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Impulsivity in Multiplayer Online Battle Arena Gamers: Preliminary Results on Experimental and Self-Report Measures

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Background and aims: Multiplayer Online Battle Arena (MOBA) games have become the most popular type of video games played worldwide, superseding the playing of *Massively Multiplayer Online Role-Playing Games* and *First-Person Shooter* games. However, empirical studies focusing on the use and abuse of MOBA games are still very limited, particularly regarding impulsivity, which is an indicator of addictive states but has not yet been explored in MOBA games. In this context, the objective of the present study is to explore the associations between impulsivity and symptoms of addictive use of MOBA games in a sample of highly involved *League of Legends* (LoL, currently the most popular MOBA game) gamers. *Methods:* Thirty-six LoL gamers were recruited and completed both experimental (Single Key Impulsivity Paradigm) and self-reported impulsivity assessments (s-UPPS-P Impulsive Behavior Scale, Barratt Impulsiveness Scale), in addition to an assessment of problematic video game use (Problematic Online Gaming Questionnaire). *Results:* Results showed links between impulsivity-related constructs and signs of excessive MOBA game involvement. Findings indicated that impaired ability to postpone rewards in an experimental laboratory task was strongly related to problematic patterns of MOBA game involvement. Although less consistent, several associations were also found between self-reported impulsivity traits and signs of excessive MOBA game involvement. *Conclusions:* Despite these results are preliminary and based upon a small (self-selected) sample, the present study highlights potential psychological factors related to the addictive use of MOBA games.

Keywords: Internet Gaming Disorder, Internet addiction, Multiplayer Online Battle Arena, videogame addiction, impulsivity, delay discounting

INTRODUCTION

The playing of video games has now become one of the most popular leisure activities worldwide, especially since the introduction of online multiplayer games featuring elements of both cooperation and competition. Despite their many positive and valuable outcomes, a growing body of literature has suggested that video game involvement can, under certain circumstances, become problematic and associated with negative outcomes and functional impairment (Gentile et al., 2011; King, Haagsma, Delfabbro, Gradisar, & Griffiths, 2013). In 2013, and despite inconsistencies in the classification and limited evidence with regard to etiology and course of the condition, *Internet Gaming Disorder* (IGD) was included in Section 3 of the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-5*; American Psychiatric Association, 2013), which called for more research into the disorder. Since the inclusion of IGD in the DSM-5, controversies and debates have continued in regard to the appropriateness of the DSM-5 IGD assessment criteria (Griffiths et al., 2016; Király, Griffiths, & Demetrovics, 2015; Petry et al., 2014, 2015). Consequently, further research is needed to better understand the factors involved in the development, maintenance, and recurrence of video game playing-related disorders. In this context, as online video game genres are very heterogeneous, a central question is whether similar factors predict the excessive use of different online video game genres or not.

Most of the earlier studies on videogame playing-related disorders have focused on the genre of *Massively Multiplayer Online Role-Playing Games* (MMORPGs). These types of video games are characterized by specific structural characteristics potentially promoting the development of addictive usage patterns, including the fact that they take place in persistent virtual worlds, encourage continuous gaming through a sophisticated advancement system, and facilitate social interactions between players (Billieux, Deleuze, Griffiths, & Kuss, 2015). This initial focus on MMORPGs was justified by their popularity, but new game genres have now emerged, presenting distinct features. Currently, the most popular online video game

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worldwide is *League of Legends* (LoL), a Multiplayer Online Battle Arena (MOBA) game. This game had 67 million monthly players in 2014 (Statista, 2016). In contrast to MMORPGs, MOBA games do not take place in never-ending virtual worlds, although they feature similar characteristics of advancement and social interaction. Importantly, LoL provides daily updated international rankings and statistics, and is the game most associated with international competitions (including a worldwide championship) and eSport practices (i.e., a growing number of players are professionals). Despite the widespread popularity of MOBA games, few studies have investigated their potentially addictive nature or the factors associated with their excessive use, while these characteristics could differ from those described in MMORPGs.

A growing amount of empirical evidence has tied problematic video gaming and IGD to poor self-control, e.g. impulsivity and sensation seeking traits, diminished inhibitory control (Billieux, Deleuze, et al., 2015; Billieux & Van der Linden, 2012; Zhou, Zhu, Li, & Wang, 2014). This interest in exploring the role of self-control related processes in the onset of problematic video gaming behaviors was mainly driven by the current view that these "disorders" might adequately be conceptualized as addictive behaviors centrally characterized by uncontrolled use (King et al., 2013), as is the case for other substance-related and behavioral addictions (e.g., Billieux et al., 2012; Groman, James, & Jentsch, 2009). An important 2-year longitudinal research conducted using a large sample of adolescents identified heightened trait impulsivity to act as a risk factor for developing subsequent problematic patterns of video game use (Gentile et al., 2011). Moreover, although most existing studies rely on self-reported measures, some experimental studies have demonstrated that problematic online gaming is characterized by impaired executive control (including prepotent response inhibition impairment, Littel et al., 2012), disadvantageous decision-making (Pawlikowski & Brand, 2011), and/or compromised delay discounting (Irvine et al., 2013). However, to date, studies are lacking that investigate self-control-related processes in MOBA gamers, yet the structural characteristics of this type of game (e.g., short and intensive game sessions, daily updated international rankings) might be susceptible to promote heightened disordered or "binge" involvement in comparison to other more studied types of video games (e.g., MMORPG, first-person shooters).

The present study fills the gap in knowledge in previous research by (a) specifically focusing on the neuropsychological factors involved in deregulated MOBA use (e.g., addiction-like symptoms, negative outcomes resulting from gaming) and (b) using both experimental laboratory and self-report measures of impulsivity. Consequently, the objective of the present paper is to explore the associations between impulsivity and symptoms of addictive use of MOBA games among a sample of highly involved LoL gamers. The rationale is to provide initial evidence regarding potential psychological factors related to disordered MOBA gaming, via the exploration of impulsivity by means of (a) an experimental task based on reward delaying and (b) self-report measures.

METHODS

Participants and procedure

Thirty-six MOBA gamers aged between 18 and 24 years ($M = 21.35$, $SD = 1.89$, 83.97% male) took part in the study. All participants completed the following self-report instruments assessing impulsivity traits and addictive use of MOBA: the short version of the UPPS-P Impulsive Behavior Scale (s-UPPS-P; Billieux et al., 2012), the Barratt Impulsiveness Scale (BIS-11; Patton, Stanford, & Barratt, 1995), and the Problematic Online Game Questionnaire (POGQ; Demetrovics et al., 2012). Table 1 shows the scales used and reports their internal consistency in the current sample. Participants then carried out a laboratory task developed for the purpose of the present study, based on a delay-discounting paradigm (see description below). Inclusion criteria included being aged at least 18 years and being a fluent French-speaker and having an advanced level in LoL. This latter criterion was applied to guarantee the inclusion of highly involved gamers. Participants reported playing an average of 16.72 hrs weekly ($SD = 8.16$) and had played a total of 1233.88 hrs on average ($SD = 846.66$; min = 192; max = 2,847), since they started playing LoL.

Behavioral task

A new version of the Single Key Impulsivity Paradigm (SKIP; Dougherty, Mathias, Marsh, & Jagar, 2005) was developed in the framework of this study to assess the tolerance for delayed rewards. The task lasted for 8 mins (four blocks of 2 mins), where the participants were free to respond as frequently as desired to earn real money (by clicking a button), while receiving feedback about the amount of money earned after each click and their global performance after each block. Participants did not have any other task to perform but in-game-related stimuli (well-known characters from the LoL game) were displayed on the screen during the whole task to promote emotional arousal and favor impulsive choices. Participants were told at the beginning of the task that the magnitude of the reward was related to the length of the delay between consecutive responses. The size of the reward varied linearly and was directly proportional to the length of delay between two consecutive responses. However, participants were also informed that if they did not click before the end of a block, the money was lost for this block, which discouraged participants from simply waiting until the end of a block before clicking, and simultaneously encouraged them to click. The tolerance for delayed rewards was indexed by the average delay between each participant's responses, with higher average delay reflecting less impulsive choices. To avoid participants mentally counting time, they were not told that each block lasted 2 mins. An algorithm was created to ensure that the participants would earn between 5 and 10 Euros/block, the total being divided by four at the end of the

Table 1. Self-report questionnaires used in the study

Questionnaire	Scale	Scale description	Cronbach's alpha (α)	Average score	Standard deviation
Problematic Online Game Questionnaire	Preoccupation	Constant thoughts about gaming experiences	.66	5.81	1.35
	Overuse	Spending too much time on the game	.79	8.06	2.67
	Immersion	Losing track of time when playing the game	.61	13.36	2.68
	Social isolation	Neglect other activities in favor of gaming	.60	5.69	1.89
	Interpersonal conflicts	Negative consequences in social life due to gaming	.71	4.58	2.20
	Withdrawal	Feeling reckless when unable to play the game	.70	9.11	2.76
	Total score	Problematic use of online video game	.77	46.61	9.35
Short version of the UPPS-P	Negative urgency	Proneness to act rashly in negative emotional contexts	.77	9.19	2.35
	Positive urgency	Proneness to act rashly in positive emotional contexts	.67	11.75	2.09
	Lack of premeditation	Difficulties to foresee the possible consequences of the action	.89	7.69	2.29
	Lack of perseverance	Difficulties to stay focused on an annoying or complicated task	.94	8.00	3.18
	Sensation seeking	Openness to new experiences and preferences for risky activities	.81	11.22	2.94
Barratt Impulsiveness Scale (11th version)	Motor impulsiveness	Acting on the spur of the moment	.53	20.60	3.35
	Cognitive impulsiveness	Difficulties to stay focused on a task	.56	17.11	2.97
	Non-planning impulsiveness	Difficulties to take on a complicated task	.72	23.86	5.05

task, so the participants would win the average amount (see Figure 1 for details).

Ethics

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). A compensation (consisting of 10 Euros + the money earned in the adapted SKIP paradigm) was given for participating in the study. The ethical committee of the Psychological Science Research Institute, Université catholique de Louvain, approved the study protocol.

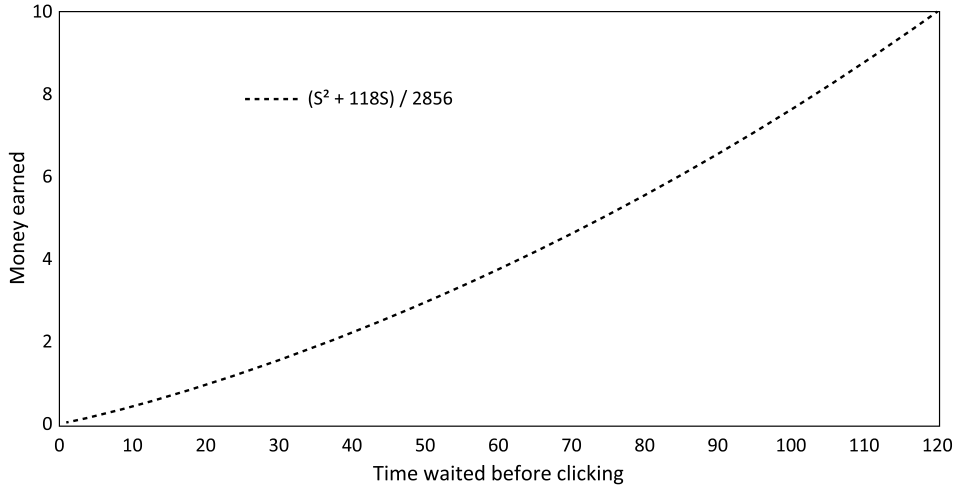

Figure 1. This figure illustrates the algorithm that was used to compute the amount of money earned for a click. This algorithm was developed to ensure that each participant earned between 5 (if he/she clicks approximately every second during each block) and 10 Euros (if he/she clicks only once per block) after completion of the task. The algorithm implies an exponential growing of the rewards earned when participants successfully delay their clicks. In this formula, "S" refers to the seconds waited before clicking.

RESULTS

Behavioral performance on the adapted SKIP paradigm

To test the progression throughout the task, a repeated-measures ANOVA was run, with the block numbers as independent measure and the average waiting time as dependent variable, using a Greenhouse–Geisser correction due to sphericity [$\chi^2(5) = .324$; $p < .001$]. This test led to a significant result for the average time waited between each click [$F(1,25) = 28.873$; $p < .001$; $\eta^2_p = .568$]. Results showed that participants' performance improved until the third block and was then stable. Table 2 reports the progression between blocks. Accordingly, the following variables were taken into account: (a) mean time between two clicks in the two first blocks (blocks for which a progression occurs) and (b) mean time between two clicks in the final two blocks (blocks for which progression stopped). These two variables were chosen instead of separate blocks analyses due to the high correlation between these blocks (i.e., $r = .790$ between blocks 1 and 2; $r = .690$ between blocks 3 and 4).

Associations between delayed reward tolerance, impulsivity, and addictive use of MOBA games

Due to the small sample size and the violation of the multivariate normality assumption, a Spearman correlation coefficient was used. The correlations between the study's variables are reported in Table 3. Several significant relationships emerged between the SKIP and indices of addictive MOBA game use. Importantly, these relationships only appeared when considering the first two blocks of the task. More specifically, impaired ability to delay reward was associated with several subscales of the POGQ (i.e., preoccupation, overuse, immersion, and conflicts), along with the total POGQ score.

The relationships between self-reported impulsivity and addictive MOBA game use were less clear and of smaller amplitude. Nonetheless, it appeared that cognitive impulsivity (BIS-11) was associated with the preoccupation and immersion subscales of the POGQ and the total POGQ score. Several non-significant trends were also observed (e.g., between the negative urgency s-UPPS-P component and the immersion subscale of the POGQ). No other significant relationship was found between self-reported impulsivity and the POGQ (see Table 3). Finally, the relationships between self-reported and laboratory-based impulsivity failed to reach significance, although motor impulsivity (BIS-11) was associated with lower delayed reward tolerance in the final two blocks of the task.

DISCUSSION

The present study examined the relationships between self-reported and experimental laboratory-based measures of impulsivity and addictive use of MOBA in a sample of highly involved MOBA gamers. Results highlighted several demonstrable links between impulsivity-related constructs and signs of excessive MOBA gaming involvement. The most important finding of the study was that an impaired ability to postpone rewards in the first part of the adapted SKIP was strongly related to problematic patterns of MOBA game involvement. This result is of theoretical significance as a poor ability to delay gratification (i.e., short-term based decision-making) has been proven central in the etiology of a wide range of addictive and excessive behaviors, such as psychoactive substance abuse, disordered eating, and disordered gambling (Bickel, Koffarnus, Moody, & Wilson, 2014; Dixon, Marley, & Jacobs, 2003).

However, it is worth noting that in the present study, the evidenced relationships only concerned the first two blocks of the experimental task. Would impulsivity have constituted the only factor at stake, the participants with a high involvement in MOBA games would have presented difficulties for the whole task. An explanation for the discrepancy between the results obtained in the two first and last blocks could be related to slower learning abilities among high-involved participants. Indeed, at the beginning of the task, participants were not aware of the algorithm and block length, and thus may have explored several strategies before optimizing their performance. Accordingly, it can be hypothesized that the lower performance observed in the first two blocks among participants highly involved in MOBA games might be related to their tendency to test more strategies before ending up with the optimal one.

Another explanation for this finding, which needs to be tested in other studies, is the arousal effect induced by the game-related pictures in this task. Using pictures from LoL, a game that all the participants enjoy playing, may have induced significant arousal among highly involved gamers, biasing the results for the two first blocks. This explanation is supported by EEG research, suggesting that orienting toward game-related cues consumes more attentional capacity in individuals addicted to gaming relative to healthy controls (Duven, Müller, Beutel, & Wölfling, 2015). This arousal would have been attenuated throughout the task, explaining the lack of relation during the second half of the task. However, since no measure of arousal or a control version of the task (i.e., without any game-related pictures) was used, this explanation should be confirmed in further studies.

Second, although the relationships between self-reported impulsivity traits and problematic MOBA game use were

Table 2. Progression through the blocks regarding the time waited between each click

Blocks (*i*–*j*)	Waiting time (*i*)	Waiting time (*j*)	Difference (*j*−*i*)	Cohen's *d*	*p*-value
1–2	14.28 s	30.19 s	15.91 s	0.874	.000
2–3	30.19 s	38.87 s	8.68 s	0.365	.000
3–4	38.87 s	41.08 s	2.21 s	0.092	.484

Table 3. Correlations between self-report measures and behavioral task

Variables	Preoccupation	Overuse	Immersion	Isolation	Conflicts	Withdrawal	Total POGQ	Hours/week	SKIP12	SKIP34
Negative urgency	.237	.057	.310[a]	.148	.092	.124	.226	.009	−.115	.065
Positive urgency	.013	−.197	.139	−.258	.009	.213	−.002	.055	.112	−.303
Lack of premeditation	.147	.040	−.014	−.154	.263	.105	.084	.034	−.034	−.038
Lack of perseverance	.320[a]	.145	.244	.000	−.037	.123	.187	.035	−.135	−.042
Sensation seeking	−.104	.100	−.065	−.192	.179	.197	.052	.026	−.223	−.074
Motor impulsivity	.130	.136	.128	−.192	.204	.168	.148	.026	−.184	−.371*
Cognitive impulsivity	.405*	.208	.331*	−.014	.263	.315[a]	.358*	.110	−.243	−.321
Non-planning impulsivity	.181	.100	.141	−.037	.202	.255	.205	.115	.040	−.032
SKIP12	−.487**	−.483**	−.370*	−.086	−.436**	−.184	−.478**	−.243	/	/
SKIP34	−.087	−.145	−.246	.182	−.069	.057	−.084	−.175	/	/

Note. Pairwise treatment of missing data. SKIP12 = mean waiting time during the first half of the task; SKIP34 = mean waiting time during the second half of the task.
[a]$p < .08$.
$*p < .05$. $**p < .01$.

less consistent and of smaller amplitude, several significant associations and non-significant trends were found between specific addiction symptoms and cognitive impulsivity, which further emphasizes the associations between impulsive personality and problematic video game involvement (Billieux, Deleuze, et al., 2015; Gentile et al., 2011). However, it has to be noted that these results have to be confirmed in larger samples and with statistically-corrected correlational analyses.

Another interesting finding is that self-reported and laboratory-based impulsivity were related to disordered MOBA game use, but not to actual MOBA game use (i.e., the weekly number of hours spent playing LoL). This dissociation further calls for the necessity to distinguish between high involvement (reflecting a non-problematic passion or leisure activity) versus addictive use of video games (Billieux, Schimmenti, Khazaal, Maurage, & Heeren, 2015; Charlton & Danforth, 2007). In conclusion, although the data are preliminary and obtained from a small sample, the results of the present study highlight potential risk factors involved in addictive use of the most popular MOBA game.

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Authors' contribution: FN and JB designed the study. FN created the adapted SKIP paradigm. FN and JD acquired the data. FN did the statistical analyses. FN, PM, and JB interpreted the results. FN and JB wrote the initial draft of the article. PM, JD, MDG, and DJK reviewed the initial draft and participated in the writing of the final draft. All authors approved the final version of the manuscript.

Conflict of interest: MDG also undertakes consultancy for various gaming companies in the area of social responsibility in gambling. No conflict of interest exists for the other authors.

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