Stavropoulos, V., Gomez, R., Müller, A., Yucel, M. & Griffiths, M.D. (2019). User-avatar bond profiles: How do they associate with disordered gaming? *Addictive Behaviors,* 106245, https://doi.org/10.1016/j.addbeh.2019.106245

Abstract

Aims: The avatar constitutes the in-game representation of the gamer. Although aspects of the user-avatar bond (UAB) have been associated with disordered gaming, there is a need for clearer understanding concerning the impact of potential UAB profiles. *Methods:* To address this need, the present study recruited a normative sample of 1022 *World of Warcraft* (*WoW*) players (M_{age} = 28.55 years, SD = 9.90). Participants completed the User-Avatar Questionnaire (to assess UAB aspects such as identification, immersion, and compensation), the Proteus-Effect Scale (to assess transference of the avatar's behaviour in real life), and the Internet Gaming Disorder Scale–Short-Form (to assess disordered gaming). *Results:* Latent class analysis indicated the existence of three UAB profiles, 'differentiated gamers' (DGs), 'identified gamers' (IGs) and 'fused gamers' (FGs). The DGs were characterized by low scores across all UAB aspects. The IGs did not report significant Proteus Effect (PE) or immersion behaviours, and despite being more identified with their avatar, did not significantly compensate through it. The FGs presented with higher PE, immersion, and compensation, although they did not significantly identify with their avatars, possibly due to having idealized them. Disordered gaming behaviours were significantly lower for the DGs and sequentially higher for the IGs and the FGs. Preoccupation and mood modification behaviours related to gaming disorder were distinctively associated with FGs. *Conclusion:* Disordered gaming assessment and treatment implications of the UAB profiles are discussed.

Keywords: user-avatar bond; gamer identity; immersion; compensation; Proteus Effect; IGD; disordered gaming; gaming profiles

1. Introduction

The impact of disordered gaming across a range of domains (e.g., mental health, relationships and general adaptation; Anderson, Steen & Stavropoulos, 2017) for a minority of gamers has led to the introduction of diagnostic-classification terminologies (Scerri, Anderson, Stavropoulos, Hu & Collard, 2019). Internet Gaming Disorder (IGD) was included as a provisional diagnosis requiring further research in the fifth edition of the *Diagnostic Statistical Manual of Mental Disorders* (DSM-5; American Psychiatric Association, [APA] 2013). Similarly, Gaming Disorder (GD) was acknowledged as an official classification in the 11th edition of the *International Classification of Diseases* (ICD-11) of the World Health Organization (WHO, 2019). Nevertheless, controversies regarding the diagnostic accuracy of the disorder remain (Jeong et al., 2018; Jo et al., 2019; Van Rooij et al., 2018). Despite these debates, it is generally agreed that it is the interplay between individual characteristics of the user, alongside features of the real and in-game context that determines the range of negative and/or positive gaming outcomes (Brand et al., 2019; Griffiths & Nuyens, 2017; Liew, Stavropoulos, Burleigh, Adams & Griffiths, 2019b; Stavropoulos, Burleigh, Beard, Gomez & Griffiths, 2018a). Within the context of this interplay, the relationship-attachment developed between gamers and their in-game character (i.e., their avatar), has been repeatedly acknowledged as an important and under-researched factor (Burleigh, Stavropoulos, Adams, Liew & Griffiths, 2018). More specifically, the user-avatar-bond (UAB) relationship has been conceptualized as ongoing and bi-directional (from the gamer to the avatar and vice-versa; Liew et al., 2018). Interestingly, and aside of contributing to disordered gaming, the UAB has been also suggested to possess a significant positive potential when employed therapeutically in the context of gamified e-health applications, as well as being implicated with the gamers'

behaviour offline via behaviour transference processes (Jones, Scholes, Johnson, Katsikitis, & Carras, 2014; Liew et al., 2018; Blinka, 2008; Ratan & Dawson, 2015).

In that context, the aim of the present study was to develop a model that would enable the categorization of gamers' UAB experiences in the light of the differentiation of self-construct applied in clinical practice (Lampis et al., 2017). The establishment of such a model was aspired to concurrently embrace diagnostic-clinical implications (i.e., capacity to categorize gamers based on their multifaceted UAB), epidemiological/prevalence implications (i.e., percentages of gamers informing the different categories), and conceptual/theoretical implications (i.e., the confirmation of the optimum number of typologies of gamers, as well as the way that these differ quantitatively and/or qualitatively).

1.2. The user-avatar bond

Blinka (2008) attempted to integrate main theoretical points considering the complex attachment, projective, and immersive dynamics associating the gamer with the avatar. More specifically, he highlighted that a psychological transmission occurs from the gamer to the avatar, because the avatar does not exactly overlap with the gamer's identity (Allison, Von Wahlde, Shockley, & Gabbard, 2006). Blinka (2008) attributed such transmissive processes on the "augmented" nature of the avatar, which cross the border between the internalized fantasy world and the collectively experienced (in-game) reality. This enables the gamers to role-play different identities, that may correspond with the various, likely suppressed, reflections/versions of the gamer's psyche/self (Burleigh et al., 2018; Blinka, 2008). It is this

emotional attachment developed between the user and the avatar that enables the projection of unconscious psychological material (Wolfendale, 2006). This prompted Tisseron (2009) to suggest that the user-avatar bond should be emphasized in the treatment of excessive gaming among adolescents. Within this context, Blinka (2008) empirically demonstrated that the gamer "transfers" psychological material to the avatar via three main channels. First, the "identification" channel, whereby the gamer fuses their identity and self-perception with that of their online representation. Second, the "immersion" channel whereby the needs, the drives, and the in-game priorities of the avatar dominate the thoughts and the feelings of the gamer offline, getting likely (and in excessive gaming cases) prioritized to the gamer's real-life needs. Third, the "compensation" channel, whereby the gamer may counterbalance through the avatar real-life deficits related to appearance (e.g., height, skin colour) and/or character behaviour (e.g., confidence, assertiveness).

Other scholars have supported that it is not only 'who the gamer is in real life' that formulates the avatar's representation in the game, but that the avatar can also affect the gamer's behaviour offline (Liew et al., 2018). More specifically, it has been postulated that non-volitional phenomena associated to playing games, termed as 'Game Transfer Phenomena' (GTP) can influence the real-life behaviour of the gamer (Dindar & Ortiz de Gortari, 2017). These non-volitional phenomena have been proposed to include altered perceptions, automatic thoughts, and even involuntary behaviours (Ortiz de Gortari, Pontes & Griffiths, 2015) ranging from bodily sensations within video games (Ortiz de Gortari et al., 2015) to altered behavioural patterns, the more avatar-attached a gamer becomes (Ortiz de Gortari, Oldfield & Griffiths, 2016).

Such phenomena seem to culminate in what has been defined as 'Proteus-effect' (PE) manifestations, which are developed in the context of the UAB (Yee, Bailenson, & Ducheneaut, 2009). According to Greek mythology, Proteus used to be the name of the ancient Greek god of transformations, who could assume any form and shape he wished in order to avoid communicating his privileged knowledge of the past, present, and future (Encyclopaedia Britannica, 2019). Based on the analogy between the god's capacity to take various forms and shapes, within the context of his effort to avoid contact, Yee and his colleagues (2009) employed the PE term to define the mutually transforming relationship between gamers and their avatar. More specifically, they noted that while the gamer may assume different avatar forms, depending on their real-life strengths and/or weaknesses, the in-game avatar can also transform the gamer's perception, behaviour, and demeanour in real-life. Empirical evidence suggests that appearance attributes of avatars, such as height and looks, exert a specific effect on real-life actions (Ratan & Dawson, 2015; Yee et al., 2009). For instance, gamers with taller avatars present with higher confidence, while others with more attractive avatars behave with more social confidence in their real-life (Yee et al., 2009).

Subsequently, the differentiation of the real and the virtual self (i.e., the avatar) could become more blurred (Stavropoulos et al., 2019b). Indeed, low self-concept clarity has been associated with problematic gaming (Šporčić & Glavak-Tkalić, 2018). Such self-avatar disentangling issues may be better conceptualized through the "differentiation of self" construct applied in clinical practice (Lampis, Cataudella, Busonera, & Skowron, 2017). This involves: (i) intra-psychic differentiation defining an individual's capacity to distinguish thoughts and feelings (self-insight; in this case awareness of internalized avatar-related cognitions and feelings), and (ii) inter-personal differentiation that refers to distinguishing

individual experience(s) and view(s) from those of others (in this case addressing the avatar as a different entity; Lampis et al, 2017). More "self-differentiated" individuals (i.e., aware of their views and feelings and their internalized views of others) are assumed to be mentally healthier and less prone to addiction (e.g., disordered gaming) due to maintaining higher identity and orientation clarity, as well as lower level of internal distress-inducing inconsistencies (that could accommodate a need to escape; Thorberg & Lyvers, 2006). This is further reinforced by literature suggesting that discrepancies between one's actual and ideal self, often projected on avatars among gamers, accommodate lower levels of wellbeing and mental health (Thomson, 2016). Accordingly, such issues should be addressed by reflective (i.e., self-mirroring and self-awareness tasks) and cognitive processing (i.e., thinking about the way one thinks) techniques in the context of treatment (in line with effective treatment approaches applied in the broader field of addictions; Thorberg & Lyvers, 2006).

1.3. The user-avatar bond and disordered gaming

Interestingly, recent empirical evidence supports significant immersive/UAB ties with disordered gaming (Lehenbauer-Baum & Fohringer, 2015). More specifically, Burleigh et al. (2018) reported that a higher sense of identification (self-presence) with the avatar, not only acts as an independent disordered gaming risk, but also concurrently increases disordered gaming risk among depressive gamers. Similarly, Liew et al. (2018) showed using mixed methods (i.e., physiological trackers and psychological scales) that experiencing the avatar as one's physiological extension (proto-self presence; Ratan & Dawson, 2015) exacerbated disordered gaming behaviours. However, these were significantly buffered by the gamer's higher level of physiological activity in real life. Additionally, Morcos et al. (2019) found that the choice of specific avatar features (i.e., Draeneis in *World of Warcraft*) accommodated

higher compensation (for real-life deficits) tendencies, thus eventuating disordered gaming. Similarly, gaming-related achievement and socialization drives, in-game avatar progression, and even virtual gender swapping (i.e., male in reality and female in the game; Arnoux et al., 2016) have been shown to be affected by one's in-game identity (Obst, Zhao, White, O'Connor & Longman, 2018; Thorens et al., 2016). These findings correspond with more recent empirical evidence confirming that creating an idealized (though non utopian-unrealistic) avatar enhances the gamer's identification, that in turn increases addiction risk (even more than avatar customization processes themselves; Mancini, Imperato, Sibilla, 2019). Nevertheless, such processes can also function positively for gamers, when the culture (interaction patterns) developed within a specific in-game group counter-balances real-life discomfort by providing a balanced sense of challenge and mastery (Snodgrass et al., 2017).

1.4. The present study

To expand the knowledge regarding the UAB and disordered gaming associations, the DSM-5 (APA, 2013) definition of disordered gaming was utilized. This conceptualizes IGD as the persistent and recurrent involvement of gaming, frequently with co-players, resulting in clinically significant impairment-distress over a 12-month period. Despite the debates concerning the conceptualization of gaming disorder, the DSM-5 criteria for IGD constitute the most broadly used and relevant criteria in both research and clinical practice (Griffiths, King, & Demetrovics, 2014). Furthermore, the DSM-5 IGD criteria was selected for the present study because: (i) the present research focused on internet gaming; (ii) it allows comparability with past international findings; and (iii) it is has well-established assessment instruments that have been used both cross-culturally and longitudinally (Stavropoulos, Bamford, Beard, Gomez & Griffiths, 2019a).

To investigate UAB aspects in relation to disordered gaming, the present study recruited a sample of *World of Warcraft* (*WoW*) gamers. *WoW* is a massively multiplayer online-role playing game (MMORPG) that involves a fantasy online world. Players participate through controlling the development and behaviour of an in-game character, who wanders across virtual places, competes with monsters to address missions, while interacting with avatars representing other gamers (Billieux et al., 2013). *WoW* was selected on the basis of its broad and relatively representative population of gamers (Morcos, Stavropoulos, Rennie, Clark, & Pontes, 2019), as well as a number of other reasons. First, it is a long-played game that enables the examination of the effect of lengthier game involvement (Billieux et al., 2013). Second, it combines game motivations that increase engagement such as online socialization, has a constant system of rewards and challenges, and includes character-development features (Morcos et al., 2019). Third, it has been highlighted as a high-risk game for disordered gaming (Billieux et al., 2013).

Based on past literature supporting the existence of different categories of gamers (Hamari & Tuunanen, 2014), alongside the higher clinical utility of typologies/profiles in clinical practice (Torres-Rodríguez, Griffiths, Carbonell, Farriols-Hernando & Torres-Jimenez, 2019), the aims of the present study were to: (i) profile *WoW* gamers according to their reported UAB aspects involving identification, immersion, compensation, and PE; (ii) assess how UAB profiles associate with disordered gaming overall and; (iii) describe differences of the potential UAB profiles according to the nine DSM-5 IGD criteria (APA, 2013).

Based on literature suggesting: (i) three main profiles/typologies among *WoW* gamers according to personality (i.e., extroversive, introversive, and ambiversive; Bean, Ferro, Vissoci, Rivero & Groth-Marnat, 2016), and (ii) differentiation of self-findings supporting

three main self-differentiation distinctions (i.e., the disengaged/emotionally cut-off, the differentiated and the fused; Knudson-Martin, McDowell & Bermudez, 2019), three distinct profiles were hypothesized/expected. Furthermore, aligning with past evidence it was expected that higher user-avatar fusion profile(s) would associate with higher disordered gaming propensity (Burleigh et al. 2018; Morcos et al., 2019) and that this would be reflected by higher scores on the DSM-5 IGD criteria (Stavropoulos et al., 2019b).

2. Methods

2.1. Participants

A normative sample comprising of 1022 *WoW* gamers (M_{age} = 28.55 years, *SD* = 9.90; mean years of education= 13.22 years, SD= 5.28; mean years of internet use= 16.08 years, SD= 5.41; mean years of playing WoW= 8.41 years, SD=4.11; mean game level = 104.99, SD=22.30; 19.8% females; 21.4% LGBT; 60% in a romantic relationship; and 26.5% with their romantic partner playing also *WoW*). For a Z = 1.96 at a confidence interval of 95%, the estimated maximum sample error was +/- 3.07%. Preliminary analysis of the sample's socio-demographic profile are provided in Table 1.

-Table 1-

2.2. Measures

Internet Gaming Disorder Scale–Short-Form (IGDS9-SF). Disordered gaming was assessed using the IGDS9-SF (Pontes & Griffiths, 2015). The nine items in the scale are responded to on a five-point Likert scale (1=never to 5=very often), with items assessing the respective nine DSM-5 criteria during the past 12 months (*"Have you jeopardised or lost an*

important relationship, job or an educational or career opportunity because of your gaming activity?"). Item responses are added together resulting to a total score ranging from 9 (minimum symptoms) to 45 (maximum symptoms; see appendix Table 1.1.). A minimum score of 25 informed by the endorsement of "very often" on five or more of the nine criterion items has been supported as the diagnostic cut-off point. Nevertheless, cross-cultural studies have indicated the same scores indicating different levels of severity across populations. The internal reliability of the instrument for in the present study was very good (Cronbach α=.85).

User-Avatar Questionnaire (UAQ; Blinka, 2008). The UAQ was used to assess various aspects of the gamer-avatar bond. The 12 items in the scale are responded to on a five-point Likert scale (1=strongly disagree-5=strongly agree). The scale items assess three dimensions: identification (four items; *"Both me and my character are the same"*), immersion (five items: *"Sometimes I think just about my character while not gaming"*), and compensation (three items: *"I would rather be like my character";* see appendix Table 1.2.). The scores reflecting each different user-avatar bond aspect were calculated adding the scores of each item in each subscale, with higher scores reflecting higher experienced levels of each respective aspect. The internal consistency rates were good (identification Cronbach α=.78; immersion Cronbach α=.72; compensation Cronbach α=.75).

Proteus Effect Scale-Avatar Identification in real life Scale (PES-AIS; modification of the Avatar Identification Scale [AIS] Van Looy, Courtois, De Vocht & De Marez, 2012). The scale was used to assess behaviour transference in real world. It comprises six items which load onto a single variable that ascertains the effect games have on behaviour (e.g., *"I see things differently when I play with another character"*). The original scale (as developed by Van Looy et al; 2012) assessed how much a player identifies with their avatar and the influence this has

on them in the virtual realm. Nonetheless, necessary modifications were made to adapt the scale to the present study. These included assessing the effect a gamer's avatar has on the player in real life. This was achieved by asking the same six items in a physical setting context (e.g., *"I behave differently in my real life when I play with another character"*). Items on the PES-AIS are responded to on a five-point Likert scale (e.g., 1="strongly disagree" to 5="strongly agree"; see appendix Table 1.3.). To determine a score on the PES-AIS for both settings, the scores ranged from 6 to 30 in which higher scores showed stronger PE behaviours. The internal consistency of the scale was very good with a Cronbach's α score of .89 for offline.

2.3. Procedure

Institutional ethics committee approval was received to proceed with the online data collection. Web collection was preferred because it is recommended for the population of online gamers, and it secures participation of otherwise hard to reach samples and has been shown not to differ in quality compared to offline data collection methods (Griffiths, 2010a; Weigold, Weigold & Russell, 2013). Digital advertising through social media and gaming forums was employed between August 2017 and April, 2019 inviting eligible adult gamers motivated to complete the measures via a *Survey-Gizmo* hyperlink. Upon accessing the survey-link, prospective participants were able to progress to the plain language information statement. Following this, they had to digitally (box-ticking) provide informed consent to continue to the measurements part. No penalties were applied for interrupted participation and all participants were informed that their data were anonymous and confidential.

2.4. Statistical analyses

Latent Class Analysis (LCA) with continuous indicators and automatic random starts (to avoid local maxima risk) using Mplus 7 (Muthén & Muthén, 2019) was implemented in line with past literature (Carras & Kardefelt-Winther, 2018)[1]. To address deviations from normality related to the nature of the data (e.g., exclusively *WoW* gamers), the means and variances of the latent class indicators and the means of the profiles were estimated by default using the Maximum Likelihood with Robust Standard Errors estimator (MLR; Li, 2016). The continuous profile indicators' means and variances were set free to vary, to appropriately reflect the variability across the profiles, in line with relevant past findings (e.g., Bean et al., 2016). The profiles' variances were restricted to be equal because it was assumed that these would not differ in regards to their homogeneity (in line with past relevant gaming profile findings; Bean et al., 2016). Finally, the profile covariances were set to 0, to address the distinct class/profile membership expected in line with past relevant studies (e.g., Bean et al., 2016). The classes of the model with the optimum fit were then regressed to total score on the IGD9-SF comprising the nine IGD criteria (APA, 2013) to further assess specific differences. Furthermore, an analysis of variance (ANOVA) of the disordered gaming scores across the classes, enhanced with bootstrapping at the minimum recommended 1000 resamples (Musciotto, Marotta, Miccichè & Mantegna, 2018) was implemented to ascertain disordered gaming variations across the classes.

3. Results

3.1. Preliminary Analysis

To address potential random socio-demographic and game participation effects IGDS9-SF, UAQ (identification, immersion, compensation), and PES-AIS scores were studied in

relation to gender, age, occupational status, ethnicity, the avatar in-game level (e.g. higher level indicates higher game progression) and the years of playing WoW. As indicated in Table 2, all the sociodemographic and game participation characteristics studied, with the exception of gender, had effect sizes in the range of "very small" and "small" (.00-.06; Cohen, 1992; Sawilowsky, 2009) across the IGD, the PES-AIS and the UAQ scores. Gender effect sizes, although small (=< .20), were mildly higher considering IGD scores, identification and compensation (as measured with the UAQ). Therefore, it was decided that the optimum profiles resulting would be additionally studied in relation to gender.

-Table 2-

3.2. Number of profiles/classes

The testing of a three-class model resulted in a Vuong-Lo-Mendell-Rubin test[2] equal to -7254.27, with a 2-Time value of 699.64 and a *p*-value of <.0001 suggesting that two categories are in-sufficient and that three categories/classes are indeed necessary. The bootstrapped parametric likelihood ratio Vuong-Lo-Mendell-Rubin test, which increases the solidity of the results (Muthén & Muthén, 2019), resulted to exactly the same results. The overall model fit resulted to an Akaike Information Criterion[3] (AIC) of 13844.89, a Bayesian Information Criterion (BIC)[4] of 13924.63 and a sample-size adjusted BIC of 13867.48, which were lower than both the alternatively tested one, two-class and four-class models respectively, thus indicating a better fit. Given the small effect size effects of gender on IGD, identification and compensation previously identified (see Table 2), a chi square analysis was conducted to assess significant gender-classes associations (e.g. whether the gender percentages were significantly different across the three classes). The analysis revealed insignificant associations between

gender and classes (X^2 = .719, p=.719, $H_{\text{of gender on classes}}$=.10). Furthermore, classes were logistically regressed on gender and results were also insignificant ($b_{\text{of class 2 with reference class 1}}$= -.263, p= 0.094; $b_{\text{of class 3 with reference class 1}}$= -.122, p=.585; $b_{\text{of class 2 with reference class 3}}$= .141, p= 0.510).

3.3. Size of classes

Considering the size of the three classes/profiles tested, the final class counts and proportions for the latent classes based on the estimated model and the estimated posterior probabilities showed that 43.79% were classified as Differentiated Gamers (DGs), 24.54% were classified as Identified Gamers (IGs), and 31.67% were classified as Fused Gamers (FGs). Nevertheless, the final class counts and proportions for the latent classes based on their most likely latent class membership resulted in slightly different findings with 43.71% in DGs, 24.35% in IGs, and 31.94% in FGs. This indicated mildly lower proportions for DGs and IGs and slightly higher for FGs.

3.4. Classification quality

The entropy[5] rate for the present model classification was .947, approximating 1 and exceeding the recommended threshold of .76, which has been associated with over 90% correct classification for models including three latent classes (and significantly above the .64, below which there is at least a 20% estimated probability of false classification; Larose, Harel, Kordas & Dey, 2016). This level of entropy indicates a solid classification of memberships across the three classes.

3.5. Classes across the indicators

Considering the three classes/ profiles, DGs averages distributed within the range of one standard deviation (below the sample's averages) across all profile indicators. Therefore, they were named as 'differentiated' gamers (from the avatar) class. IGs were close to the mean (less than half standard deviation above the mean) on PE and immersion, more than one standard deviation above the mean on identification, and more than half a standard deviation below the mean for compensation. Consequently, they were named as 'identified' gamers (but not fused with the avatar) class. Finally, FGs were more than one standard deviation above the mean for PE, immersion, and compensation, and close to the mean (less than half a standard deviation above) for identification. Furthermore, variability across the indicators was lower for DGs compared to IGs and FGs. FGs reported the highest variability on PE and compensation, and IGs reported the highest variability in identification and immersion (see Table 2 and Figure 1).

-Table 3-

- *Figure 1*-

3.6. Classes/profiles and disordered gaming

To identify the potential associations of the three UAB profiles identified via LCA with disordered gaming, a multinomial logistic regression of the latent classes on the disordered gaming score was additionally calculated. This improved the model fit. The AIC was 13522.53, the BIC was 13611.13 and the sample-size adjusted BIC of 13547.63, which were lower than those of the model without the classes being regressed on the disordered gaming rate. This indicated that the addition of disordered gaming improved the model fit. More specifically, the parameterization with reference the DGs resulted to an odds ratio (OR) of .27 for the IGs (Standard-Error= .03, p<.001) and of .30 for the FGs (Standard-Error=.03, p=.001). Therefore,

for every point of increase in disordered gaming scores the possibility of a particular participant being classified as IG instead of DG increased by .27, while for Class 3 it was .30. To more specifically identify the differences of the three profiles in relation to disordered gaming scores, as well as to clarify the effect size of the association, an ANOVA of the disordered gaming scores across the three classes additionally indicated that these significantly differed in relation to disordered gaming (DGs_{mean}=8.26, $Standardized_{mean}$=-.65, *SD*=5.52, $Standardized_{SD}$=.66; IGs_{mean}=17.97, $Standardized_{mean}$=.52, *SD*=6.22, $Standardized_{SD}$=.75; FGs_{mean}=20.09, $Standardized_{mean}$=.77, *SD*=7.58, $Standardized_{SD}$=.90; F=18262.45, $p<.001$, η^2=.432). The inspection of the post-hoc Bonferroni criterion indicated more significant mean differences between the FGs and the DGs (11.60; Standard Error=.59, $p<.001$) and the IGs and DGs (10.01; Standard Error=.63, $p<.001$) and a less strong, yet still a significant difference between FGs and IGs (1.59; Standard Error= .67, p=.05).

-*Figure 2*-

To detect the exact differences of the three classes in relation to the DSM-5 IGD criteria, the classes were further regressed on each of the criteria separately using several multinomial regressions. The classes' means and standard deviations, as well as the ORs between classes across each of the criteria separately are described in Table 4. Being classified as an IG instead of a DG was associated with DMS-5 criteria 1, 4, 8 and 9. Being profiled as an FG instead of an IG was associated with criteria 1, 2, 4, 7, 8 and 9. The classes' profile (reported item means) across the nine DSM-5 criteria indicated the IGs' escalating (more than the other two classes) on Criterion 7 (deception) and the FGs' escalating on Criterion 1 (preoccupation) and Criterion 8 (mood-modification).

Table 4.

4. Discussion

The present study recruited a normative sample of 1022 *WoW* gamers to examine potential user-avatar bond (UAB) profiles (involving identification, immersion, compensation, and PE) and their associations with disordered gaming. Latent class analysis identified three UAB profiles which were subsequently termed 'Differentiated' gamers (DGs), 'Identified' gamers (IGs), and 'Fused' gamers (FGs). The DGs presented low scores across all UAB aspects. The IGs did not report significant Proteus Effect (PE) and immersion behaviours, and despite being more identified with their avatar, did not significantly compensate via it. Finally, the FGs presented with higher PE, immersion, and compensation, although they did not significantly identify with their avatars, possibly due to having idealized them. Disordered gaming behaviours were significantly lower for the DGs and sequentially higher for the IGs and the FGs. The IGD indicators of preoccupation and mood modification were distinctively predictive of FGs' UAB.

4.1. The 'Differentiated Gamer' UAB profile

The DG class comprised approximately 44% of the gamers. DGs tended to identify less with their avatars, experienced lower immersion related to their avatar's in-game life/actions, and compensated less via their avatars for real life deficits. Consequently, these gamers presented with significantly lower IGD9-SF scores across all the relevant DSM-5 criteria. The size of this class is significant given the high average game exposure and accomplishment of the present sample (more than eight years playing the game, with an average level of over 100 which indicates accomplished players). Therefore, it could be assumed that lengthier game

involvement and achievement does not necessarily lead to user-avatar identity fusion or disordered gaming in line with past literature suggestions (Griffiths, 2010b; Van Rooij et al., 2018).

4.2. The 'Identified Gamer' UAB profile

The IG class comprised just over 24% of the sample. IGs tended to behave in a way that was somehow impacted by their avatars in their real life and also to be sometimes (average level) immersed by the avatars' in game action. Furthermore, and despite being more identified with their avatars compared to any other class, they tended not to compensate for real life deficits via their game character. This could indicate a convergence of their in-game representation with their real-life identity perception instead of the other way around. Presumably, due to being less dissatisfied with their real-life self-perception they did not exhibit the need of compensating online. In fact, they tended to match their avatar with their real self. Accordingly, their reported disordered gaming behaviours, although significantly higher than the DGs, were still significantly lower than the FGs, except for deception. The latter could be indicative of a functionally deceptive behaviour to avoid unnecessary concerns regarding the pathologization of normal gaming behaviours from their context or a need of privacy (Jo et al., 2019; Van Rooij et al., 2018). Nevertheless, more investigation is needed to ascertain the validity of this explanations, potentially through qualitative research involving gamers with the specific class profile.

4.3. The 'Fused Gamer' UAB profile

The FG class comprised just over 31% of the sample. FGs tended to present with real-life behaviours more impacted by their online avatars, while concurrently tending to be more immersed with their avatar in-game action, and to use avatars more as a mean to compensate real-life deficits (Brand et al., 2019; Griffiths & Nuyens, 2017; Liew et al., 2019; Stavropoulos et al., 2019b). Although, they tended to identify with their avatars more than the DGs, they were significantly lower on identification than the IGs. This could indicate that their avatars tended to constitute idealized self-versions, compared to which they felt inferior and therefore could not identify with (Morcos et al., 2019). Interestingly, the variability of the reported identification was higher among the FGs compared to DGs and IGs, indicating the presence of FGs with concurrently high senses of identification, compensation, and immersion within this class to the extent that the boundaries between real and game identity could be significantly blurred (Stavropoulos et al., 2019b). Not surprisingly, the FGs presented with significantly higher IGD9-SF scores, with preoccupation and mood modification behaviours related to disordered gaming being significantly associated with this class (Mancini et al., 2019; Obst et al, 2018; Snodgrass et al., 2017; Thorens et al., 2016).

4.4. Conclusions, limitations, and further research

Based on the findings of the present study, there appears to a significant association between the UAB and disordered gaming. This needs to be further investigated in the context of the three distinct UAB profiles identified involving the DGs, the IGs and the FGs. Findings address (through quantitative/numerical arguments) already intuitively applied clinically treatment practices for disordered gaming involving the UAB (Tisseron, 2009). These findings suggest utilizing the user-avatar bond in the treatment of disordered gaming, by inviting gamers to talk about their virtual personas, and their game-related achievements and investigating ways

that such avatar aspects of their "in-game" avatar life can be transferred to real life (Tisseron, 2009). Accordingly, issues of user-avatar differentiation could be carefully addressed by reflective (i.e., self-mirroring and self-awareness tasks) and cognitive processing (i.e., thinking about the way one thinks) strategies in the context of treatment (in line with supported treatment practices in other addictions; Thorberg & Lyvers, 2006). Consequently, it is implied that the UAB aspects should be considered in the case formulation for disordered gaming prevention and treatment. These suggestions should be considered in the context of the limitations of the present study, which relate to the community-sourced, cross-sectional, self-selecting, and self-report nature of the data which refer to *WoW* gamers exclusively, that may accommodate biases and does not enable the examination of the direction of causality. Longitudinal and mixed methods designs are required, alongside studies using clinical and comorbid populations and different game genres, as well as other recent emerging popular games (e.g., *Fortnite*), to further clarify the profiles suggested in the present study as well as their associations with disordered gaming.

References

Allison, S.E., Walde, L.von, Shockley, T., O´Gabard, G. (2006). The development of self in the era of the internet and role-playing games. *American Journal of Psychiatry 163*, 381-385. doi: 10.1176/appi.ajp.163.3.381

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders.* Arlington, VA: American Psychiatric Publishing. doi: 10.1176/appi.books.9780890425596.744053

Anderson, E. L., Steen, E., & Stavropoulos, V. (2017). Internet use and problematic internet use: A systematic review of longitudinal research trends in adolescence and emergent adulthood. *International Journal of Adolescence and Youth*, *22*(4), 430-454. doi: 10.1080/02673843.2016.1227716

Arnoux, G., Rothen, S., Achab, S., Billieux, J., Zullino, D., Khazaal, Y., & Thorens, G. (2016). PO-04: gender swapping in World of Warcraft. *Journal of Behavioral Addictions*, *5*(S1), 48-49.

Bean, A. M., Ferro, L. S., Vissoci, J. R. N., Rivero, T., & Groth-Marnat, G. (2016). The emerging adolescent World of Warcraft video gamer: A five factor exploratory profile model. *Entertainment Computing, 17*, 45-54. doi:10.1016/j.entcom.2016.08.006

Billieux, J., Van der Linden, M., Achab, S., Khazaal, Y., Paraskevopoulos, L., Zullino, D., & Thorens, G. (2013). Why do you play World of Warcraft? An in-depth exploration of self-reported motivations to play online and in-game behaviours in the virtual world of Azeroth. *Computers in Human Behavior*, *29*(1), 103-109. doi: 10.1016/j.chb.2012.07.021

Blinka, L. (2008). The relationship of players to their avatars in MMORPGs: differences between adolescents, emerging adults and adults. *Cyberpsychology: Journal of Psychosocial Research on Cyberspace*, *2*(1), 5. Retrieved September 26, 2019, from: https://cyberpsychology.eu/article/view/4211/3252

Brand, M., Wegmann, E., Stark, R., Müller, A., Wölfling, K., Robbins, T. W., & Potenza, M. N. (2019). The Interaction of Person-Affect-Cognition-Execution (I-PACE) model for addictive behaviors: Update, generalization to addictive behaviors beyond Internet-use disorders, and specification of the process character of addictive behaviors. *Neuroscience & Biobehavioral Reviews*, *104,* 1-10. doi:10.1016/j.neubiorev.2019.06.032

Burleigh, T. L., Stavropoulos, V., Liew, L. W. L., Adams, B. L. M., & Griffiths, M. D. (2018). Depression, internet gaming disorder, and the moderating effect of the gamer-avatar relationship: An exploratory longitudinal study. *International Journal of Mental Health and Addiction*, *16,* 102-124. https://doi.org/10.1007/s11469-017-9806-3

Carras, M. C., & Kardefelt-Winther, D. (2018). When addiction symptoms and life problems diverge: A latent class analysis of problematic gaming in a representative multinational sample of European adolescents. *European Child & Adolescent Psychiatry*, *27*(4), 513-525. doi: 10.1007/s00787-018-1108-1

Celeux, G., & Soromenho, G. (1996). An entropy criterion for assessing the number of clusters in a mixture model. *Journal of Classification*, *13*(2), 195-212. doi: 10.1007/BF01246098

Cohen, J. (1992). "A power primer". *Psychological Bulletin. 112* (1): 155–159. doi:10.1037/0033-2909.112.1.155

Dindar, M., & Ortiz de Gortari, A. B. (2017). Turkish validation of the Game Transfer Phenomena Scale (GTPS): Measuring altered perceptions, automatic mental processes and actions and behaviours associated with playing video games. *Telematics and Informatics*, *34,* 1802-1813. doi:10.1016/j.tele.2017.09.003

Encyclopaedia Britannica (2019). *Proteus, Greek mythology*. Retrieved September 26, 2019, from: https://www.britannica.com/topic/Proteus-Greek-mythology

Faulkner, G., Irving, H., Adlaf, E. M., & Turner, N. (2015). Subtypes of adolescent video gamers: A latent class analysis. *International Journal of Mental Health and Addiction*, *13*(1), 1-18. doi: 10.1007/s11469-014-9501-6.

Gomez, R., Stavropoulos, V., Beard, C., & Pontes, H. M. (2019). Item response theory analysis of the recoded internet gaming disorder scale-short-form (IGDS9-SF). *International Journal of Mental Health and Addiction*, *17*(4), 859-879. doi: 10.1007/s11469-018-9890-z

Griffiths, M. D. (2010a). The use of online methodologies in data collection for gambling and gaming addictions. *International Journal of Mental Health and Addiction*, *8*(1), 8-20. doi: 10.1007/s11469-009-9209-1

Griffiths, M. D. (2010b). The role of context in online gaming excess and addiction: Some case study evidence. *International Journal of Mental Health and Addiction*, *8*, 119-125. doi: 10.1007/s11469-009-9229-x

Griffiths, M., King, D., & Demetrovics, Z. (2014). DSM-5 internet gaming disorder needs a unified approach to assessment. *Neuropsychiatry*, *4*(1), 1-4. doi: 10.2217/NPY.13.82

Griffiths, M. D. & Nuyens, F. (2017). An overview of structural characteristics in problematic videogame playing. *Current Addiction Reports, 4,* 272-283. doi: 10.1007/s40429-017-0162-y

Hamari, J., & Tuunanen, J. (2014). Player types: A meta-synthesis. Retrieved September 26, 2019, from: https://trepo.tuni.fi/bitstream/handle/10024/99064/player_types_a_meta_synthesis.pdf?sequence=1

Jeong, H., Yim, H. W., Lee, S. Y., Lee, H. K., Potenza, M. N., Kwon, J. H., ... & Choi, J. S. (2018). Discordance between self-report and clinical diagnosis of Internet gaming disorder in adolescents. *Scientific Reports*, *8*(1), 10084. doi: 10.1038/s41598-018-28478-8

Jo, Y. S., Bhang, S. Y., Choi, J. S., Lee, H. K., Lee, S. Y., & Kweon, Y. S. (2019). Clinical characteristics of diagnosis for internet gaming disorder: Comparison of DSM-5 IGD and ICD-11 GD diagnosis. *Journal of Clinical Medicine*, *8*(7), 945. doi: 10.3390/jcm8070945

Jones, C., Scholes, L., Johnson, D., Katsikitis, M., & Carras, M. C. (2014). Gaming well: links between videogames and flourishing mental health. *Frontiers in Psychology*, *5*, 260. doi: 10.3389/fpsyg.2014.00260

Jung, T., & Wickrama, K. A. S. (2008). An introduction to latent class growth analysis and growth mixture modeling. *Social and Personality Psychology Compass*, *2*(1), 302-317. Doi: 10.1111/j.1751-9004.2007.00054.x

Lehenbauer-Baum, M., & Fohringer, M. (2015). Towards classification criteria for internet gaming disorder: Debunking differences between addiction and high engagement in a German

sample of World of Warcraft players. *Computers in Human Behavior*, *45*, 345-351. doi: 10.1016/j.chb.2014.11.098

Li, C. H. (2016). Confirmatory factor analysis with ordinal data: Comparing robust maximum likelihood and diagonally weighted least squares. *Behavior Research Methods*, *48*(3), 936-949. doi: 10.3758/s13428-015-0619-7

Liew, L. W. L., Stavropoulos, V., Adams, B. L. M., Burleigh, T. L., & Griffiths, M. D. (2018). Internet Gaming Disorder: The interplay between physical activity and user–avatar relationship, *37*, 558-574 *Behaviour and Information Technology*. https://doi.org/10.1080/0144929X.2018.1464599

Lampis, J., Cataudella, S., Busonera, A., & Skowron, E. A. (2017). The role of differentiation of self and dyadic adjustment in predicting codependency. *Contemporary Family Therapy*, *39*(1), 62-72. doi: 10.1007/s10591-017-9403-4

Larose, C., Harel, O., Kordas, K., & Dey, D. K. (2016). Latent class analysis of incomplete data via an entropy-based criterion. *Statistical Methodology*, *32*, 107-121. doi: 10.1016/j.stamet.2016.04.004

Mancini, T., Imperato, C., & Sibilla, F. (2019). Does avatar's character and emotional bond expose to gaming addiction? Two studies on virtual self-discrepancy, avatar identification and gaming addiction in massively multiplayer online role-playing game players. *Computers in Human Behavior*, *92*, 297-305. Doi: 10.1016/j.chb.2018.11.007

Martončik, M., & Lokša, J. (2016). Do World of Warcraft (MMORPG) players experience less loneliness and social anxiety in online world (virtual environment) than in real world (offline)? *Computers in Human Behavior*, *56*, 127-134. Doi: 10.1016/j.chb.2015.11.035

Morcos, M., Stavropoulos, V., Rennie, J. J., Clark, M., & Pontes, H. M. (2019). Internet Gaming Disorder: Compensating as a Draenei in World of Warcraft. *International Journal of Mental Health and Addiction*, 1-17. Epub ahead of print. doi: 10.1007/s11469-019-00098-x

Musciotto, F., Marotta, L., Miccichè, S., & Mantegna, R. N. (2018). Bootstrap validation of links of a minimum spanning tree. *Physica A: Statistical Mechanics and its Applications*, *512*, 1032-1043.doi: 10.1016/j.physa.2018.08.020

Muthén, L. K., & Muthén, B. (2019). Mplus. *The comprehensive modelling program for applied researchers: User's guide*, *5*. Los Angeles, CA: Muthén & Muthén.

Obst, P. L., Zhao, X., White, K. M., O'Connor, E. L., & Longman, H. (2018). Game identity-based motivations of playing world of warcraft and their psychological outcomes. *Cyberpsychology, Behavior, and Social Networking*, *21*(10), 655-660. doi: 10.1089/cyber.2018.0185

Ortiz de Gortari, A. B., Oldfield, B., & Griffiths, M. D. (2016). An empirical examination of factors associated with Game Transfer Phenomena severity. *Computers in Human Behavior, 64*, 274-284. doi:10.1016/j.chb.2016.06.060

Ortiz de Gortari, A. B., Pontes, H. M., & Griffiths, M. D. (2015). The Game Transfer Phenomena Scale: An instrument for investigating the nonvolitional effects of video game

playing. *CyberPsychology, Behavior & Social Networking, 18*(10), 588-594. doi:10.1089/cyber.2015.0221

Pontes, H. M., & Griffiths, M. D. (2015). Measuring DSM-5 Internet gaming disorder: Development and validation of a short psychometric scale. *Computers in Human Behavior*, *45*, 137-143. doi: 10.1016/j.chb.2014.12.006

Ratan, R. A., & Dawson, M. (2015). When Mii Is Me. *Communication Research*, *43*(8), 1065–1093. https://doi.org/10.1177/0093650215570652

Sawilowsky, S. S. (2009). New effect size rules of thumb. *Journal of Modern Applied Statistical Methods, 8*(2), 26. Doi: 10.22237/jmasm/1257035100

Scerri, M., Anderson, A., Stavropoulos, V., & Hu, E. (2019). Need fulfilment and internet gaming disorder: A preliminary integrative model. *Addictive Behaviors Reports*, *9*, 100144. doi: 10.1016/j.abrep.2018.100144

Snodgrass, J. G., Batchelder, G., Eisenhauer, S., Howard, L., Dengah, H. F., Thompson, R. S., ... & Powell, C. (2017). A guild culture of 'casual raiding' enhances its members' online gaming experiences: A cognitive anthropological and ethnographic approach to World of Warcraft. *New Media & Society*, *19*(12), 1927-1944. doi: 10.1177/1461444816644804

Šporčić, B., & Glavak-Tkalić, R. (2018). The relationship between online gaming motivation, self-concept clarity and tendency toward problematic gaming. *Cyberpsychology: Journal of Psychosocial Research on Cyberspace*, *12*(1). doi: 10.5817/CP2018-1-4

Stavropoulos, V., Bamford, L., Beard, C., Gomez, R., & Griffiths, M. D. (2019a). Test-retest measurement invariance of the nine-item Internet Gaming Disorder Scale in two countries: A

preliminary longitudinal study. *International Journal of Mental Health and Addiction*, 1-18. Epub ahead of print. https://doi.org/10.1007/s11469-019-00099-w

Stavropoulos, V., Burleigh, T. L., Beard, C. L., Gomez, R., & Griffiths, M. D. (2019b). Being there: A preliminary study examining the role of presence in internet gaming disorder. *International Journal of Mental Health and Addiction*, *17,* 880-890. doi: 10.1007/s11469-018-9891-y

Tisseron, S. (2009). L'ado et ses avatars. *Adolescence*, *69*(3), 591-600.

Thomson, W. (2016). Depression, neuroticism, and the discrepancy between actual and ideal self-perception. *Personality and Individual Differences*, *88*, 219-224. doi: 10.1016/j.paid.2015.09.003

Thorberg, F. A., & Lyvers, M. (2006). Attachment, fear of intimacy and differentiation of self among clients in substance disorder treatment facilities. *Addictive Behaviors, 31*(4), 732-737. doi: 10.1016/j.addbeh.2005.05.050

Thorens, G., Rothen, S., Achab, S., Deleuze, J., Zullino, D., & Billieux, J. (2016). OR-103: World of Warcraft Avatars longitudinal progression study based on the characteristics of players. *Journal of Behavioral Addictions*, *5*(S1), 42-43.

Torres-Rodríguez, A., Griffiths, M. D., Carbonell, X., Farriols-Hernando, N., & Torres-Jimenez, E. (2019). Internet gaming disorder treatment: A case study evaluation of four different types of adolescent problematic gamers. *International Journal of Mental Health and Addiction*, *17*(1), 1-12. doi: 10.1007/s11469-017-9845-9

Tseng, F. C. (2011). Segmenting online gamers by motivation. *Expert Systems with Applications*, *38*(6), 7693-7697. doi: 10.1016/j.eswa.2010.12.142

Van Looy, J., Courtois, C., De Vocht, M., & De Marez, L. (2012). Player identification in online games: Validation of a scale for measuring identification in MMOGs. *Media Psychology*, *15*(2), 197-221. doi: 10.1080/15213269.2012.674917

Van Rooij, A. J., Ferguson, C. J., Colder Carras, M., Kardefelt-Winther, D., Shi, J., Aarseth, E., ... & Deleuze, J. (2018). A weak scientific basis for gaming disorder: Let us err on the side of caution. *Journal of Behavioral Addictions*, *7*(1), 1-9. doi: 10.1556/2006.7.2018.19

Vrieze, S. I. (2012). Model selection and psychological theory: a discussion of the differences between the Akaike information criterion (AIC) and the Bayesian information criterion (BIC). *Psychological Methods*, *17*(2), 228. doi:10.1037/a0027127

Weigold, A., Weigold, I. K., & Russell, E. J. (2013). Examination of the equivalence of self-report survey-based paper-and-pencil and internet data collection methods. *Psychological Methods*, *18*(1), 53. doi: 10.1037/a0031607

Wolfendale, J. (2006) *My Avatar, my self: virtual harm and attachment.* In: Polčák, R., Škop, M., Šmahel, D. (Eds.), *Cyberspace 2005* (pp. 305-310). Brno: Masaryk University. doi: 10.1037/a0031607

World Health Organization (2019). *International Classification of Diseases 11th Edition:* Retrieved on the September 26, 2019, from: https://icd.who.int/browse11/l-m/en.

Yee, N., Bailenson, J. N., & Ducheneaut, N. (2009). The Proteus Effect. *Communication Research*, *36*(2), 285–312. https://doi.org/10.1177/0093650208330254

Note 1: Latent class (profile) analysis enables the conclusion of the optimum number of classes/ profiles that best describe the variance of a population across selected variables, providing concurrently model fit indicators. 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 specific category. Additionally, factor analysis was 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).

Appendix

1. Measures

1.1. Internet Gaming Disorder Scale–Short-Form (IGDS9-SF; Pontes & Griffiths, 2015)

	Never	Rarely	Sometimes	Often	Very Often
1. Do you feel preoccupied with your gaming behaviour? (Some examples: Do you think about previous gaming activity or anticipate the next gaming session? Do you think gaming has become the dominant activity in your daily life?)	○	○	○	○	○
2. Do you feel more irritability, anxiety or even sadness when you try to either reduce or stop your gaming activity?	○	○	○	○	○
3. Do you feel the need to spend increasing amount of time engaged in gaming in order to achieve satisfaction or pleasure?	○	○	○	○	○
4. Do you systematically fail when trying to control or cease your gaming activity?	○	○	○	○	○
5. Have you lost interests in previous hobbies and other entertainment activities as a result of your engagement with the game?	○	○	○	○	○
6. Have you continued your gaming activity despite knowing it was causing problems between you and other people?	○	○	○	○	○
7. Have you deceived any of your family members, therapists or others because of the amount of your gaming activity?	○	○	○	○	○
8. Do you play in order to temporarily escape or relieve a negative mood (e.g., helplessness, guilt, anxiety)?	○	○	○	○	○
9. Have you jeopardised or lost an important relationship, job or an educational or career opportunity because of your gaming activity?	○	○	○	○	○

1.2. User-Avatar Questionnaire (UAQ; Blinka, 2008)

	Disagree Strongly	Disagree Moderately	Neither Agree/ Nor Disagree	Agree Moderately	Agree Strongly
1. I possess the same skills and abilities as my character does.	○	○	○	○	○
2. My character skills and abilities are like mine, but somewhat greater.	○	○	○	○	○
3. My character compensates my own skills and abilities.	○	○	○	○	○
4. Both me and my character are the same.	○	○	○	○	○
5. Sometimes I think just about my character while not gaming.	○	○	○	○	○
6. Sometimes I think just about situations from the game while not gaming.	○	○	○	○	○
7. I think about my character itself rather than about the game situations.	○	○	○	○	○
8. Sometimes I feel ashamed for my character	○	○	○	○	○
9. Sometimes I feel proud of my character					
10. My character possesses totally opposed skills and abilities to my own	○	○	○	○	○
11. I would rather be like my character	○	○	○	○	○
12. Being like my character would help me in some situations of my real life	○	○	○	○	○

1.3. Proteus Effect Scale-Avatar Identification in real life (modified by Van Looy et al., 2012)

	Disagree Strongly	Disagree Moderately	Neither Agree/ Nor Disagree	Agree Moderately	Agree Strongly
1.When I play with a different character, I feel different in my real life.	○	○	○	○	○
2. I behave differently in my real life when I play with another character.	○	○	○	○	○
3.When I play with another character, I feel involved in a different way with tasks in my real life.	○	○	○	○	○
4. The choice of game character determines how I experience my real life.	○	○	○	○	○
5. I have different game characters so that I can act in different ways in my real life.	○	○	○	○	○
6. I see things differently in my real life when I play with another character.	○	○	○	○	○

Note: The scale was modified with the addition of the reference of the real-life context in each of the items in order to reflect Proteus Effect Behaviours/ Behaviour transference in real life.

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

Educational Status

			Professional Degree (e.g. MD, JD etc)	PhD	MSc	BSc	BSC attended (not completed)	Inte-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%	100,0 0%

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%
	Tota-	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%

Note: The socio-demographic information of the sample is comparable to that of the study of Morcos et al., (2019). Further, although it is not significantly different considering the chronological age to that of Obst, Zhao, White, O'Connor, & Longman, (2018) it involves a rather lower proportion of females. Last, the present sample is significantly older to that of Martončik & Lokša, (2016), while it involves a higher proportion of females.

Table 2. *Preliminary analyses of sociodemographic and game participation effects on IGD, PES-AIS and UAQ scores*

Gender					
	Mean	*SD*	*t*	*Sig.*	*Effect Size Cohen's d*
	IGD				
Females	19.38	6.52	-2.68	.008	.20
Males	20.93	7.25			
	PES-AIS				
Females	16.07	7.12	.20	.839	.02
Males	15.96	6.66			
	UAQ-Identification				
Females	7.75	3.67	1.12	.265	.09
Males	7.41	3.10			
	UAQ-Immersion				
Females	12.58	4.35	.35	.724	.03
Males	12.46	4.34			
	UAQ-Compensation				
Females	8.78	2.96	2.30	.022	.18
Males	8.21	3.18			

Age				
	b	*B*	*Sig.*	*Effect Size R^2*
IGD	-.09	-.13	.000	.02
PES-AIS	.04	.06	.093	.00
UAQ-Identification	-.02	-.04	.174	.00
UAQ-Immersion	-.03	-.07	.040	.00
UAQ-Compensation	-.02	-.05	.115	.00

Avatar In-Game Level				
	b	*B*	*Sig.*	*Effect Size R^2*
IGD	-.00	-.01	.729	.00
PES-AIS	.00	.01	.844	.00
UAQ-Identification	-.03	-.17	.000	.03
UAQ-Immersion	.00	-.00	.955	.00
UAQ-Compensation	.01	.04	.230	.00

Years playing WoW				
	b	*B*	*Sig.*	*Effect Size R^2*
IGD	-.05	-.03	.360	.00
PES-AIS	.03	.02	.586	.00
UAQ-Identification	-.10	-.11	.000	.01
UAQ-Immersion	-.08	-.08	.027	.01
UAQ-Compensation	-.02	-.02	.412	.00

Ethnicity					
	Mean	*SD*	*F*	*Sig.*	*Effect Size H^2*
IGD					
White-Caucasian	20.37	7.05	1.17	.320	.01
Asian	22.33	6.91			
African	18.50	6.36			
Native American	20.55	4.53			
Indigenous Australian or	18.80	8.53			

Torres Strait Islander					
Pacific Islander	18.57	10.44			
Mixed	20.31	7.83			
PES-AIS					
White-Caucasian	15.92	6.74	1.51	.173	.01
Asian	16.99	6.03			
African	9.00	1.41			
Native American	14.18	4.26			
Indigenous Australian or Torres Strait Islander	10.20	6.26			
Pacific Islander	17.14	9.28			
Mixed	16.33	6.62			
UAQ-Identification					
White-Caucasian	7.08	3.39	10.68	.000	.06
Asian	9.83	4.62			
African	5.50	.71			
Native American	10.64	3.85			
Indigenous Australian or Torres Strait Islander	6.60	4.22			
Pacific Islander	8.14	6.12			
Mixed	9.62	3.78			
UAQ-Immersion					
White-Caucasian	12.32	4.23	1.91	.076	.01
Asian	13.89	4.54			
African	10.50	3.54			
Native American	12.64	3.11			
Indigenous Australian or Torres Strait Islander	12.60	5.08			
Pacific Islander	11.00	7.21			
Mixed	12.29	4.55			
UAQ-Compensation					
White-Caucasian	8.37	3.13	.27	.952	.00
Asian	8.38	3.08			
African	7.50	4.95			
Native American	7.55	3.67			
Indigenous Australian or Torres Strait Islander	9.00	3.94			
Pacific Islander	8.29	3.09			

Mixed	7.82	3.47			
Occupational Status					
	Mean	*SD*	*F*	*Sig.*	*Effect Size* H^2
IGD					
Full-time employment			4.12	.000	.03
Part-time/ casual employment	19.85	6.56			
Student	20.27	7.06			
Trainee	20.70	7.23			
Unemployed	17.00	6.38			
On temporary leave (education leave, public service leave, training, maternity leave)	24.18	8.48			
Other	21.45	7.29			
	20.38	7.20			
PES-AIS					
Full-time employment			3.30	.003	.02
Part-time/ casual employment	15.88	6.9			
Student	16.28	6.58			
Trainee	15.42	6.50			
Unemployed	12.25	6.13			
On temporary leave (education leave, public service leave, training, maternity leave)	18.93	7.08			
Other	16.00	6.00			
	17.35	6.97			
UAQ-Identification					
Full-time employment			1.26	.273	.01
Part-time/ casual employment	7.29	3.77			
Student	7.46	3.38			
Trainee	7.66	3.72			
Unemployed	4.25	.50			
On temporary leave (education leave, public service leave, training, maternity leave)	8.20	3.85			
Other	7.55	4.18			
	7.37	4.00			

UAQ-Immersion					
Full-time employment			2.90	.008	.02
Part-time/ casual employment	12.19	4.28			
Student	13.00	4.22			
Trainee	12.25	4.16			
Unemployed	12.00	2.31			
On temporary leave (education leave, public service leave, training, maternity leave)	13.69	4.68			
Other	11.82	4.17			
UAQ-Compensation					
Full-time employment			7.41	.000	.04
Part-time/ casual employment	7.79	3.04			
Student	9.05	2.83			
Trainee	8.27	3.13			
Unemployed	10.00	3.46			
On temporary leave (education leave, public service leave, training, maternity leave)	9.87	3.30			
Other	7.45	3.80			
Educational Status	*Mean*	*SD*	*F*	*Sig.*	*Effect Size* H^2
IGD					
Professional Degree (e.g. MD, JD etc)	18.96	5.98	1.42	.186	.01
PhD	19.94	7.31			
MSc	19.45	6.96			
BSc	20.34	7.62			
BSC attended (not completed)	21.60	6.95			
Inte-rmediate degree (e g technical training)	20.51	6.39			
High school year 9 to 12	20.31	7.40			
Middle school year 7 to 8	21.89	11.20			
Primary School	20.85	5.32			

PES-AIS					
Professional Degree (e.g. MD, JD etc)	15.67	6.05	1.39	.138	.01
PhD	13.43	6.26			
MSc	15.19	6.72			
BSc	16.29	6.65			
BSC attended (not completed)	16.67	6.77			
Inte-rmediate degree (e g technical training)	16.14	7.02			
High school year 9 to 12	15.17	6.69			
Middle school year 7 to 8	16.44	9.07			
Primary School	18.91	4.99			
UAQ-Identification					
Professional Degree (e.g. MD, JD etc)	8.12	3.61	1.84	.067	.02
PhD	8.06	4.45			
MSc	7.21	3.76			
BSc	7.40	3.75			
BSC attended (not completed)	7.22	3.59			
Inte-rmediate degree (e g technical training)	7.48	3.75			
High school year 9 to 12	7.75	3.74			
Middle school year 7 to 8	9.56	3.43			
Primary School	10.23	3.66			
UAQ-Immersion					
Professional Degree (e.g. MD, JD etc)	11.89	4.29	3.418	.001	.03
PhD	9.88	5.20			
MSc	11.01	4.20			
BSc	12.82	4.16			
BSC attended (not completed)	12.83	4.30			
Inte-rmediate degree (e g technical training)	12.28	4.38			

High school year 9 to 12	12.75	4.09			
Middle school year 7 to 8	13.89	6.94			
Primary School	14.69	4.42			
UAQ-Compensation					
Professional			2.63	.008	.02
Degree (e.g. MD, JD etc)	7.56	3.08			
PhD	6.31	2.77			
MSc	7.89	2.84			
BSc	8.17	2.98			
BSC attended (not completed)	8.69	3.09			
Inte-rmediate degree (e g technical training)	8.45	3.51			
High school year 9 to 12	8.50	3.29			
Middle school year 7 to 8	9.00	3.12			
Primary School	9.93	3.13			

Note: Effect sizes in the area of .01 were deemed as very small, in the area of .20 as small, in the area of .50 as medium, in the area of .80 as large (Cohen, 1992; Sawilowsky, 2009).

Table 3. *Classes Means across Proteus Effect, Identification, Immersion and Compensation*

	Proteus Effect	Ident.	Immer.	Comp.
Differentiated Gamers' (DGs)	1.29	.55	.30	.15
Identified Gamers (IGs)	10.56	11.56	6.88	.56
Fused Gamers (FGs)	17.84	7.07	12.73	9.15
Total: Mean	8.83	5.31	5.87	3.12

Table 4. *The three classes across the disordered gaming criteria introduced in DMS-5 (APA, 2013)*

			Mean	Std. Deviation	DGs from IGs	FGs from IGs
IGD_1	Do you feel preoccupied with your gaming behaviour? (Some examples: Do you think about previous gaming activity or anticipate the next gaming session? Do you think gaming has become the dominant activity in your life?) ***Preoccupation***	DGs	2.15	1.27	OR = -.44 SE=.18 p= .014	OR=.73 SE=.17 p=.000
		IGs	2.33	1.13		
		FGs	2.98	1.15		
IGD_2	Do you feel more irritability, anxiety or even sadness when you try to either reduce or stop your gaming activity? ***Withdrawal***	DGs	1.92	1.13	OR= .22 SE=.17 p= .199	OR=-.58 SE=.18 p=.001
		IGs	2.26	1.02		
		FGs	2.11	1.01		
IGD_3	Do you feel the need to spend an increasing amount of time engaged in gaming in order to achieve satisfaction or pleasure? ***Tolerance***	DGs	2.32	1.39	OR=-.20 SE= .14 p= .158	OR=-.037 SE=.14 p=.790
		IGs	2.24	1.26		
		FGs	2.36	1.13		
IGD_4	Do you systematically fail when trying to control or cease your gaming activity? **Loss of control**	DGs	2.18	1.38	OR= -.46 SE= .18 p = .008	OR=-.373 SE=.17 p=.031
		IGs	2.24	1.21		
		FGs	1.95	1.05		
IGD_5	Have you lost interests in previous hobbies and other entertainment activities as a result of your engagement with the game? ***Loss of Interest***	DGs	1.76	1.13	OR= .33 SE=.20 p= .100	OR=.04 SE=.15 p=.761
		IGs	2.28	1.36		
		FGs	2.28	1.12		
IGD_6	Have you continued your gaming activity despite knowing it was causing problems between you and other people? ***Continuation***	DGs	1.97	1.37	OR= .13 SE= .16 p= .421	OR=-0.23 SE=.13 p=.083
		IGs	2.16	1.40		
		FGs	2.00	1.12		
IGD_7	Have you deceived any of your family members, therapists or others because the amount of your gaming activity? ***Deception***	DGs	2.07	1.52	OR= .23 SE=.14 p=.109	OR=-.790 SE=.15 p=.000
		IGs	2.69	1.47		
		FGs	1.60	0.96		
IGD_8	Do you play in order to temporarily escape or relieve a negative mood (e g helplessness, guilt, anxiety)? ***Mood Modification***	DGs	2.03	1.53	OR= -.42 SE=.16 p=.007	OR=.73 SE=.14 p=.000
		IGs	1.89	1.29		
		FGs	3.00	1.32		
IGD_9	Have you jeopardised or lost an important relationship, job or an educational or career opportunity because of your gaming activity? ***Functional Impairment***	DGs	2.11	1.67	OR=-.34 SE=.17 p= .040	OR=-.39 SE=.15 p=.011
		IGs	1.91	1.20		
		FGs	1.56	0.98		