Proteus Effect Profiles: how Do they Relate with Disordered Gaming Behaviours?

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Abstract

Gamers represent themselves in online game worlds through their avatars. The term "Proteus Effect" (PE) defines the potential influences of the gamers' avatars on their demeanour, perception and conduct and has been linked with excessive gaming. There is a significant lack of knowledge regarding likely distinct PE profiles and whether these could be differentially implicated with disordered gaming. A normative group of 1,022 *World of Warcraft* (*WoW*) gamers were assessed here (Mean $_{age}$ = 28.60 years). The Proteus Effect Scale (PES) was used to evaluate the possible avatar effect on gamers' conduct, and the Internet Gaming Disorder Scale–Short-Form was used to examine gaming disorder behaviors. Latent class profiling resulted in three distinct PE classes, 'non-influenced-gamers' (NIGs), 'perception-cognition-influenced-gamers' (PCIGs), and 'emotion-behaviour-influenced-gamers' (EBIGs). The NIGs reported low rates across all PES items. The PCIGs indicated higher avatar influence in their perception-experience but did not report being affected emotionally. The EBIGs indicated significantly higher avatar influence in their emotion and behaviour than the other two classes but reported stability in their perception of aspects independent of their avatar. Gaming disorder behaviours were reduced for the NIGs and progressively increased for the PCIGs and the EBIGs.

Keywords: user-avatar bond; gamer identity; gaming immersion; Proteus Effect; IGD; disordered gaming; gaming disorder; gaming addiction

The consequences of excessive gaming across several areas of everyday life (e.g., psychological, inter-personal, and wellbeing; Anderson et al., 2017) for a small but significant proportion of gamers has prompted the emergence of formal psychopathological classification (Scerri et al., 2019). Internet Gaming Disorder (IGD) was defined as a tentative disorder needing additional clinical and empirical investigation in *Diagnostic Statistical Manual of Mental Disorders* (DSM-5; American Psychiatric Association, [APA] 2013). More recently, Gaming Disorder (GD) was formally introduced as a diagnostic category in the latest revision of the *International Classification of Diseases* (ICD-11) of the World Health Organisation (WHO, 2019).

Despite these advancements, disagreements and debates considering the diagnostic value of disorder gaming persist (Griffiths et al., 2016; Griffiths et al., 2017; Jeong et al., 2018). Furthermore, attention has also focused on the accurate measurement of gaming disorder manifestations, as well as defining and identifying the differences between recreational and addictive gaming (Jo et al., 2019; Van Rooij et al., 2018). In the light of these definitional and theoretical considerations, it is generally agreed by those in the gaming research area that the diversity of potential adaptive and/or maladaptive gaming effects is explained by (i) the interaction between individual features and traits of the gamer alongside effects of the real, (ii) in-game surrounding-environment and (iii) the structural characteristics of the game (Brand et al., 2019; Griffiths & Nuyens, 2017; Liew et al., 2018; Stavropoulos et al., 2018a). Within these broader interactions, the association occurring between players and their in-game representational figures (i.e., their avatars), has been highlighted as a significant (yet under-investigated) factor underlying gamers' experiences (Burleigh et al., 2018). In particular, the User-Avatar-Bond (UAB) has been theorised as a continuous and counter-influential association and effect (from the player to the game-character, and the other way

around; Liew et al., 2018). In addition to its role in disordered gaming, the UAB has been shown to facilitate an important positive potential when utilised in online psychological interventions (e.g., gamified e-health programs) and to play a contributory role to gamers' real-life conduct (Jones, Scholes, Johnson, Katsikitis, & Carras, 2014; Liew et al., 2018; Blinka, 2008; Ratan & Dawson, 2015).

Avatar and real-life behaviour

The literature in the gaming studies field has suggested that the avatar's behaviour-conduct in-game may exert an influence in the gamer's real-life conduct (Liew et al., 2018). In particular, it is proposed that unconscious, un-planned, and unintentional manifestations related to the in-game participation, defined as 'Game Transfer Phenomena' (GTP) may affect the offline conduct of the gamers (Dindar & Ortiz de Gortari, 2017). These non-volitional manifestations are supported to entail experiences and cognitions, emotions, and actions (Ortiz de Gortari et al., 2015) starting from physiological sensations experienced in the context of gaming (Ortiz de Gortari et al., 2015) and leading to game-simulated real life conduct, the more gamers invest in their in-game avatar (Ortiz de Gortari et al., 2016).

These experiences appear to inform what is termed in the scientific literature as the 'Proteus Effect' (PE; Yee et al., 2009). Ancient Greek myths describe Proteus as the god of transformations, who chose to represent himself with various forms and shapes in order not to be recognised. This enabled him to hide his superficial awareness of the past, present, and future (Encyclopaedia Britannica, 2019). This similarity across the Proteus' transformation ability (interestingly when aiming to avoid communicating) prompted Yee and his collaborators (2009) to suggest the term PE to describe the bi-directionally transforming link-attachment between players and their in-game characters. In particular, they highlighted that as players might choose diverse in-game representations (frequently on the basis of their real-

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life preferred and less preferred characteristics), the avatars may similarly change the gamers' experience, emotion, and behaviour offline. Previous empirical studies have confirmed these hypotheses suggesting that formative features of avatars, as their height and presentation, influence (to a certain extent) offline reactions (Ratan & Dawson, 2015; Yee et al., 2009). For example, research has demonstrated that gamers with taller avatars experience higher self-esteem, while gamers with more attractive in-game avatars present as more socially confident outside of the game (Yee et al., 2009).

A cognitive-behavioural therapy understanding of the Proteus Effect

The effect of PE can be interpreted with the employment of cognitive-behavioural therapy (CBT) principles (Stavropoulos et al., 2019). CBT suggests that experiences inform perceptions and cognitions that may precipitate and perpetuate emotions, when stimuli and/or conditions related to the past experience are encountered (Stavropoulos et al., 2019). The quality of the emotions experienced (i.e., negative or positive) informs, in turn, the reactions and the behaviours of the person within the specific context (Stavropoulos et al., 2019). Consequently, while gaming, experiences related to the self-perception of users may be confounded with those related to their game representation (Burleigh et al., 2018). This may be reinforced by "augmented" real-life dimensions, such as time and social contact, aspects of online games, which (to some extent) may make users neglect the mediating contribution of the online application in their game perception, generating the sense of actually "being there" (Riva et al., 2003; Stavropoulos et al., 2018). This mixture between offline reality and the gaming experience has been conceptualised as the experience of (tele)-presence and (from a CBT perspective) may endorse the game experiences with meaning equally significant to that of real-life experiences (Stavropoulos et al., 2018), and therefore helping define specific emotions and behaviours. Consequently, it could be assumed that the avatar's identity could effect more the self-perception and behaviour of the gamer, as manifested in the context of

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PE, the higher the game exposure is. Therefore, excessive gaming patterns, such as those involved with disordered gaming, have been associated with higher PE experiences (Liew et al., 2018).

Study Aims

To examine the potential association between PE and gaming disorder, this research utilised a normative group of *World of Warcraft* (*WoW*) players. *WoW* was primarily chosen because it appeals to a wide and relatively representative gaming audience (Morcos, Stavropoulos, Rennie, Clark, & Pontes, 2019). Furthermore, it is a rather 'old' game (i.e., has been played since its release in 2004) that can accommodate the investigation of the effect of more time-lengthy game participation (Billieux et al., 2013). It additionally stimulates playing motivations that enhance game-absorption such as online-relationships, progressively higher levels of rewards and challenges, and personalised complex avatar options (Morcos et al., 2019). Finally, *WoW* (like many online role-playing games) was linked with an increased inclination for gaming disorder behaviours (Billieux et al., 2013; Ghuman & Griffiths, 2013).

For the present study, the DSM-5 (APA, 2013) conceptualization of IGD is preferred over others. IGD has been depicted as the persistent and recurrent gaming engagement, usually along other gamers, leading to clinical impairment and distress over a one-year period. Although disagreements and discussions regarding the definition of GD persist (Griffiths & Pontes, 2019), the DSM-5 IGD description has been the most widely employed in the international academic literature and mental-health procedures (Griffiths, King, & Demetrovics, 2014). The DSM-5 IGD terminology was particularly preferred here on the basis of: (i) comparability with peer-reviewed empirical evidence; and (iii) the provision of well-established psychometric tools, assessed across-cultures and across time (Stavropoulos et al., 2019).

Furthermore, prompted by available evidence suggesting distinct typologies of game participation (Hamari & Tuunanen, 2014; Nagygyörgy et al., 2013), alongside the therapeutic utility of typologies and profiles of gamers in mental health services (Torres-Rodríguez et al., 2019), the goals of this reserach involved: (i) profiling *WoW* players based on their PE responses targeting perceptual, cognitive, emotional, and behavioural avatar related influences to the gamer; and (ii) assessing whether different PE typologies are associated with disordered gaming features (APA, 2013).

Finally, an additional goal was to introduce a profile categorisation of gamers' PE experiences in the context of CBT principles (Stavropoulos, Cokorilo, Kambouropoulos, Collard & Gomez, 2019). These involve influences in perceptions, cognitions, emotions, and behaviours in consensus with the cognitive cycle (Stavropoulos et al., 2019). A PE profiling of gamers could have important diagnostic-value (i.e., capacity to categorise gamers according to their experienced PE aspects), and epidemiological and prevalence value (i.e., proportions of gamers belonging to the suggested profiles), as well as conceptual and theoretical value (i.e., describing the various PE gamer profiles, alongside the clarification of the nature of their differences, both quantitatively and qualitatively).

Methods

 Participants

A large sample comprising 1,022 *WoW* gamers was recruited (M_{age} = 28.60 years, *SD* = 9.90; average duration of educational attendance = 13.22, SD = 5.28; average duration of internet usage = 16.08, SD = 5.41; average duration of *WoW gaming* = 8.41, SD = 4.11; average avatar level = 104.99, SD = 22.30, min= 1, max= 129; 19.8% females; 20.6% self-defined as non-heterosexual; 60% were engaged in couples' relationships; and 26.5% had their significant other also participating in the game). Considering, Z = 1.96, confidence

interval 95%, the calculated maximum sampling error is +/- 3.07%. Preliminary socio-demographic analyses of the participants is provided in Table 1.

-Table 1-

Instruments

Socio-demographic, internet and game use information was collected alongside the main measurement scales listed below.

Internet Gaming Disorder Scale–Short-Form (IGDS9-SF; Pontes & Griffiths, 2015). The IGDS9-SF was utilised to examine disordered gaming. The nine scale questions, reflecting the relevant DSM-5 described behaviours with reference to the past calendar year (*"Have you jeopardised or lost an important relationship, job or an educational or career opportunity because of your gaming activity?"*) are addressed across five-points (1 = *never* to 5 = *very often*). Responses are accumulated formulating an IGD rate ranging from 9 (minimum behaviours) to 45 (maximum behaviours). The internal reliability of the scale here was sufficient (Cronbach α = .85).

Proteus Effect Scale (PES; Van Looy, Courtois, De Vocht & De Marez, 2012). The PES was employed to measure behavioural effects in reality. The PES involves six questions which inform a single dimension that reflects the influence games pose on the user offline (e.g., *"I see things differently when I play with another character"*). The original measure assessed the extent a gamer identified with his/her in-game character and the effect this posed on him/her whilst gaming. However, amendments were introduced to adapt the measure to the present study. These involved assessing the influence a gamer's avatar posed on the gamer in reality by addressing the same six questions two times; first, with reference to the game (e.g., *"Please respond to the answer that best represents your behaviours and feelings*

in the game") and second with reference to real life (e.g., *"Please respond to the answer that best represents your behaviours and feelings in your real life"*). Items were addressed across five-points (e.g., 1 = *strongly disagree* to 5 = *strongly agree*). Points were accumulated twice, first with reference to the game context and second with reference to real life, resulting to scores ranging between 6 and 30 and increased rates reflecting increased PE experiences. The internal consistency rate here resulted to a Cronbach's α of .89 for real life behaviors (which was employed in the present analyses) and .88 for online behaviours.

Procedure

The ethics committee license from the researchers' institution was provided before progressing to the online collection. Online data was chosen as it is proposed for Internet players, it enables participation of hard to access populations differently and is supported not to vary in quality from face to face collection (Griffiths, 2010a; Weigold, Weigold & Russell, 2013). Online promotion via social networks and gaming forums was conducted from August 2017 to April 2019. After activating the survey-link, eligible gamers accessed the plain language information statement. Following this, they had to digitally provide informed consent to continue to the online survey assessment (via an on-screen 'tick box'). No cost or limitations were employed for discontinuing and responses were anonymous and confidential.

Statistical analyses

Latent Class Profiling-Analysis (LCA) with numeric indicators and automatic random starts (to prevent local maxima) utilizing M*plus* 7 (Muthén & Muthén, 2019) was used aligning with available research (Carras & Kardefelt-Winther, 2018). The means and variances of the indicators and the profiles' averages were calculated with the Maximum Likelihood with Robust Standard Errors estimator[1] (MLR; Li, 2016). The numeric classes'

indicators' averages, and variances were free whilst the classes' variances were restricted to be equal, while the covariances between different profiles were set to 0. The profiles of the structure with the best fit were later regressed to the IGD9-SF score, as well as the different IGD items separately (APA, 2013).

Results

Number of classes

The testing of a three-class structure corresponded to a Vuong-Lo-Mendell-Rubin test[2] (VLMR-LRT; H0 Loglikelihood Value) equal to -11871.409, with a 2-Time value of 765.98 and a *p*-value of .049 proposing that two profiles were insufficient and that three profiles were required. The bootstrapped parametric likelihood ratio VLMR-LRT, which advances the findings' robustness (Muthén & Muthén, 2019), informed similar findings. The final structure fit corresponded to an Akaike Information Criterion[3] (AIC) of 23028.840, a Bayesian Information Criterion (BIC)[4] of 23144.013 and a sample-size adjusted BIC of 23061.467, which were improved to both the one-class and the two-class structures respectively, thus suggesting higher applicability. The four-class model was rejected (although it presented with lower AIC and BIC; see Table 2) because the related VLMR-LRT value was insignificant indicating that three classes were sufficient.

Size of classes

Regarding the proportions of the three profiles suggested, the final class counts and proportions and the estimated posterior probabilities revealed that approximately 70% were classified as Class 1, 26% were classified as Class 2, and 4% were classified as Class 3.

Classification quality

The entropy[5] score for the three classes structure was .974, reaching 1 and being over the cut-off of .76, that corresponds to over 90% accurate classification for structures involving three profiles (and significantly higher .64, lower of which there is a minimum 20% likelihood of inaccurate classification; Larose, Harel, Kordas & Dey, 2016).

-Table 2-

Classes across the indicators

Class 1 means varied in the area of one standard deviation lower of the sample's means considering all PES items. Therefore, those in Class 1 were defined as 'non-influenced gamers' (NIGs) from the avatar class. Class 2 was lower than half standard deviation below the mean on PE Item 1 *("When I play with a different character, I feel different"),* and higher than one standard deviation above the mean on Item 3 *("When I play with another character, I feel involved in a different way")* and Item 4 *("The choice of game character determines how I experience things").* Subsequently, those in Class 2 were named as 'perception-cognition influenced gamers' (PCIGs) because in relation to their perception and experience they reported influence but in relation to their emotion they did not. Finally, Class 3 was higher than three standard deviations above the mean for Item 1 *('When I play with a different character, I feel different')* and more than one standard deviation above the mean for Item 2 *('I behave differently when I play with another character').* Consequently, those in Class 3 were named as 'emotion and behaviour influenced gamers' (EBIGs; see Table 3 and Figure 1).

-Table 3
&
Figure 1-

Classes and disordered gaming

To examine the possible links of the three PE classes proposed with gaming disorder behaviours, multinomial logistic regression of the three profiles on the disordered gaming score was also conducted. This increased the model fit. The AIC was 22816.574, the BIC was 22940.606 and the sample-size adjusted BIC of 22851.711, which were better than those of the structure including the three classes only. This revealed that adding gaming disorder scores increased the model fit. The parameterisation with reference to Class 3 resulted to an odds ratio (OR) of .65 for Class 1 (Standard-Error = .24, p = .006) and of .51 for Class 2 (Standard-Error = .24, p = .030). Accordingly, for every point of increase in gaming disorder behaviours, the likelihood of a player being classified as Class 3 instead of Class 1 elevated by .65, while for Class 2 it was .51.

To detect the exact variations between the three classes with reference to the DSM-5 IGD criteria, the profiles were additionally regressed on every single item separately utilizing several multinomial regressions. Membership of Class 3 instead of Class 1 and 2 was associated with DMS-5 'tolerance' criterion 3 *"Do you feel the need to spend an increasing amount of time engaged in gaming in order to achieve satisfaction or pleasure?"* (Class 3 vs. 2b = .56, p < .001; Class 3 vs. 1b = .91, p < .001), DSM-5 'loss of control' criterion 4 *"Do you systematically fail when trying to control or cease your gaming activity?"* (Class 3 vs. 2b = .58, p < .001; Class 3 vs. 1b = .68, p < .001), and DSM-5 'mood modification' criterion 8 *"Do you play in order to temporarily escape or relieve a negative mood (e.g., helplessness, guilt, anxiety)?"* (Class 3 vs. 2b = .23, p = .007; Class 3 vs. 1b = .31, p < .001).

Discussion

The current research assessed a normative sample of 1,022 *WoW* gamers to identify possible PE profiles and their links with gaming disorder behaviours. Latent class analysis illustrated three PE classes that (based on their PE characteristics) were named as 'non-influenced gamers' (NIGs), 'perception-cognition influenced gamers' (PCIGs), and 'emotion and behaviour influenced gamers' (EBIGs). The NIGs demonstrated consistently low scores across all PE items assessed referring to the avatar influence in their real life. The PCIGs did not indicate significant emotional and behavioural avatar-related effects, although they reported relatively higher influence in the way they experienced and were involved with real life stimuli. Finally, the EBIGs reported significantly higher emotional and behavioural effects of their in-game characters in reality. The overall number of reported disordered gaming symptoms (as described in DSM-5; APA, 2013) were lower for the NIGs and progressively higher for the PCIGs and the EBIGs. The three IGD criteria of tolerance, loss of control, and mood modification were specifically related to the EBIGs' PE class.

The non-influenced gamer PE class

The NIG class comprised approximately 70% of the participants. NIGs were inclined to report lower perception-cognition, as well as lower emotional and behavioural influences from their in-game characters. Unsurprisingly, these gamers were less likely to present with higher IGD9-SF scores, as reflected by the nine DSM-5 IGD criteria (APA, 2013). The proportion of this profile is important provided the relatively increased average game participation and achievement of the current participants (i.e., over eight years gaming WoW, with a mean avatar level of over 100 that suggests well-engaged players). Subsequently, this supports the contention that higher game engagement and accomplishment may not necessarily make the user behaving like their avatar in real life (i.e., higher PE) or disordered

gaming as has been indicated elsewhere in the available evidence (Billieux et al., 2013; Griffiths, 2010b).

The perception-cognition influenced gamer PE class

The PCIG class accounted for approximately 26% of all respondents. PCIGs were inclined to perceive, experience, and involve with real-life stimuli in a way that was somewhat influenced by their in-game characters, but without reporting significant emotional and behaviour-related influences (compared to the other two classes). This supports a perceptive-experiential effect, as described in the initial stage of the CBT sequence (i.e., experience-informing cognitions, which inform feelings eventuating in behaviours; Stavropoulos et al., 2019) which is not accompanied by any significant emotional and behavioural reactions. Therefore, although their perception and experience might sometimes converge with their in-game character, their offline-life emotional and behavioural conduct is not particularly influenced by their avatars. Consequently, their indicated gaming disorder manifestations, although increased compared to the NIGs, were reduced compared to the EBIGs. Nevertheless, more research is required to confirm these interpretations, likely through qualitative methodologies targeting players of a particular profile.

The emotion and behaviour influenced gamer PE class

The EBIG class comprised approximately 4% of the participants. EBIGs were inclined to report that their real-life feelings and (to a lesser extent) behaviours were influenced by their in-game avatars. This was despite reporting lower perception and experience influences by their in-game character compared to PCIGs. From a CBT cycle perspective, this could indicate that EBIGs experience a higher avatar influence in later stages of the CBT sequence (perceptions and experiences influencing feelings that in turn influence behaviours), and in that context they might be consumed and dominated by these aspects

compared to perception-related influences. Consequently, it could be assumed that gamers with this profile might be more be more likely to blur the boundaries between their real life and in-game representation. Unsurprisingly, the EBIGs exhibited with higher IGD9-SF scores, with tolerance, loss of control, and mood modification game-related behaviours being distinctively predictive of this class.

Conclusions, limitations, and further research

There presents to be an important link between PE and gaming disorder behaviors. This should be additionally examined in the light of the three separate PE classes (i.e., the NIGs, the PCIGs and the EBIGs). Furthermore, the present results expand and advocate (through quantitative empirical evidence) non-evidence based psychological therapy protocols for gaming disorder employing the avatar (i.e., recommended inquiries and reflections about the online identity of gamers and how this compare with their real one; Tisseron, 2009). Therefore, it is recommended that PE manifestations should be taken into consideration in the case formulation of gaming disorder behaviours, as well as in their prevention and intervention planning. However, these ideas should be approached in the light of the restrictions of the current research, which employed a community-sourced sample, a cross-sectional design and self-reporting data, that might invite biases and caveats and compromise the examination of the direction of causality between PE and gaming disorder behaviours. Over-time and mixed methodological designs (involving biological indicators) are necessary, as well as studies utilising clinical samples, to clearer define and test the profiles supported in the present study and to further elucidate their associations with disordered gaming.

Compliance with Ethical Standards

Conflict of Interest:

The authors of the present study do not report any conflict of interest.

Ethical Standards – Animal Rights:

All procedures performed in the study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors.

Informed consent:

Informed consent was obtained from all individual participants included in the study.

Confirmation Statement:

Authors confirm that this paper has not been either previously published or submitted simultaneously for publication elsewhere.

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Table 1. *Socio-Demographic Profile of the Sample*

Educational Status

			Professional Degree (e.g. MD, JD etc)	PhD	MSc	BSc	BSC attended (not completed)	Inter-rmediate degree (e g technical training)	High school year 9 to 12	Middle school year 7 to 8	Primary School	Total
Educational Status by Gender	Females	N	5	3	25	54	57	24	34	0	1	202
		%	0,50%	0,30%	2,40%	5,30%	5,60%	2,30%	3,30%	0,00%	0,10%	19,80%
	Males	N	50	13	73	203	231	102	128	10	9	820
		%	4,90%	1,30%	7,10%	19,90%	22,60%	10,00%	12,50%	1,00%	0,90%	80,20%
	Total	N	55	16	97	258	288	126	161	10	10	1022
		%	5,40%	1,60%	9,50%	25,20%	28,20%	12,30%	15,80%	1,00%	1,00%	100,00%

Occupational Status

			Full-time employment	Part-time/casual employment	Student	Trainee	Unemployed	On temporary leave (education leave, public service leave, training, maternity leave)	Other	Total
Occupational Status by Gender	Females	N	67	41	55	0	20	3	16	202
		%	6,55%	4,00%	5,45%	0,00%	2,00%	0,30%	1,40%	19,80%
	Male	N	334	87	301	2	55	8	33	820
		%	32,65%	8,60%	29,45%	0,20%	5,40%	0,80%	3,20%	80,20%
	Total	N	401	128	356	2	75	11	49	1022
		%	39,20%	12,60%	34,90%	0,20%	7,40%	1,10%	4,60%	100,00%

Ethnicity

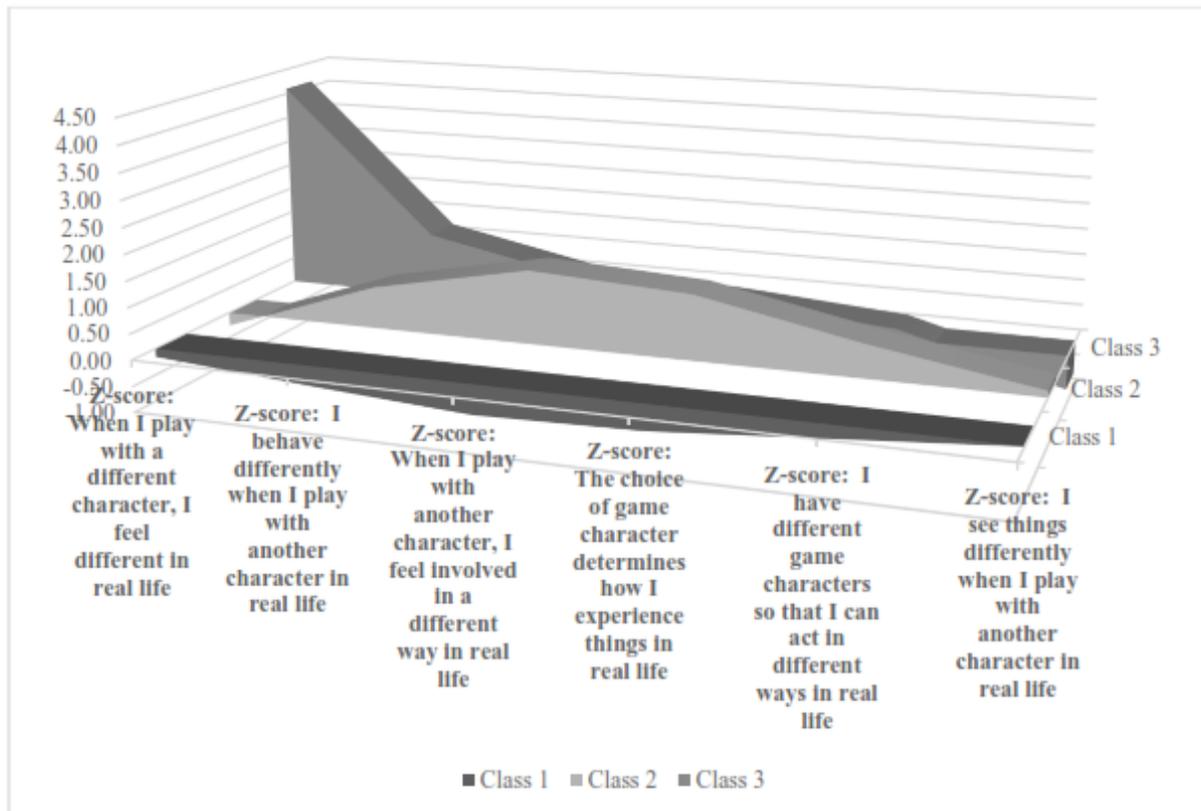|			White-Caucasian	Asian	African	Native American	Indigenous Australian or Torres Strait Islander	Pacific Islander	Mixed	Total
Ethnicity by Gender	Females	N	182	5	0	4	2	6	3	202
		%	17,85%	0,50%	0,00%	0,40%	0,15%	0,55%	0,30%	19,80%
	Males	N	700	92	1	8	4	2	14	820
		%	68,45%	9,00%	0,10%	0,80%	0,35%	0,15%	1,40%	80,20%
	Total	N	882	97	1	12	6	8	17	1022
		%	86,30%	9,50%	0,10%	1,20%	0,50%	0,70%	1,70%	100,00%

Table 2. The three classes across the disordered gaming criteria introduced in DMS-5 (APA, 2013)

LCA	Classes	Mean PES (Z-Score)	%	Posterior Probability	VLMR-LRT P Value	LMR-aLRT P Value
Class=1 *BIC= 24940.260* *AIC= 24887.103*	*1*	*0*		*1*		
Class = 2 *BIC = 23864.982* *AIC = 23780.817* *Entropy=.954*	*2*	*Class 1= -.49* *Class 2=1.20*	*Class 1=71%* *Class 2=29%*	*Class 1= .7113* *Class 2= .2887*	*.000*	*.000*
Class = 3 *BIC =23144.013* *AIC = 23028.840* *Entropy=.974*	*3*	*Class 1= -.51* *Class 2=1.17* *Class 3=1.19*	*Class 1=70%* *Class 2=26%* *Class 3=4%*	*Class 1=.6997* *Class 2=.2570* *Class 3=.0433*	*.049*	*.049*
Class = 4 *BIC =22824.639* *AIC =22678.459* *Entropy=.974*	*4*	*Class 1=-.62* *Class 2=1.23* *Class 3=1.19* *Class 4=.89*	*Class 1=63%* *Class 2=15%* *Class 3=4%* *Class 4=18%*	*Class 1=.6318* *Class 2=.1482* *Class 3=.0432* *Class 4=.1769*	*.461*	*.468*

Table 3. The three classes across the PES items referring to real life

	Z-score: When I play with a different character, I feel different in real life	Z-score: I behave differently when I play with another character in real life	Z-score: When I play with another character, I feel involved in a different way in real life	Z-score: The choice of game character determines how I experience things in real life	Z-score: I have different game characters so that I can act in different ways in real life	Z-score: I see things differently when I play with another character in real life
Class 1	-0.16	-0.38	-0.57	-0.50	-0.25	-0.01
Class 2	-0.26	0.81	1.43	1.26	0.65	0.13
Class 3	4.10	1.26	0.64	0.44	0.20	-0.66

Note 1: Cluster analysis was not preferred as despite providing information about different clusters of gamers, it does not provide information about the overall fit/applicability of the model and the exact chances of a specific gamer being classified into a certain category. Factor analysis was also not utilised as it refers to the extraction of dimensional-continuous latent factors and not categories-profiles, which was the aim here.

Note 2: This test assesses the model with the number of typologies proposed against a model with one less typology (class). An insignificant Vuong-Lo-Mendell-Rubin test indicates that the assumed number of classes/typologies/profiles is necessary (Jung & Wickrama, 2008).

Note 3: The AIC is regarded as an information theory goodness of fit measure—applicable when maximum likelihood estimation is used (Vrieze, 2012). This index is used to compare different models. Like the chi square index, the AIC also reflects the extent to which the observed and predicted covariance matrices differ from each other. Models that generate the lowest values are optimal.

Note 4: The BIC is similar to the AIC expressing the log of a Bayes factor of the target model compared to the saturated model and penalises against complex models. Furthermore, a penalty against small samples is included in BIC calculation (Vrieze, 2012).

Note 5: Entropy with values approaching 1 indicate clear delineation of classes (Celeux & Soromenho, 1996).