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Schizotypal personality traits and problematic use of massively-multiplayer online role-playing games (MMORPGs)



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ABSTRACT

A link between maladaptive personality traits and an excessive use of massively multiplayer online role-playing games (MMORPGs) has been documented. However, the role of schizotypal personality traits in MMORPG use is understudied. The aim of this study was to explore the potential links between schizotypal traits, motivations for playing MMORPGs, and symptoms of problematic MMORPG use. Eighty-three MMORPG gamers were enrolled in the study. They filled out questionnaires measuring schizotypal personality traits and an adapted version of the same scale designed to measure in-game schizotypal traits. All participants also filled out questionnaires assessing motivations for gaming and disordered use of MMORPGs. Results of the study showed that the disorganized and interpersonal traits of schizotypy decreased when participants were thinking about themselves in the virtual world. Schizotypal traits, together with achievement and immersion motives, predicted problematic use of MMORPGs. The findings of this study may suggest that schizotypal traits and motivations for playing can interact and play a pivotal role in the onset and maintenance of problematic gaming.

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1. Introduction

Massively multiplayer online role-playing games (MMORPGs) are computer games that allow many gamers to play in an evolving virtual world at the same time via Internet servers open 24/7. Thousands of gamers can be connected together and can explore, cooperate, fight, and communicate when they need to or want to.

When the player is offline, the virtual world continues to exist. The most populated server of World of Warcraft (or WoW), one of the most famous MMORPGs in the European Union, is Outland, which had 778,576 characters in 2016 (Realm Pop, 2016).

Excessive involvement in MMORPGs has been linked to several psychological and psychiatric constructs such as low self-esteem, high social anxiety, feelings of loneliness, increased levels of dissociation, reduced school performance, high impulsivity, and addiction symptoms, among others (Billieux et al., 2011; Schimmenti, Guglielmucci, Barbasio, & Granieri, 2012; Van Rooij, Kuss, Griffiths, Shorter, Schoenmakers, & Van de Mheen, 2014; Yee, 2006).

In the broad literature about MMORPGs, many studies have explored the motivations of gamers (Ryan, Rigby, & Przybylski, 2006; Yee, 2006) and the impact of these motivations on the problematic use of this type of game (Billieux et al., 2013, 2015;

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Fuster, Chamarro, Carbonell, & Vallerand, 2014; Kuss, Louws, & Wiers, 2012). Several studies examined the motivations implicated in the use of MMORPGs, and achievement (e.g., in-game advancement, entering into competition) and immersion (e.g., role playing, using the virtual world to avoid real-life problems) consistently emerged as important motivations related to their excessive use (Billieux et al., 2015, 2013; Hellström, Nilsson, Leppert, & Aslund, 2012; Kirby, Jones, & Copello, 2014; Yee, 2006). It is worth noting that elevated involvement in MMORPGs is not necessarily linked to problematic use associated with negative outcomes, which supports the relevance of distinguishing between high involvement – or passion – and addictive use (Billieux et al., 2013; Burnay, Billieux, Blairy, & Larøi, 2015; Charlton & Danforth, 2007). However, among video game users, MMORPG players seem particularly prone to being affected by problematic use (Hahn et al., 2014; Leménager et al., 2014; Stavropoulos, Kuss, Griffiths, Wilson, & Motti-Stefanidi, 2017) and are even susceptible in certain cases to *Internet gaming disorder* (IGD), as conceptualized by the current version of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association [APA], 2013)*. IGD has been included in Section 3 of the *DSM-5* as a condition that requires further research before potentially being considered as a mental disorder. IGD is described in the *DSM-5* as a form of behavioral addiction related to Internet gaming, which shares behavioral similarities with gambling and substance use disorders (APA, 2013, p. 796) for symptoms such as preoccupation with the behavior, withdrawal and tolerance symptoms, and inability to control the behavior. Moreover, a linkage has been established between substance use (e.g., alcohol, cannabis, tobacco) and problematic use of video games, with substance users being two times more likely than non-substance users to present problematic use of video games (Van Rooij et al., 2014; Yen, Ko, Yen, Chen, & Chen, 2009).

2. Relationships among schizotypal personality traits, motivations for playing, and problematic use of MMORPGs

2.1. Schizotypal personality traits and Internet use

Notably, personality traits stand out as being among the most important predictors of both motivations to play MMORPGs (Collins, Freeman, & Chamarro-Premuzic, 2012; Graham & Gosling, 2013; Yee, 2006) and excessive use of the Internet (Dong, Wang, Yang, & Zhou, 2013; Kayış et al., 2016; Mehroof & Griffiths, 2010; Öztürk, Bektas, Ayar, Özgüven Öztoranci, & Yağcı, 2015). For example, a recent meta-analysis emphasized that people high in neuroticism and low in extraversion, agreeableness, and openness to experience are at increased risk for developing problematic Internet use (Kayış et al., 2016). This finding is mirrored in research on personality disorders, where problematic Internet use has been linked with personality disorders such as avoidant, borderline, dependent, narcissistic, and schizoid (Floros, Siomos, Stogiannidou, Giouzevas, & Garyfallos, 2014; Laconi, Andréoletti, Chauchard, Rodgers, & Chabrol, 2016; Wu, Ko, & Lane, 2016).

Strikingly, few studies have examined the relationships between schizotypal personality traits and problematic Internet use, and to the best of our knowledge, no study has examined the interaction between schizotypal traits and motives for playing MMORPGs in the development of IGD symptoms. Schizotypal personality disorder is defined as a “pervasive pattern of social and interpersonal deficits marked by acute discomfort with, and reduced capacity for, close relationships as well as by cognitive or perceptual distortions and eccentricities of behavior, beginning by early adulthood and present in a variety of contexts” (APA, 2013, p. 655). It includes symptoms such as ideas of reference, odd beliefs or magical

thinking, unusual perceptual experiences, odd thinking and speech, suspiciousness or paranoid ideation, inappropriate or constricted affect, eccentric behavior or appearance, lack of close friends or confidants, and excessive social anxiety that does not diminish with familiarity. Although schizotypal personality disorder is included as a discrete diagnosis in the *DSM-5*, its conceptualization is under debate. Some researchers (Aguirre, Sergi, & Levy, 2008; Raine, 2006) support Meehl's (1962) proposal to conceive it as an overarching organization of the personality, mainly related to genetic vulnerability to schizophrenia. According to these authors, schizotypal individuals display biobehavioral, neurocognitive, and social deficits that are qualitatively similar to, but quantitatively less severe than, those found in patients with schizophrenia or other psychotic disorders. Other researchers conceive schizotypy as a combination of cognitive and emotional traits that are distributed along a dynamic continuum from psychological well-being to schizophrenia (Claridge, 1997; Fonseca-Pedrero, Paino, Lemos-Giráldez, & Muñiz, 2013). However, research is consistent in showing that schizotypy is a multidimensional construct and that three main dimensions of disordered functioning are involved in schizotypal personality: (a) a cognitive-perceptual dimension, (b) an interpersonal deficit dimension, and (c) a disorganized dimension (Fossati, Raine, Carretta, Leonardi, & Maffei, 2003; Raine et al., 1994; Reynolds, Raine, Mellinger, Venables, & Mednick, 2000).

A linkage has already been established between schizotypal traits and substance use disorder (Esterberg, Goulding, McClure-Tone, & Compton, 2009); moreover, schizotypal symptoms such as lack of close friends and excessive social anxiety could be related to escapism motives and excessive use of the Internet. Thus, it is surprising that research on the relationship between schizotypal traits and problematic use of MMORPGs is so scant. Recently, Truzoli, Osborne, Romano, and Reed (2016) examined the relationship between schizotypal traits and Internet addiction symptoms, also controlling for depression and anxiety, in a sample of 100 university students between 20 and 30 years of age. They found significant associations between Internet addiction scores and the schizotypal subcomponents of introverted anhedonia and impulsive nonconformity. However, Truzoli and colleagues did not examine Internet activities in their sample, which is an important limitation, as “Internet addiction” is now considered to reflect a spectrum of related, yet relatively distinct, Internet-associated disorders (e.g., dysfunctional involvement in online video games, cybersex, or social networking) that may have both common and unique etiological factors (Starcevic & Billieux, 2017). In another study, Mittal, Tessner, and Walker (2007) compared 19 adolescents with schizotypal personality disorders with 22 adolescents with other types of personality disorders and 28 non-referred adolescents and found that those with schizotypal personality disorder tended to interact lesser with real-life friends and used the Internet more for social interactions than did non-referred adolescents. Moreover, in that study, playing cooperative online games was positively associated with the severity of the schizotypal personality disorder. Unfortunately, Mittal and colleagues did not examine the type of online games participants were involved with (e.g., casual games or MMORPGs).

2.2. Schizotypal personality traits and motivations for playing MMORPGs: a possible interaction

Many of the studies on the motives related to playing MMORPGs are anchored in Yee's (2006) seminal work on the motivations that drive players in virtual worlds. Through in-depth qualitative studies conducted with hundreds of MMORPG gamers, Yee emphasized the existence of three broad motivation domains, namely achievement, social, and immersion, which can be divided

into subcomponents. Achievement motivations include the wish to level up rapidly and increase skills (*advancement* motive), understand the mechanisms of play (*mechanics* motive), and enter into competition (*competition* motive). Social motivations refer to creating relationships in game (*relationship* motive), socializing (*social* motive), and practicing collaborative playing (*teamwork* motive). Finally, the immersion motivation refers to the enjoyment of discovering the virtual world (*discovery* motive), role playing (*role playing* motive), customizing the avatar (*customization* motive), and using the virtual world to relay or avoid real-life problems (*escapism* motive). The structural validity of Yee's model of MMORPG-related motivations has been verified through confirmatory factor analytic approaches, whereas its external validity was established through links with in-game behaviors and rankings (Billieux et al., 2013). Research has consistently shown that motivations for playing are important predictors in the development of problematic use of MMORPGs (Billieux et al., 2015, 2011; Yee, 2006). However, motivations for playing, as with motivations in general, always emerge as a result of psychological and contextual factors (Deci & Ryan, 2000; Ryan et al., 2006). It has already been observed that personality traits stand out as relevant variables to understand problematic Internet use. Thus, it is possible that individuals with high levels of schizotypal traits may fulfill some of their psychological needs in the context of MMORPGs, and this might increase their motivations to play.

In fact, people who display schizotypal traits often show excessive social anxiety, which might decrease when in an MMORPG because of the context of virtuality and the mediation of the computer for social interaction (e.g., the communication is mediated by the avatar). Accordingly, interpersonal symptoms of schizotypy might be reduced in play, as schizotypal-prone people may feel more comfortable because they do not have to share their feelings as much as in real life, may feel less stress when talking to an unknown person, and may be more satisfied by less close relationships. In addition, people with high levels of schizotypal traits may find it easier to focus on the mechanics of the game rather than the “relational side” of the Internet because of their constricted affectivity.

Similar observations could be made for indicators of the cognitive-perceptual and disorganized dimensions of schizotypy, such as odd beliefs or eccentric behavior and appearance. Individuals with high schizotypal traits may find it easier in the virtual world to share with others their opinions and beliefs without fear of judgment, and they may even feel more comfortable in the virtual world because it is usually represented as a fantasy world that includes peculiar rules and unlikely characters and events. Therefore, these individuals may perceive less negative social judgment when they play MMORPGs, as it is the avatar's appearance and behaviors that is observed by others. Moreover, the presence of specific in-game reinforcement schedules (e.g., intermittent reinforcement, unpredictable reward magnitude) and the fact that certain behaviors are rewarded in the game but obviously not in real life (e.g., beating other people, being the one who spent the most time in a specific repetitive and not necessarily productive behavior) may in some cases perpetuate the magical thinking and odd beliefs of schizotypal individuals.

All of these considerations support the suggestion that examining the impact of schizotypal personality traits in individuals' excessive involvement in MMORPGs could be relevant, as the structural characteristics of these specific games and the opportunities provided by the virtual world could make them particularly motivating and attractive for some individuals with high schizotypal traits. In fact, understanding whether dysfunctional personality traits interact with motivations for playing in exacerbating problematic gaming behaviors, or even in generating IGD, could be

critical for research, prevention, and clinical purposes.

2.3. Purposes of the study

The current study constitutes a first attempt to shed light on the relationships between schizotypal personality traits, motivations to play MMORPGs, and problematic use of MMORPGs. More precisely, we sought (a) to identify whether specific dimensions of schizotypy were associated with IGD symptoms, (b) explore whether MMORPG players reported different levels of schizotypal traits when thinking about real-life or in-game behaviors, and (c) investigate the interactions between schizotypy and motivations for playing in predicting IGD symptoms. The hypotheses of the study are as follows:

H1. Schizotypal personality traits are linked to the use of MMORPGs. We predicted that schizotypal traits would be less prominent when these traits are examined in relation to MMORPG sessions, so that self-reported schizotypal traits would be decreased when related to the game environment versus in real life.

H2. Schizotypal traits are linked to motivations for gaming and to symptoms of IGD. We predicted that (**H2a**) schizotypal traits would predict motivations for gaming, (**H2b**) schizotypal traits would predict IGD symptoms among gamers, (**H2c**) motivations for gaming would add to the prediction of IGD symptoms, and (**H2d**) significant interactions would be observed between schizotypal traits and motivations for gaming in the prediction of IGD symptoms.

3. Methods

3.1. Participants and procedure

Participants were French-speaking gamers who took part in online surveys. Inclusion criteria included playing WoW, and exclusion criteria were based on the reliability of the subject on the socio-demographic measure and on labeling and identification issues for outliers, according to Hoaglin and Iglewicz's (1987) method (e.g., self-reported level of the character higher than what is reported in the official WoW websites, aberrant self-reported weekly playing time, unreliable name of character or server). Gamers had to report their gender, age, and mother tongue, as well as the name of their main character, the server in which they play, their character level in the game, and finally the time they spend on the Internet for WoW on a weekly basis.

In order to recruit participants, a Facebook event was created and announcements posted on social networks and on the official forum of WoW. Furthermore, flyers describing the research and asking for participation were distributed at Louvain-La-Neuve in Belgium. All participants were informed about the study and gave online consent before starting the online survey. Anonymity of the participants was guaranteed (no personal data were collected). Participants had the possibility to participate in a lottery and win an in-game item (a “pet” that can be used by all character classes) if they completed the survey (the actual financial value of the pet is equal to 10 Euros, and the likelihood of winning the prize was approximately 10%). The ethical committee of the Psychological Science Research Institute, Université Catholique de Louvain, approved the study protocol.

In total, 105 gamers agreed to participate in the study. Of these, 22 were excluded from the initial sample because they met the exclusion criteria. The final sample consisted of 83 gamers (75.90% males, mean age = 23.95 years, SD = 8.07). Gamers were on a PvE

server (55.4%), a PvP server (28.9%), an RP server (7.2%), or an RP-PvP server (8.4%). They played WoW for more than 4 years (64.3%), for 2–4 years (20.2%), for 1–2 years (10.7%), or less than 1 year (3.6%). The mean hours devoted weekly to WoW was 21.43 (SD = 11.48, min = 4, max = 60). Briefing and debriefing was provided to all participants.

3.2. Measures

3.2.1. Schizotypal Personality Questionnaire – Brief (SPQ-B)

The French version (Dumas et al., 2000) of the SPQ-B was used in this study. The SPQ-B is a 4-point Likert scale containing 22 items, which is based on the SPQ questionnaire (74 items) developed by Raine (1991). The questionnaire measures the three dimensions of the schizotypal personality (cognitive-perceptual dysfunction, interpersonal deficit, and disorganization). The cognitive-perceptual dysfunction items (eight items, Cronbach's $\alpha = 0.73$) measure magical thinking, unusual experiences, ideas of reference, and paranoid ideation (e.g., “When I shop, I've the feeling that people notice me”). The interpersonal deficit items (eight items, Cronbach's $\alpha = 0.86$) measure lack of close friends, constricted affectivity, social anxiety, and paranoid ideation (e.g., “I feel very uncomfortable when I talk to people I don't know well”). Finally, the disorganization items (six items, Cronbach's $\alpha = 0.80$) measure odd speech and odd beliefs (e.g., “Some people think I'm a very weird person”). Cronbach's α for the entire SPQ-B in this study was 0.91.

3.2.2. Schizotypal Personality Questionnaire – In game (SPQ-IG)

The SPQ-IG is a version of the SPQ-B that was specifically adapted to the framework of the current study to test in-game schizotypal experiences. The purpose of this measure was to assess schizotypy in the context of WoW. The SPQ-IG assesses the individuals' schizotypal traits when they think about, and project, themselves in the gaming context (i.e., when they think about themselves playing WoW, and not during the game). The questionnaire contains the 22 items of the SPQ-B adapted to the context of WoW and assessed on a 4-point Likert scale. A sample item for the measure is “When I am in game, I feel very uncomfortable when I talk to people I don't know well” (related to the interpersonal deficit). Cronbach's alphas were 0.86 for the total score, 0.68 for the cognitive-perceptual dimension, 0.82 for the interpersonal dimension, and 0.76 for the disorganized dimension.

3.2.3. Motivations to Play Online Games Questionnaire (MPOGQ)

The players' motives to engage in online games were measured by the MPOGQ. The MPOGQ was developed by Yee (2006), and the version used in this study was adapted to WoW (Billieux et al., 2013). The questionnaire contains 39 items scored on a 5-point Likert scale. Fourteen items measure the achievement motivations ($\alpha = 0.85$, e.g., “How important is it to you that your character is as optimized as possible for their profession/role?”). Of these, six assess the advancement ($\alpha = 0.79$), four the mechanics ($\alpha = 0.66$), and four the competition ($\alpha = 0.78$) motivations. Eleven items measure social motivation ($\alpha = 0.78$, e.g., “How often do you talk to your online friends about your personal issues?”). Of these, four assess socializing ($\alpha = 0.81$), three relationship ($\alpha = 0.72$), and four teamwork ($\alpha = 0.65$) motivations. Finally, 14 items measure immersion motivations ($\alpha = 0.90$, e.g., “How often do you play to relax from the day's work?”). Of these, four measure discovery ($\alpha = 0.89$), four role playing ($\alpha = 0.87$), three customization ($\alpha = 0.83$), and three escapism ($\alpha = 0.72$) motivations.

3.2.4. Internet Addiction Test (IAT)

A French version of the IAT (Khazaal et al., 2008) adapted to

WoW (Billieux et al., 2013, 2015) was used. The IAT was used in this context as a measure of excessive use of WoW and impact on the daily life of players (e.g., “Did you ever play WoW longer than you had intended?”). The questionnaire consists of 20 items scored on a 5-point Likert scale (Cronbach's alpha = 0.85).

3.2.5. DSM-5 criteria for IGD (IGD-9)

The DSM-5 criteria (APA, 2013) for IGD were used to assess symptoms of an addiction (i.e., the presence of symptoms such as abstinence, tolerance, preoccupation, and withdrawal) to WoW (Ko et al., 2014). A sample item is “When I don't play for a while I'm irritable, anxious, or sad”. The questionnaire consists of nine items with a dichotomous scale (KR-20 = 0.71).

4. Results

4.1. Difference between schizotypal traits in real life and in game

Descriptive statistics of SPQ-B and SPQ-IG scores, Pearson's r correlations between the SPQ variable pairs, and results of analysis of variance with repeated measures (to control for potential confounding effects of gender and age) are reported in Table 1 in order to illustrate the presence and magnitude of differences between schizotypal traits in the real world (SPQ-B) and in game (SPQ-IG). Gamers' scores on overall schizotypal traits, the interpersonal problem dimension, and the disorganized dimension significantly decreased when traits were reported that referred to in-game activities (SPQ-IG). The differences in the cognitive-perceptual dimension of schizotypy offline and in game were, however, not significant (see Table 1). Gender did not have a significant effect in any of the models, whereas age had marginal effects on the difference between SPQ total scores (partial $\eta^2 = 0.05$, $p = 0.045$) and interpersonal scores (partial $\eta^2 = 0.06$, $p = 0.023$), so that being younger was related to higher SPQ scores on these scales.

Therefore, Hypothesis 1 was partially confirmed. The gamers' attitudes in the context of the virtual world decreased their interpersonal and disorganized schizotypal traits, but did not reduce their cognitive-perceptual traits.

4.2. Do schizotypal traits predict motivations for gaming?

For testing Hypothesis 2a, we performed three sets of multiple linear regressions with SPQ-B trait scales included as independent variables (together with gender and age as potential covariates) in order to test whether schizotypal traits would predict the achievement (Model A), social (Model B), and immersion (Model C) motivations. All three models were significant. Specifically, the predictors explained 21.8% of the variance in Model A ($F_{(6,76)} = 4.30$, $p = 0.002$; $t_{(\text{constant})} = 4.25$, $p < 0.001$), with only the cognitive-perceptual dimension of schizotypy significantly explaining any part of the variance of the achievement motivation score apart from the variance already explained by the other variables ($\beta = 0.29$, 95% confidence interval [CI] [0.07, 1.13], $t = 2.23$, $p = 0.03$). For social motivation (Model B), the predictors explained 34.0% of the variance ($F_{(6,76)} = 7.94$, $p < 0.001$; $t_{(\text{constant})} = 12.62$, $p < 0.001$), with only the interpersonal dimension of schizotypy being a significant and negative predictor of social motivation apart from the variance already explained by the other variables ($\beta = -0.60$, 95% CI [-0.82, -0.39], $t = 5.60$, $p < 0.01$). The predictors explained 27.1% of the variance in Model C ($F_{(6,76)} = 5.72$, $p < 0.001$; $t_{(\text{constant})} = 2.21$, $p = 0.030$), and the cognitive-perceptual dimension of schizotypy was the only significant and positive predictor of the immersion motivation apart from the variance already explained by the other variables ($\beta = 0.29$, 95% CI [0.10, 1.34], $t = 2.32$, $p = 0.02$). Gender and age did not add to the prediction in any of the models.

Table 1
Offline and in-game schizotypal traits: descriptive statistics, intercorrelations, and differences between reported traits.

	SPQ-B M (SD)	SPQ-IG M (SD)	Correlation (<i>r</i>)	<i>F</i> _(1,80)	<i>P</i>	partial η^2
Schizotypal traits (total score)	48.52 (12.43)	45.87 (8.60)	0.76	8.97	0.004	0.101
Cognitive-Perceptual traits	16.17 (4.55)	15.71 (3.93)	0.61	1.37	0.246	0.017
Interpersonal traits	18.59 (5.49)	17.43 (4.32)	0.75	8.72	0.004	0.098
Disorganization traits	13.76 (4.14)	12.72 (3.13)	0.55	6.28	0.014	0.073

Note: SPQ-B = Schizotypal Personality Questionnaire – Brief; SPQ-IG = Schizotypal Personality Questionnaire – In Game.

Hypothesis 2a was confirmed. The cognitive-perceptual traits of schizotypy positively predicted the achievement and immersion motivations, while the interpersonal traits of schizotypy were negatively associated with social motivation.

4.3. Do schizotypal traits and motivations for gaming predict symptoms of IGD?

We next performed correlational analysis (all *dfs* = 81) to explore the associations between IAT scores, IGD-9 scores, SPQ-B scores, and MPOGQ scores in our sample of WoW players. The results of this analysis are shown in Table 2.

Both IAT scores and IGD-9 scores were positively associated with all three schizotypal domains of the SPQ-B. In addition, the SPQ-B total score was associated at $r = .46$ ($p < 0.001$) with the IAT score and at $r = .47$ ($p < 0.001$) with the IGD score. Moreover, the SPQ-B total score was significantly correlated with all three domains of motivation for playing, i.e., positively associated with achievement ($r = 0.27$, $p = 0.013$) and immersion ($r = 0.43$, $p < 0.001$) and negatively associated with social motivations ($r = -0.41$, $p < 0.001$). Notably, Table 2 shows that the IAT and IGD-9 patterns of association with the MPOGQ scales were similar: both IAT scores and IGD-9 scores were negatively associated with teamwork (a facet of social motivation), whereas they were positively associated with advancement and mechanics (two facets of achievement motivation) and with customization and escapism (two facets of immersion motivation). IAT scores were also associated with role playing (a facet of immersion motivation). This supported our hypothesis that all three factors – achievement, social, and immersion motivations – were related to problematic use of MMORPGs. In fact, IAT and IGD-9 scores were similarly correlated with achievement ($r = 0.48$, $p < 0.001$, and $r = 0.43$, $p < 0.001$, respectively), social ($r = -0.24$, $p = 0.032$, and $r = -0.28$, $p = 0.009$, respectively), and immersion ($r = 0.39$, $p < 0.001$, and

$r = 0.29$, $p = 0.007$, respectively) domains.

On the basis of correlational analyses, which showed that a high correlation between IAT and IGD-9 scores existed in our gamers sample, we followed a robust approach to data analysis on the clinical construct by running a principal component analysis on these two variables. We aimed to determine the linear combination of the two measures that can summarize the gamers' results and at the same time maximize the explained variance. As expected, one component was extracted (eigenvalue = 1.77), which explained 88.58% of the variance. Gamers' regression scores on this component were then used as a composite measure of IGD, as this variable was generated by combining symptoms of excessive and problematic use of WoW (IAT) with specific symptoms of Internet gaming disorder (IGD-9).

We entered this IGD variable as a dependent variable into a hierarchical regression analysis. The gender and age of gamers were entered as predictors in Step 1 to control for these potential covariates in the regression model. SPQ-B total scores were entered as predictors in Step 2 to test for Hypothesis 2b, and achievement, social, and immersion motivations were entered as predictors in Step 3 to test Hypothesis 2c. The results of this analysis are presented in Table 3.

The final model presented in Table 3 was significant ($F_{(6,76)} = 10.07$, $p < 0.001$; $t_{(\text{constant})} = -2.53$, $p = 0.012$) and explained 44% of the variance in the IGD variable ($R^2 = 0.443$). Hypotheses 2b and 2c were supported. SPQ-B scores significantly and positively predicted IGD scores at both Step 2 and Step 3 (supporting Hypothesis 2b), and the achievement and immersion motivations added to the prediction of IGD scores (supporting Hypothesis 2c). Gender, age, and social motivations for playing did not predict IGD scores in the model.

For testing Hypothesis 2d, we used the PROCESS macro (Hayes, 2013) for moderation analyses. Specifically, we examined the possible interactions between the SPQ-B total scores (predictor)

Table 2
Pearson's *r* correlations between problematic use of WoW, gaming addiction symptoms, schizotypal traits, and motivations for gaming.

	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. IAT	0.37**	0.77**	0.39**	0.46**	0.56**	0.33**	0.20	-0.09	-0.10	-0.33**	0.20	0.27*	0.37**	0.49**
2. IGD-9	–	0.41**	0.44**	0.38**	0.55**	0.26*	0.14	-0.15	-0.13	-0.35**	0.11	0.19	0.28*	0.44**
3. SPQ-B Cognitive-Perceptual	–	–	0.55**	0.68**	0.30**	-0.04	0.19	-0.05	-0.20	-0.27*	0.26*	0.38**	0.46**	0.23*
4. SPQ-B Interpersonal	–	–	–	0.74	0.32**	0.04	0.12	-0.33**	-0.36**	-0.40**	0.18	0.32**	0.35**	0.14
5. SPQ-B Disorganized	–	–	–	–	0.34**	0.06	0.14	-0.16	-0.25*	-0.27*	0.22*	0.37**	0.44**	0.18
6. MPOGQ Advancement	–	–	–	–	–	0.51**	0.49**	-0.01	-0.06	-0.31**	0.10	0.25*	0.34**	0.33**
7. MPOGQ Mechanics	–	–	–	–	–	–	0.36**	0.09	0.21	-0.07	-0.19	-0.09	0.03	0.22
8. MPOGQ Competition	–	–	–	–	–	–	–	0.14	0.11	-0.03	-0.11	0.07	0.18	-0.07
9. MPOGQ Socialization	–	–	–	–	–	–	–	–	0.36**	0.29**	0.17	0.16	0.04	0.03
10. MPOGQ Relationship	–	–	–	–	–	–	–	–	–	0.29**	-0.03	-0.01	-0.13	0.05
11. MPOGQ Teamwork	–	–	–	–	–	–	–	–	–	–	-0.22	-0.19	-0.42**	-0.23*
12. MPOGQ Discovery	–	–	–	–	–	–	–	–	–	–	–	0.59**	0.53**	0.30**
13. MPOGQ Role play	–	–	–	–	–	–	–	–	–	–	–	–	0.64**	0.34**
14. MPOGQ Customization	–	–	–	–	–	–	–	–	–	–	–	–	–	0.39**
15. MPOGQ Escapism	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Note: IAT = Internet Addiction Test; IGD-9 = DSM-5 Criteria for Internet gaming disorder; SPQ-B = Schizotypal Personality Questionnaire – Brief; MPOGQ = Motivations to Play Online Games Questionnaire. * $p < 0.05$, ** $p < 0.01$.

Table 3
Hierarchical regression analysis predicting Internet gaming disorder.

	Step 1					Step 2					Step 3				
	β	t	p	95% CI	sr	β	t	p	95% CI	sr	β	t	p	95% CI	sr
Gender (female)	-0.19	-1.72	0.09	-0.94–0.07	-0.19	-0.20	-2.06	0.04	-0.89–0.02	-0.23	-0.14	-1.57	0.12	-0.74–0.09	-0.18
Age	-0.09	-0.83	0.41	-0.04–0.02	-0.09	0.10	0.99	0.32	-0.01–0.04	0.11	0.12	1.20	0.23	-0.01–0.04	0.14
SPQ- B Schizotypy						0.53	5.22	<0.01	0.03–0.06	0.51	0.30	2.68	0.01	0.01–0.04	0.29
MPOGQ Achievement motivation											0.35	3.75	<0.01	0.02–0.06	0.40
MPOGQ Social motivation											-0.11	-1.12	0.27	-0.05–0.02	-0.13
MPOGQ Immersion motivation											0.22	2.24	0.03	0.00–0.04	0.25
F	(2,80)	=1.84				(3,79)	=10.72				(6,76)	=10.07			
R^2 change		=.04					=.25					=.15			
p		=.165					<0.001					<0.001			

Note: SPQ-B = Schizotypal Personality Questionnaire – Brief; MPOGQ = Motivations to Play Online Games Questionnaire; CI = confidence interval.

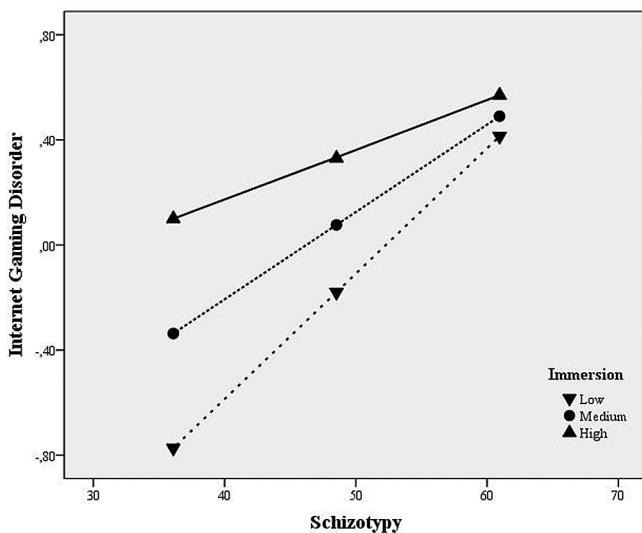


Fig. 1. Symptoms of Internet gaming disorder at different levels of schizotypy and immersion motives for playing.

and the motivations for gaming (moderators) in the prediction of IGD symptoms. We applied Model 1 with 1000 bootstrap samples. We did not find significant interactions between SPQ-B and achievement motivation ($t = 1.33, p = 0.19, n.s.$) or between SPQ-B and social motivation ($t = 1.13, p = 0.26, n.s.$) in the prediction of IGD symptoms. However, we found a significant interaction between SPQ-B and immersion motivation ($t = 2.31, p = 0.046$). Thus, we examined the relationship between SPQ-B and IGD symptoms at different values (at -1 SD, mean, $+1$ SD) of the predictor (SPQ-B total scores) and of the moderator (immersion scores), as suggested by Aiken and West (1991). We observed that higher immersion usually corresponded to higher scores in IGD symptoms and that an increase in SPQ-B scores were generally related to an increase in IGD symptoms, but also that the three slopes were differently inclined (see Fig. 1), so that schizotypal traits had less influence than immersion at lower levels of IGD symptoms, but became more and more relevant at higher levels of IGD symptoms.

Thus, Hypothesis 2d was partially confirmed. We did not find significant interactions between schizotypal traits and achievement or between schizotypal traits and social motivations for playing in the prediction of IGD symptoms, but we found that schizotypal traits interact with immersion motivations for playing in the prediction of these symptoms.

5. Discussion

In the current study, we examined the relationships between

schizotypal traits, motives for playing, and IGD symptoms. Consistent with our hypotheses, MMORPG players reported that their schizotypal traits were reduced when they were involved in gaming. This finding is consistent with the theory suggesting that people with higher psychological vulnerabilities may use virtual worlds as a psychic retreat to avoid dealing with real-life difficulties and anxieties (Schimmenti & Caretti, 2010; Schimmenti et al., 2012). This process can be described in terms of a coping mechanism, i.e., a compensatory strategy through which individuals may try to overcome their psychological and relational difficulties through excessive involvement with MMORPGs (Kardefelt-Winther, 2014). However, our findings suggest that this strategy could be maladaptive for people with more marked schizotypal traits. In fact, despite the current study showing that the interpersonal and disorganization dimensions of schizotypy decreased during MMORPG sessions, it also revealed that higher schizotypal traits are negatively associated with social motivations for playing and positively associated with achievement and immersion motivations. Accordingly, in some cases, playing MMORPGs in the long run might reinforce, rather than reduce, schizotypal symptoms in real life, such as lack of close friends, social anxiety, constricted affectivity, or magical thinking.

In the current sample of WoW gamers, this observation is also reflected in the positive association between schizotypal traits and IGD scores. This finding is consistent with previous research (Truzoli et al., 2016) and suggests that schizotypal traits might play a relevant role in the onset and maintenance of IGD. Moreover, achievement and immersion motivations added to the prediction of IGD symptoms, which is consistent with previous research (Billieux et al., 2013, 2015). Furthermore, a significant interaction between schizotypal traits and the immersion motivation was shown, so that these two factors interacted in the prediction of IGD scores. Strikingly, the effects of schizotypal traits on such an interaction were more evident at higher levels of the IGD variable, where the strong effects of the immersion motivation became less relevant if a higher level of schizotypal traits was displayed. In other words, some schizotypal-prone individuals might be at increased risk of developing excessive use of MMORPGs (and potentially other virtual environments) to cope with the difficulties they encounter in “real” life.

This research comes with a number of limitations. The sample is not overly large and is not representative of the population, and so the findings cannot be generalized. Moreover, it is not possible to establish causal links with our correlational design; thus, longitudinal studies are greatly needed to clarify our findings on the relationship between schizotypal traits, motivations for playing, and IGD symptoms. Despite our attempts to develop a robust variable for assessing IGD, the data were collected through self-report measures, and so the accuracy of individual reports cannot be

guaranteed. A multi-method assessment is warranted for future research on the topic.

Despite its limitations, this study is the first to examine schizotypal traits, motivations for playing, and IGD symptoms in a sample of MMORPG players, providing convincing indications that schizotypy could be an important factor to consider for people with IGD. In sum, our findings suggest that schizotypal traits can affect the motivations for playing and can play a pivotal role in excessive and dysfunctional uses of MMORPGs. This result has important theoretical and conceptual implications. In fact, on a theoretical level, our study suggests that IGD may emerge in some people as the result of a dysfunctional compensatory strategy to cope with maladaptive personality traits.

This view is important in that it challenges the current trend that consists in systematically conceptualizing IGD as an addictive behavior, within the lens of the biomedical model of substance dependence (Ko et al., 2014; Petry & O'Brien, 2013). In contrast, the current findings are consistent with recent data showing that dysfunctional involvement in online games is a highly heterogeneous disorder composed of various subtypes (Billieux et al., 2015) that can be conceptualized either as primary addictive-, obsessive-, or impulsive-like disorders, or as secondary disorders (or coping strategies) displayed to face life adversity or pre-existing psychopathology (Karddefelt-Winther, 2014; Schimmenti & Caretti, 2010; Schimmenti et al., 2012). In this vein, the current study adds to the literature by highlighting that schizotypy-related features might be central when it comes to considering the psychopathological variables responsible for the development of IGD as a consequence of another disorder. It is worth noting that this reasoning is supported by clinical data, obtained in a behavioral addiction outpatient program where IGD is the most frequent condition treated, showing that psychosis-related disorder is the second most frequent comorbid diagnosis encountered after social phobia in treatment-seeking cases (Thorens et al., 2014). The present study also has implications vis-à-vis diagnosis and treatment of IGD. More precisely, it appears to be crucial to determine whether or not IGD symptoms reflect a coping strategy in order to avoid proposing treatments that target addictive behaviors (e.g., motivational interviewing, relapse prevention) in persons displaying other types of psychopathological problems. Indeed, although such treatments may or may not mitigate gaming behaviors, they will unlikely affect the factors underlying IGD symptoms. To conclude, the present findings suggest that it could be useful to assess the presence and severity of schizotypal symptoms and the motives for playing in individuals who display symptoms of IGD, as this could help clinicians differentiate between primary and secondary disorders, guide their understanding of the origin of the symptoms, and foster individualized psychological interventions.

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