightly connected to overall gaming-related distress in that region.

Tables 2a and 2b present additional detail on the relationship between this North America/Europe CFA's four Gaming Distress dimensions and their individual items ( $n = 1043$ ). Factor loadings for dimension 1 in each region display a pattern of loadings on which basis we term it Addiction, given that the classic addiction symptoms consistently loaded highly on it in this confirmatory analysis. (In what follows, we capitalize the four dimension/secondary factor descriptors, while each dimension's individual items are italicized and lower case.) Note that *all eight* of the classic addiction symptoms among our items loaded highly (typically substantially above 0.4) on this dimension in each of the two regions (items 37, 42, 43, 44, 46, 47, 48, and 53). Notably, *push my body too far* (Item 41) loads highly on North America's Addiction dimension, though, based on earlier EFA, it was not included in Europe's first dimension, with the high factor loading confirming here that the North American “addiction” experience is intertwined closely with such achievement motivations (Tables 2a, 2b and 3a, 3b's bolded items highlight regional differences). Likewise, *social isolation* is connected to Addiction in North America, but not in Europe, with the high factor loading once again confirming our prior EFA findings and theory-based hypothesizing.

The next three dimensions—what we call Loss of Pleasure, Regret, and Toxic Mood—also share a similar structure across the two culture areas, though with some regional differences. Confirming the earlier EFA, the second Loss of Pleasure dimension is closely related in each of these two regions to *boring routine*, *negative social obligation*, and *draining job*. *Social isolation* and *need for social approval* link to this second Loss of Pleasure factor in Europe, though not in North America, illuminating the distinctive way this problem experience factor connects to European as compared to North American social processes. The third dimension or secondary factor, Regret, is most strongly characterized in each region by the single *regret* item and also by *perceived failure*. Finally, key items in both regions loading high on the fourth Toxic Mood dimension are *mood deterioration* (frustration, disappointment, etc.), feeling that gaming is *draining* and thus leaves one mentally and physically depleted, experiencing the gaming community as *toxic*, and experiences of *negative anonymity*. As we learned via interviews, observations, and our own experiences, online gaming groups can be associated with overt racism, sexism, and homophobia, along with a generally hyper-competitive and thus unpleasant online experience, leading in many cases to *loss of confidence*, another important item on this dimension. (Note that both *toxic community* and *negative anonymity* load somewhat low in our CFA on this factor, as they also did in earlier EFA, suggesting the need for caution in interpreting their connection to Toxic Mood's interrelated experiences.) Also, *need for social approval* links to this fourth Toxic Mood dimension only in North America, but not in Europe, suggesting somewhat distinctive connections between mood and social processes in these two regions.

Figs. 3 and 4 present SEM diagrams for the confirmatory factor analysis results of the North America and China matched samples (each with  $n = 535$ ). Again, each of the four secondary factors load high on the overarching Gaming Distress primary factor in North America (Addiction = 0.98, Loss of Pleasure = 0.72, Regret = 0.73, Toxic Mood = 0.73), as well as in China (Addiction = 0.90, Loss of Pleasure = 0.99, Regret = 0.81, Toxic Mood = 0.81).

Tables 3a and 3b present more detail on the relationship between this CFA's four Gaming Distress dimensions and their individual items, in this case for the North America/China matched pairs ( $N = 535$  pairs). As in the previous North America/Europe comparison, our CFA confirms the way that the dimension 1 is characterized by classic “addiction” symptoms, connected as it is to *six of the eight* symptoms included in our survey: *negative cognitive salience* (*preoccupation*), *withdrawal*, *continue to play despite problems* (“*bad habit*”), *loss of control/*

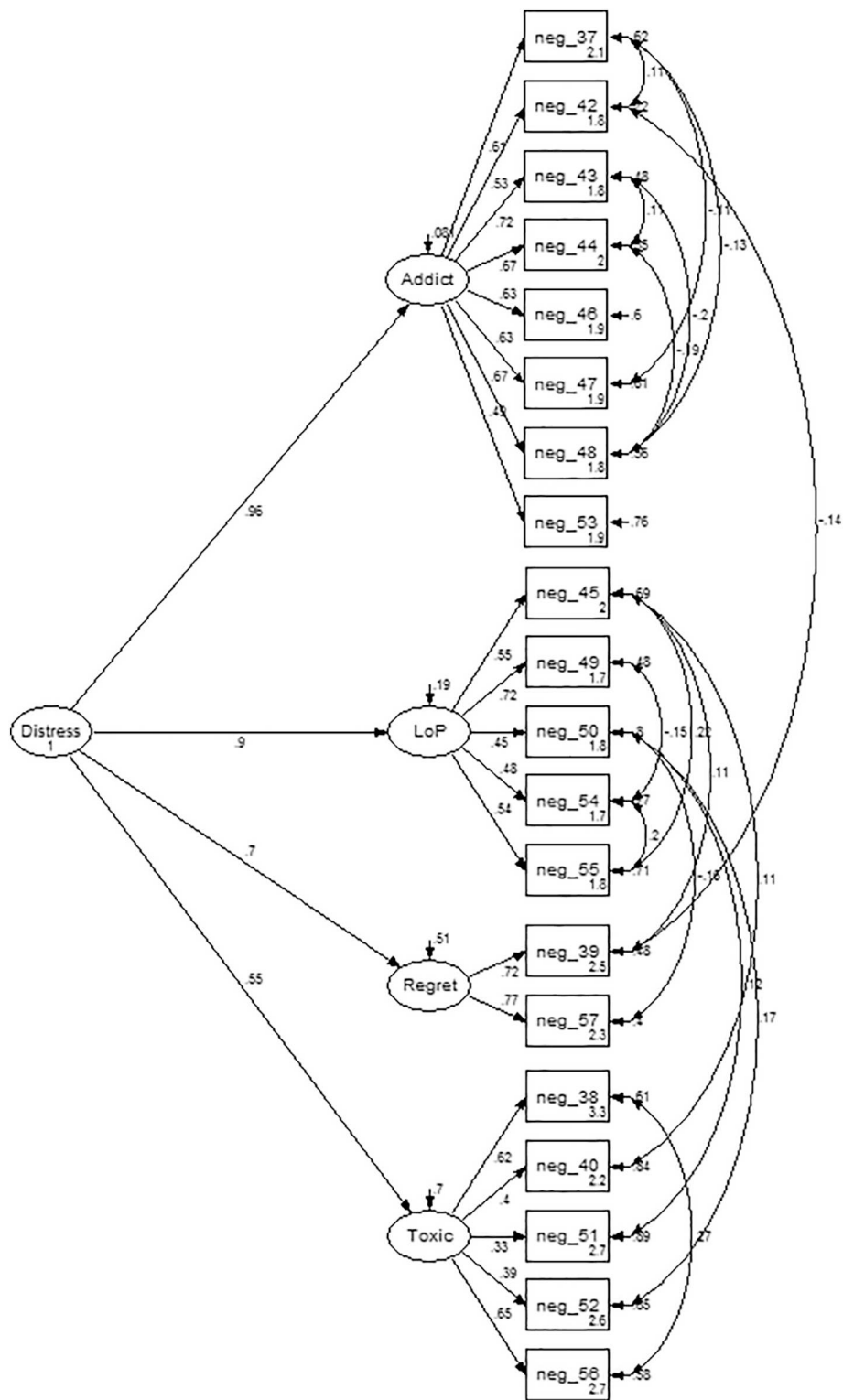


**Fig. 1.** SEM diagram for CFA results of negative online gaming consequences items for North America, from North America/Europe matched samples (n = 1043 each).

Factor key: Distress = gaming distress; Addict = addiction; LoP = loss of pleasure; Regret = regret; Toxic = toxic mood. To improve model fit, item covariances added as shown.

relapse (reduce/stop), avoidance/mood modification (escape adverse moods), and conflict (risk/lose relationships/opportunities). Push body too far, which we use as one potential proxy for achievement motivations, is confirmed to be connected to the Addiction dimension in both

regions, as is social isolation. Loss of interest in other activities and tolerance, both classic addiction symptoms, are connected in this CFA to North America's gaming-related distress Addiction dimension, but not to China's.



**Fig. 2.** SEM diagram for CFA results of negative online gaming consequences items for Europe, from North America/Europe matched samples (n = 1043 each). Factor key: Distress = gaming distress; Addict = addiction; LoP = loss of pleasure; Regret = regret; Toxic = toxic mood. To improve model fit, item covariances added as shown.

The Loss of Pleasure, Regret, and Toxic Mood dimensions in this matched North America/China comparison also resemble each other in important ways, though again with regional differences. The Loss of Pleasure dimension is characterized in this North America/China CFA comparison by the shared items *boring routine* and *negative social obligation*. This Loss of Pleasure factor is thus related in both regions to

playing out of obligation to others rather than out of one's own desire to do so. There are notable differences, though: as in North America, *draining job* loads highly on Loss of Pleasure, while not in China, but in China, *tolerance* and *toxic community* load higher on this factor (though the latter only marginally), while neither one does in North America. In secondary factor 3, "Regret," the single *regret* item and also *perceived*

**Table 2a**  
Confirmatory factor analysis results of negative online gaming consequences items for North America/Europe matched samples (n = 1043 each).

		North America (n = 1043)				Europe (n = 1043)			
Factor		1: Addiction	2: Loss of pleasure	3: Regret	4: Toxic mood	1: Addiction	2: Loss of pleasure	3: Regret	4: Toxic mood
Item	Descriptor								
37	Negative cognitive salience	0.610	-	-	-	0.613	-	-	-
38	Mood deterioration	-	-	-	0.516	-	-	-	0.625
39	Regret	-	-	0.752	-	-	-	0.722	-
40	Draining	-	-	-	0.539	-	-	-	0.405
41	Push body too far	<b>0.552<sup>a</sup></b>	-	-	-	-	-	-	-
42	Withdrawal	0.520	-	-	-	0.529	-	-	-
43	Bad habit/play despite problems	0.770	-	-	-	0.721	-	-	-
44	Loss of control/relapse	0.723	-	-	-	0.672	-	-	-
45	Boring routine	-	0.683	-	-	-	0.555	-	-
46	Loss of interest in other activities	0.638	-	-	-	0.633	-	-	-
47	Avoidance/mood modification	0.670	-	-	-	0.627	-	-	-
48	Tolerance	0.592	-	-	-	0.666	-	-	-
49	Social isolation	<b>0.716</b>	-	-	-	-	<b>0.719</b>	-	-
50	Need for social approval	-	-	-	<b>0.529</b>	-	<b>0.448</b>	-	-
51	Toxic community	-	-	-	0.448	-	-	-	0.335
52	Negative anonymity	-	-	-	0.313	-	-	-	0.387
53	Conflict	0.519	-	-	-	0.491	-	-	-
54	Negative social obligation	-	0.513	-	-	-	0.478	-	-
55	Draining job	-	0.649	-	-	-	0.5536	-	-
56	Loss of confidence	-	-	-	0.613	-	-	-	0.645
57	Perceived failure	-	-	0.796	-	-	-	0.773	-

<sup>a</sup> Bolded items highlight differences across the two culture regions.

**Table 2b**  
Goodness-of-fit indices of CFA results of Negative Scale.

	$\chi^2$	df	CFI	TLI	RMSEA	SRMR
North America	494.223	168	0.952	0.940	0.043 (0.039, 0.048)	0.038
Europe	401.690	150	0.955	0.943	0.040 (0.035, 0.045)	0.039

**Table 3b**  
Goodness-of-fit indices of CFA results of Negative Scale.

	$\chi^2$	df	CFI	TLI	RMSEA	SRMR
North America	429.010	171	0.936	0.921	0.053 (0.047, 0.059)	0.048
China	399.010	168	0.946	0.933	0.051 (0.044, 0.057)	0.042

failure are confirmed to be important in each of the two regions, while in China, Regret is linked to the distinctive experience of feeling “drained,” associated as it is with both *draining* and *draining job*, as well as with *loss of interest in other activities*. Finally, Toxic Mood items include in both regions *mood deterioration (frustration, disappointment,*

etc.), *need for social approval, negative anonymity, and loss of confidence* (though note the relatively low CFA loadings of *negative anonymity*). *Draining* and *toxic community* are only associated with this fourth secondary factor in the North American case.

Finally, results of second-order CFA analysis on each of the three

**Table 3a**  
Confirmatory factor analysis results of negative online gaming consequences items for North America/China (n = 535 each).

		North America (n = 535)				China (n = 535)			
Factor		1: Addiction	2: Loss of Pleasure	3: Regret	4: Toxic mood	1: Addiction	2: Loss of pleasure	3: Regret	4: Toxic mood
Item	Descriptor								
37	Negative cognitive salience	0.621	-	-	-	0.659	-	-	-
38	Mood deterioration	-	-	-	0.614	-	-	-	0.499
39	Regret	-	-	0.711	-	-	-	0.781	-
40	Draining	-	-	-	<b>0.502</b>	-	-	<b>0.573</b>	-
41	Push body too far	0.522	-	-	-	0.645	-	-	-
42	Withdrawal	0.534	-	-	-	0.628	-	-	-
43	Bad habit/play despite problems	0.745	-	-	-	0.780	-	-	-
44	Loss of control/relapse	0.737	-	-	-	0.795	-	-	-
45	Boring routine	-	0.660	-	-	-	0.679	-	-
46	Loss of interest in other activities	<b>0.636<sup>a</sup></b>	-	-	-	-	-	<b>0.736</b>	-
47	Avoidance/mood modification	0.683	-	-	-	0.756	-	-	-
48	Tolerance	<b>0.642</b>	-	-	-	-	<b>0.562</b>	-	-
49	Social isolation	0.742	-	-	-	0.661	-	-	-
50	Need for social approval	-	-	-	0.542	-	-	-	0.601
51	Toxic community	-	-	-	<b>0.499</b>	-	<b>0.267</b>	-	-
52	Negative anonymity	-	-	-	0.363	-	-	-	0.406
53	Conflict	0.574	-	-	-	0.606	-	-	-
54	Negative social obligation	-	0.582	-	-	-	0.449	-	-
55	Draining job	-	<b>0.739</b>	-	-	-	-	<b>0.508</b>	-
56	Loss of confidence	-	-	-	0.677	-	-	-	0.658
57	Perceived failure	-	-	0.810	-	-	-	0.769	-

<sup>a</sup> Bolded items highlight differences across the two culture regions.



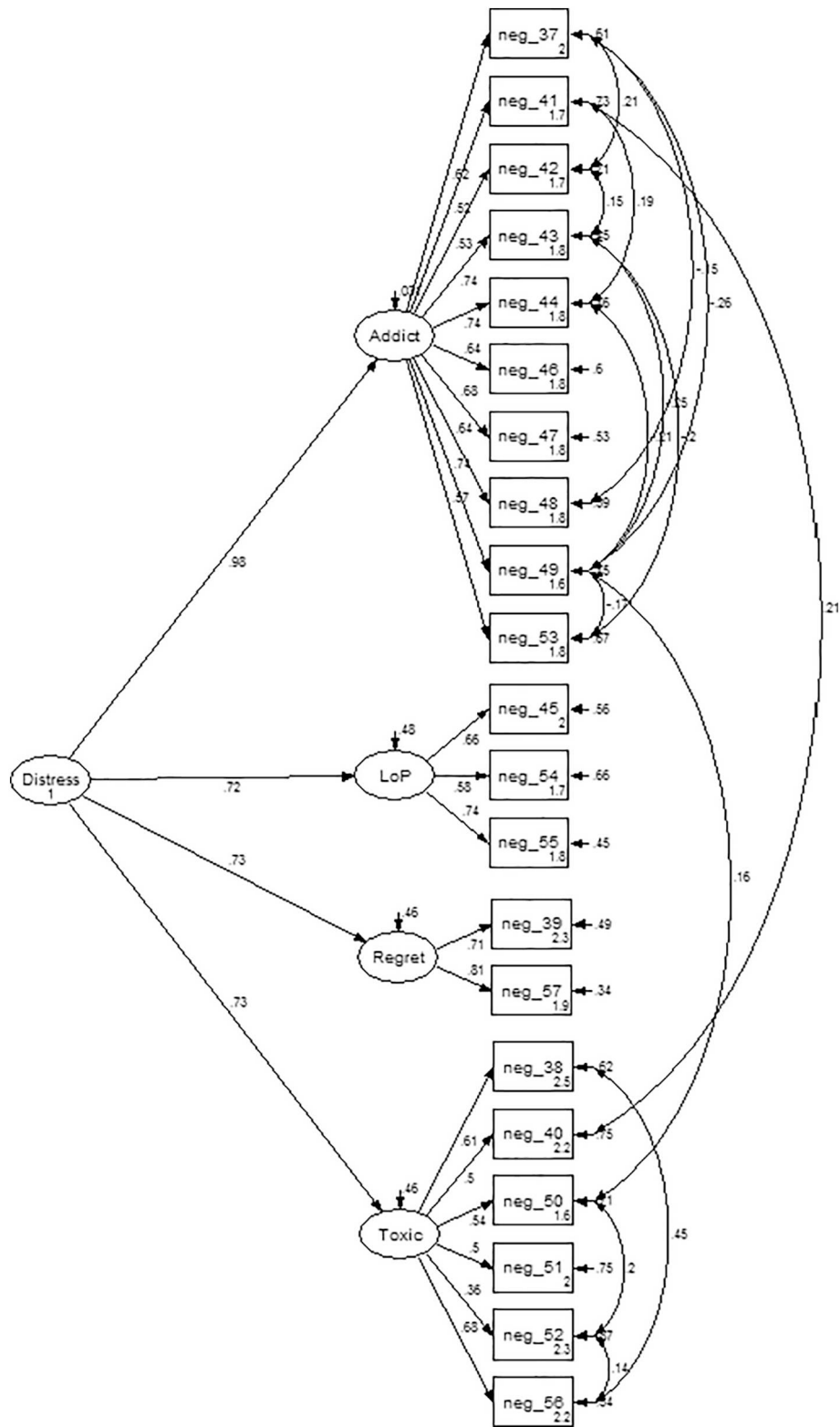


Fig. 3. SEM diagram for CFA results of negative online gaming consequences items for North America, from North America/China matched samples (n = 535 each). Factor key: Distress = gaming distress; Addict = addiction; LoP = loss of pleasure; Regret = regret; Toxic = toxic mood. To improve model fit, item covariances added as shown.

samples indicated acceptable overall model fit according to our criteria (Acock, 2013; Hooper et al., 2008), confirming the appropriateness of modeling our data in each regional case with a primary Gaming Distress factor, which is in turn composed of four secondary factors or dimensions, Addiction, Loss of Pleasure, Regret, and Toxic Mood, with results

presented in Tables 2b and 3b.

#### 4. Discussion

Stepping back, our findings verify that “addictive” gaming is a

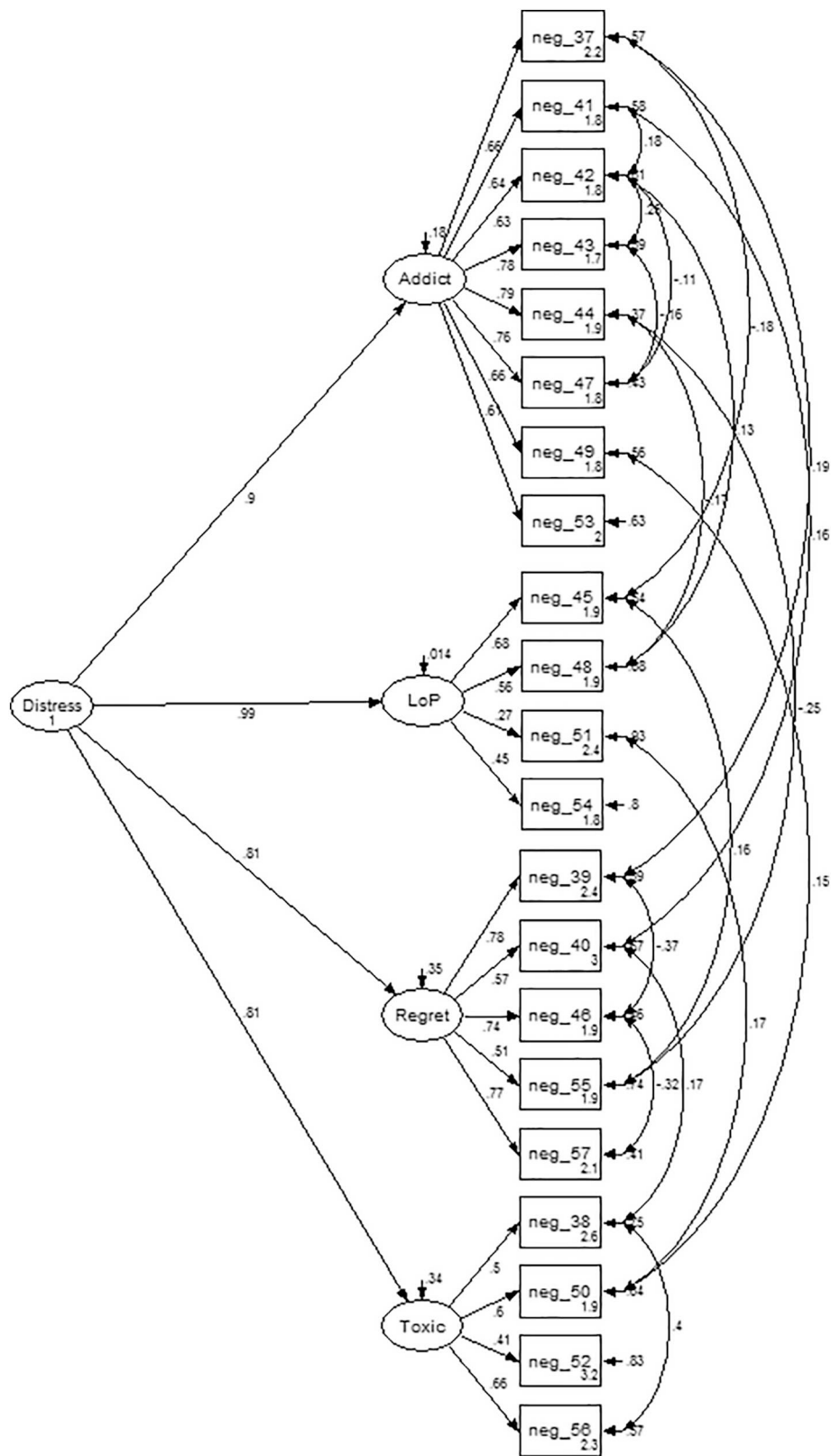


Fig. 4. SEM diagram for CFA Results of negative online gaming consequences items for China, from North America/China matched samples (n = 535 each). Factor key: Distress = gaming distress; Addict = addiction; LoP = loss of pleasure; Regret = regret; Toxic = toxic mood. To improve model fit, item covariances added as shown.

central feature of general online gaming-related distress, as classic addiction symptoms (Addiction) items are confirmed to load highly in each culture region on the primary Gaming Distress factor (Snodgrass,

Zhao, et al., 2018). All eight behavioral addiction symptoms included in our survey are confirmed in North America and Europe to be associated with a latent gaming-related distress Addiction dimension, with six of

the eight symptoms showing similar associations in the North America/China comparison. Thus, at least six of eight conventional addiction symptoms share a common secondary factor recurring across each of the three regions in the demographically matched CFA comparisons. The six addiction symptoms shared across these three regions are: *negative cognitive salience (preoccupation)*, *withdrawal*, *continue to play despite problems*, *loss of control/relapse (reduce/stop)*, *avoidance/mood modification (escape adverse moods)*, and *conflict (risk/lose relationships/opportunities)*. The fact that this set of experiences shares a similar pattern of association recurring cross-culturally could reflect that gaming distress partly rests on a relatively stable underlying neurobiology of addiction (Leshner, 1997; Panksepp et al., 2002; Siviý & Panksepp, 2011; Volkow et al., 2003).

Nevertheless, cultural factors do play a role in how this “addiction” dimension is expressed. Thus, for example, we can imagine how problems and processes related to “pushing” oneself to one’s limits in gaming contexts might reflect North American and Chinese achievement orientations (Bax, 2013; Bax, 2014; D’Andrade, 2008; Golub & Lingley, 2008), not just a universal neurobiology of craving. Also, though not considered as a typical addiction symptom, the experience of *social isolation* appears in our analysis as importantly implicated in various forms of distressful gaming. For example, in our analysis, *social isolation* is closely connected in both North America and China to the Addiction dimension, suggesting a culturally variable experience linking isolation and loneliness to “addiction.” These findings confirm the importance of loneliness and social isolation in addictive and problem gaming, which echoes a now substantial body of literature (Kim et al., 2009; Nowland et al., 2017; Snodgrass et al., 2018), as well as specific descriptions of North America (Ducheneaut et al., 2006; Putnam, 2000; Turkle, 2012) and China (Qian et al., 2016).

Likewise, each region’s factor analysis confirms a similar gaming-related distress four-factor dimensional structure: beyond the initial Addiction dimension are ones we refer to as Loss of Pleasure, Regret, and Toxic Mood. Again, this suggests a commonly recurring set of experiences that in some sense transcends cultural context. Still, cultural factors also play a role in these three additional dimensions or secondary factors. We see this in the distinctive way in China in particular that *tolerance* is linked to the Loss of Pleasure dimension, rather than to other classic “addiction” symptoms, as it is in the North American and European cases. Also, the third dimension, Regret, reflects gamers’ often expressed sentiments that gaming could feel like a waste of time, which, given the amount of time and energy invested, was holding them back in life—again, an experience reminiscent of addiction and problem play experiences described in other contexts (Singer, 2012; Snodgrass, Dengah, & Lacy, 2014). But in China, Regret takes on a distinctive cultural flavor, closely connected to two reported items related to feeling psychosomatically “drained”—*draining* and *draining job*—echoing classic medical anthropological work by Kleinman and others on the embodied, somaticized, and neurasthenia-like features of Chinese suffering compared to that in the West (Kleinman, 1980; Kleinman, 1988; Lee, 1999; Ryder et al., 2008; Zhang & Wu, 2005). Too, social processes—*need for social approval*, *toxic community*, and *negative anonymity*, for example—connect somewhat idiosyncratically in each region to problem gaming experiences related to Loss of Pleasure and Toxic Mood.

Overall, the current analysis offers further support for the earlier core/peripheral psychiatric symptoms theoretical framework we developed elsewhere (Snodgrass, Zhao, et al., 2018), which was based on preliminary descriptive and exploratory factor analysis of the current study’s datasets in whole, rather than by analyzing demographically matched samples. There, we identified via EFA a similar four-factor structure, with addictive symptoms “core” to a broader set of more “peripheral” problem gaming experiences, using that analysis to illustrate how a core/peripheral psychiatric symptoms theoretical framework could help anthropology and games studies advance in their understanding of addictive and problem gaming. In the present study, we

show via second-order CFA modeling that our data supports a generalized and primary Gaming Distress experience, while also confirming the secondary importance of the same four gaming-related distress dimensions, Addiction, Loss of Pleasure, Regret, and Toxic Mood, illuminated in our earlier more exploratory work. Further, utilizing propensity score matching, we were able to separate in the current analysis the role demographic as compared to regional cultural factors might play in shaping the revealed factor analytic structures, something we were not able to demonstrate in our earlier study.

## 5. Conclusion

Current Internet Gaming Disorder (IGD) formulations of problem gaming modeled as a behavioral addiction, including those found in WHO’s and APA’s diagnostic manuals (American Psychiatric Association, 2013; Petry & O’Brien, 2013; World Health Organization, 2017; World Health Organization, 2018), were largely developed in North American contexts. Nevertheless, our results indicate that they do capture central features of online gaming distress that go beyond that culture. Alongside the prominence in our study of Gaming Distress having Addiction as its first dimension, two of our other secondary dimensions, Loss of Pleasure and Regret also capture at their own symptomatic “cores” additional classic addiction experiences (Snodgrass et al., 2014; Snodgrass, Zhao, et al., 2018). The fact that they occur so prominently in two of our three additional generalized gaming distress dimensions, irrespective of culture region, would seem again to support current APA, WHO, and other formulations of problem gaming as importantly akin to a behavioral addiction.

Nevertheless, culture also shapes gaming-related distress in these three parts of the world. Toxic Mood in particular is not adequately captured by current WHO and APA formulations of “addictive” gaming, nor is the way that “addiction” experiences are further inflected by culturally-specific drives to achieve and succeed, experiences of social isolation and loneliness, and many other subtle but potentially important configurational differences revealed in our factor analytic tables.

Taking all these findings into consideration, our study overall leads us to conclude that online gaming-related distress does involve dimensions that can be usefully framed as resembling “addiction” in each of the three culture regions considered in our study, thus giving support to WHO and APA formulations about IGD. Central to distressful gaming is the feeling of losing control over one’s play (Addiction), as well as gaming in ways that no longer bring pleasure (Loss of Pleasure), are associated with feelings of profound regret (Regret), and actively produce emotional distress (Toxic Mood)—a set of experiences close to standard formulations of addiction (Lende, 2005; Singer, 2012), even when taking into consideration the cultural nuances revealed by our analysis. Nevertheless, cultural differences should also be attended to by researchers and clinicians alike, as they partially structure the psychiatric presentation of gaming-related distress symptoms in each regional case. As demonstrated by our second-order CFA analysis, cultural differences can shape the experience and presentation of core “addiction” experiences, secondary and more peripheral “problem” play experiences, and also the relationship between “addictive” and “problem” gaming, which, as others have suggested, are often tightly intertwined (Billieux et al., 2015; Billieux et al., 2017; Charlton & Danforth, 2007; Griffiths et al., 2017; Kardefelt-Winther, 2014; King et al., 2013; Snodgrass et al., 2017; Snodgrass, Zhao, et al., 2018; Van Rooij & Prause, 2014).

### 5.1. Study limitations

While the methods we have followed are useful for obtaining data from sizeable numbers of persons in the relevant populations, we nevertheless do not claim a statistical basis for the generalizability of our results to these regional populations, as all data on which we report

here are derived from volunteer samples, recruited through the particular venue of online forums. Additionally, though our 21-item problem gaming scale (Snodgrass et al., 2017) appeared to fit well with the experience of gamers elsewhere in the world, we would still recommend in order to further expand the symptoms pool that future researchers develop similar qualitative observational, interview, and cultural domain analysis methods of negative internet gaming experiences in all cultural contexts appearing in a given study. Finally, our analysis examines only one dimension of IGD: the manner in which addictive gaming symptoms consistently cluster together across cultures, thus suggesting they represent a coherent set of behaviors and experiences, which is an important precondition for framing these symptoms as a disease or disorder. However, additional work, including the employment of clinical interviews, is needed to validate the presentation of IGD symptoms over time among gamers displaying clinical levels of distress and disorder, as opposed to among the general gaming populations featured in the current work.

### Conflict of interest

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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### Appendices 1 and 2. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.abrep.2018.100146>.

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