FULL-LENGTH REPORT

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Delay discounting, risk-taking, and rejection sensitivity among individuals with Internet and Video Gaming Disorders

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Background and aims: There is a previous evidence for impulsivity in individuals with Internet and Video Gaming Disorders. The aim of this study was to examine whether Internet and video game addictions are associated with experiential delay discounting, risk-taking, and sensitivity to social rejection using computerized tasks and questionnaires. *Methods:* Twenty participants (mean age 24, $SD = 1.55$) with high score on the Problematic Online Gaming Questionnaire (POGQ) were compared with 20 participants (mean age 24.8, $SD = 1.34$) with low score on the POGQ. They performed on computerized Balloon Analog Risk Task and Experiential Delay discounting Task (EDT), and filled in the sensitivity to social rejection questionnaire. *Results:* Participants with high POGQ scores had lower measures of delay discounting, higher measures of risk-taking, and higher measures of sensitivity to social rejection compared with participants with low POGQ scores. *Discussion:* The results of this study support the previous evidence of risk-taking and provide new evidence for difficulties in delay discounting and sensitivity to social rejection among those who score high on Internet and video games. *Conclusions:* The results suggest that Internet- and video game-addicted individuals seek immediate gratification and cannot wait for later reward. Furthermore, these individuals spend time in the virtual world, where they feel safe, and avoid social interactions presumably due to fears of social rejection.

Keywords: Internet and Video Gaming Disorder, risk-taking, delay discounting, impulsivity

INTRODUCTION

There is an increasing use of Internet and video games, such as "Grand Theft Auto," "Mortal Combat," "Call of duty," and others, and this resulted in an increasing number of users worldwide and a rapidly growing industry (Király, Nagygyörgy, Griffiths, & Demetrovics, 2014; Kuss, 2013). Playing Internet and video games has become one of the most popular leisure activities regardless of culture, age, and gender (Király et al., 2014; Kuss, 2013). Playing multiplayer games on the Internet involves communication with players around the world, and it is considered social activity. In particular, males who were heavy players scored highly on the "preference to friends" need, but interestingly, they were also likely to see their friends more often outside school, thus providing no support for the theory that computer games are taking the place of normal social interaction (Colwell, Grady, & Rhaiti, 1995).

Other studies have shown the relationships between excessive video games early start and dependence (Fisher, 1994; Griffiths & Hunt, 1998) and that Internet Gaming Disorder (IGD) involves excessive or poorly controlled preoccupations, urges, or behaviors regarding computer and video game play that lead to impairment or distress. There are three different models proposed for IGD: an impulse control disorder, an obsessive–compulsive disorder, and a behavioral addiction model (Grant, Potenza, Weinstein, & Gorelick, 2010; Weinstein & Aboujaude, 2015; Weinstein, Feder, Rosenberg, & Dannon, 2014). The behavioral addiction model argues that IGD shows the features of excessive use despite adverse consequences, withdrawal phenomena, and tolerance that characterize substance use disorders. In the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013), IGD is identified in Section III as a condition warranting more clinical research and experience before it might be considered for inclusion as a formal disorder (see Weinstein & Aboujaoude, 2015; Weinstein et al., 2014 for review).

It has also been argued that Internet and video game playing should be classified as an impulse control disorder because players often cannot control their urges to play. This model is supported by evidence that individuals who become addicted to computer and video games find it hard to quit or reduce their online gaming despite the efforts they make (Hellman, Schoenmakers, Nordstrom, & van Holst, 2013). IGD is therefore characterized as a compulsive or excessive use of the Internet without control that can interfere with daily activity and can result in harm or distress (Weinstein et al., 2014; Weinstein & Lejoyeux, 2010). It has

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been argued that Internet and video games are means for satisfaction excitement and reward similar to other behavioral addictions (Griffiths, 2008).

First, consistent with the view that IGD should be considered a behavioral addiction there is the notion that individuals who are addicted to Internet and video games are impulsive and cannot control their urges and prefer immediate reward to long-term gains. Previous studies have shown that impulsivity is enhanced in substance use disorders (Perry & Carrol, 2008; Robbins, Gillan, Smith, de Wit, & Ersche, 2012). There is further evidence that Internet-addicted individuals are characterized by impulsive behavior (Cao, Su, Liu, & Gao, 2007) and that they prefer small immediate rewards to large delayed rewards (Irvine et al., 2013).

There are several paradigms that have been used to investigate risk-taking, such as the Balloon Analog Risk Task (BART) (Lejuez et al., 2002), Bechara's gambling task (Iowa Gambling Task, IGT; Bechara, Damasio, Tranel, & Damasio, 2005), or a task that measures behavioral choice (Mitchell, 1999). In this study, we have used a task that measures risk-taking – the Balloon Analog Risk Task (BART) (Lejuez et al., 2002). This task has been used extensively in drug, alcohol, nicotine addiction as well as gambling, kleptomania aggression, and unprotected sex in adolescents and adults (Hunt, 2005). The task measures the tendency to pre-empt responses and to respond quickly to external stimuli (balloons).

Second, consistent with the impulsivity hypothesis for IGD, we have investigated the process of delay discounting among individuals with IGD. Studies on drug addiction and behavioral addiction, such as gambling, have shown evidence for delay discounting (Bickel, Odum, & Madden, 1999; Madden, Petry, Badger, & Bickel, 1997; Vuchinich & Simpson, 1998). It is established that there is an association between IGD and delay discounting because Internet use gives immediate reward on the expense of social and professional activities that yield long-term rewards (Irvine et al., 2013; Saville, Gisbert, Kopp, & Telesco, 2011; Young, 2004). It is therefore important to investigate delay discounting among individuals with IGD. Few studies have attempted to compare the performance on the BART, IGT, and Experiential Delay discounting Task (EDT) in IGD (Xu, Korczykowski, Zhu, & Rao, 2013), and the reliability of the trials on these tasks was mixed. Hence, there is a need to compare risk-taking and delay discounting two facets of impulsivity in individuals with IGD.

Finally, although people often report that the Internet connects them socially and enables communication, it also paradoxically reduces individual involvement in social relations and may lead into isolation and lack of social contact (Davis, Flett, & Besser, 2002). Consequently, those who are addicted to the Internet spend more time by playing multiplayer games rather than using other means for communication, such as email or social networks (Young, 1998). We have decided to investigate one of the consequences of IGD that is social isolation and impairment in interpersonal relationships. This was done using the sensitivity to social rejection or interpersonal sensitivity. These two constructs describe a cognitive–affective worry of rejection that can impair well-being and interpersonal function.

People who have fears and doubts of acceptance by others and who expect rejection act in more hostile, aggressive ways in relationships compared with more secure individuals (e.g., Downey, Feldman, & Ayduk, 2000; Downey, Freitas, Michaelis, & Khouri, 1998; Dutton, Saunders, Staromski, & Bartholomew, 1994; Gaines et al., 1997; Mikulincer, 1998). They experience more troubled and dissatisfying relationships that end sooner (e.g., Downey & Feldman, 1996; Downey et al., 1998; Simpson, Ickes, & Grich, 1999) and are more susceptible to loneliness, social anxiety, and depression following rejection (e.g., Ayduk, Downey, & Kim, 2001; Baldwin, 1994; Cooper, Shaver, & Collins, 1998; Hammen, Burge, Daley, & Davila, 1995; Kobak & Sceery, 1988; Shaver & Hazan, 1987; Simpson, Rholes, & Phillips, 1996).

Rejection sensitivity may also be associated with pathological gambling. Pathological gambling has a close relationship with rejection as both can stem from physiological or emotional pain. Rejection can also cause people to feel socially isolated, and this can be enhanced by further isolation during gambling. The association between pathological gambling and rejection sensitivity needs to be examined further.

It is therefore important to investigate whether IGD is associated with sensitivity to social rejection or interpersonal sensitivity.

It was hypothesized that Internet- and video game-addicted individuals would have higher impulsivity, delay discounting, and higher levels of sensitivity to social rejection compared with non-addicted individuals.

METHODS

Procedure

Participants. There were 40 participants and they were split into two groups: 20 participants in the high Problematic Online Gaming Questionnaire (POGQ) score group (19 males and 1 female) and 20 participants in the low POGQ score group (19 males and 1 female) with the age range of 22–28. The high POGQ score group had the mean age of 24 years and 1 month, and in the low POGQ score group, the mean age was 24 years and 10 months. Participants were recruited using a "snowball" method or "a friend brings a friend" method and were not rewarded for participation. They were required to fill in questionnaires on Google forms and to perform on the computerized tasks for 1 h. The experiment was approved by the Ethical Committee of the Ariel University.

Questionnaires. Three questionnaires were administered in this study. First, a demographic questionnaire with personal details, such as age, sex, and years of education. Second, the Problematic Online Gaming Questionnaire (POGQ) – Short Form that assessed online gaming. The questionnaire has 12 items to measure problematic use of computer games (Pápay et al., 2013). The original questionnaire had 18 items (Demetrovics et al., 2012). The questionnaire measures occupation, excessive use, degree of immersion in the virtual reality of the game, social isolation, interpersonal conflicts, and regression. The short

form contains 2 items for each of these sub-scales. Ratings are from 1 "never" to 5 "always." The reliability of the POGQ – Short Form in this study was Cronbach's α = .90.

Third, the Rejection Sensitivity Questionnaire (RSQ) was developed by Downey and Feldman (1996). The questionnaire measures personal sensitivity to rejection in social situations. The participants read 18 hypothetical interpersonal descriptions of situations of possible rejection from significant others (e.g., "you ask your partner to move in with you"). They were required to rate from 1 to 6 how worried they are about asking their partner and how high they rate their expectations that the other will respect or accept the request. Score was calculated by multiplying the probability of rejection in each situation with the degree of worry about the request. The questionnaire had a Cronbach's α of .78 in this study.

Computerized tasks.

1. Balloon Analog Risk Task (BART) [developed by Lejuez et al. (2002)]: The participants sat in a quiet room with neutral background and were required to perform the experiment. They were requested to fill the air in a virtual balloon by pressing the "space" key on the computer board to expand it without exploding the balloon. A certain sum of money was given for each trial. The participant can choose to cash the sum by pressing the "enter" key on the computer board ("pump"). All the money that was acquired is lost if the balloon explodes. There were 30 trials for each participant. The game was finished with a message for each participant with the amount gained on the task.
2. Experiential Delay discounting Task (EDT) [developed by Rachlin, Raineri, and Cross (1991)]: The participants sat in a quiet room with neutral background and were required to perform the experiment. The participants were presented with two sums of money: a "large" sum of 1.2 that is uncertain and delayed, and a "small" sum that is changeable and immediate but lower than 1.2. If they decide to cash the money, they should press the square in which the money is displayed. There were four rounds with 15 trials in each round with different delay times for each trial (1, 5, 10, and 20 s).

Analysis of the results of the BART

The score is calculated based on three parameters: (a) number of trials without explosion, (b) number of trials with explosion – number of trials without explosion, and (c) the sum of money acquired. This task has a Cronbach's α reliability of .87 (Ronay & Kim, 2006).

Analysis of the results of the EDT

Delay discounting score was calculated based on counting all choices and times of delay following the method described by Saville et al. (2011) and Reynolds and Schiffbauer (2004). Delay discounting curves are plotted from indifference points. An indifference point was defined as the point during a block of choices when the standard- and adjusting-option amounts were of equal subjective value at a certain delay to receive the standard option. Discounting data are well characterized by the hyperbolic model (Mazur, 1987), notated as follows:

$$\text{Value} = A/(1 + kD), \quad (1)$$

where Value represents the value of the delayed reinforce, and A and D are the amount of reinforcer and length of delay to its delivery, respectively. The term k is a free parameter and indicates the steepness of the discount curve. Higher k-values indicate more rapid discounting that has been defined as more impulsive (e.g., Mazur, 1987; Rachlin, 2000; Richards, Zhang, Mitchell, & de Wit, 1999). A number of studies have shown that patterns of discounting by delay are better characterized (i.e., are fit better) by a hyperbolic function than by an exponential function (e.g., Kirby & Herrnstein, 1995; Myerson & Green, 1995; Rachlin et al., 1991; Richards et al., 1999), which is notated as follows:

$$\text{Value} = Ae^{-kD}, \quad (2)$$

where again A is the amount of reinforcer, D is the delay to receive the reinforcer, and k is the free parameter indicating steepness of the discount function. The exponential model has historically been the standard of rational choice in the field of economics (e.g., Loewenstein, 1992; Samuelson, 1937). Findings of better fits with a hyperbolic, non-rational model take on importance in the study of impulsive behavior. The quality of the fit index (R^2) is determined by a method described by Reynolds and Schiffbauer (2004). A Wilcoxon signed-rank test is used to ensure that the hyperbolic and exponential models did not differ significantly across conditions, thus, justifying the combining of these data. All individual R^2 values from Eqs. (1) and (2) were compared using a Wilcoxon signed-rank test. The Wilcoxon signed-rank test was also used to examine the sleep deprivation effects on the delay discounting task with individual k-values from the model of best fit as the outcome variable (Reynolds & Schiffbauer, 2004).

Ethics

The study was approved by the Institutional Review Board (IRB, Helsinki Committee) of the Ariel University. All participants signed an informed consent form.

RESULTS

Table 1 shows means on the POGQ, BART, delay discounting task, and RSQs in the high POGQ and low POGQ groups (*SD* in brackets).

Between group comparison of all measures

The BART. First, a comparison of scores on the BART between the high and low POGQ control groups showed that the high POGQ group scored higher on risk-taking measure on the task (number of key pressing that results in balloon explosion – number of key pressing that does not result in balloon explosion) than the low POGQ group [$t(1, 19) = 3.36$, $p < .01$]. Cohen's $d = 0.68$. Cohen's d is calculated as

$$\text{k group 1} - \text{k group 2}/SD\,(\text{group 1} + \text{group 2}).$$

Table 1. Means on the POGQ, BART, delay discounting task, and Rejection Sensitivity Questionnaires in the high and low POGQ groups (*SD* in brackets)

Questionnaires and tasks, mean (*SD*)	High POGQ ($n = 20$)	Low POGQ ($n = 20$)	Cohen's *d*	Between group comparison
POGQ	42 (5)	13 (2.92)	7.08	$t(1, 19) = 4.54$, $p < .001$
BART				
Number of trials with explosion	633 (182)	398 (168)	1.34	$t(1, 19) = 4.34$, $p < .001$
Number of trials without explosion	464 (87)	344 (143)	1.01	$t(1, 19) = 3.62$, $p < .01$
Number of key pressing (pumps) that results in balloon explosion – number of key pressing (pumps) that does not result in balloon explosion	169 (136)	54 (43)	1.14	$t(1, 19) = 3.36$, $p < .01$
Mean number of key pressing	31.61 (2.03)	19.89 (8.37)	1.92	$t(1, 19) = 4.34$, $p < .001$
Mean number of explosions	6 (2.714)	3.3 (1.26)	1.28	$t(1, 19) = 4.24$, $p < .001$
Delay discounting	0.038 (0.03)	0.019 (0.016)	0.68	$t(2, 16) = 2.16$, $p < .05$
Rejection sensitivity	9.29 (1.64)	5.26 (2.06)	2.16	$t(1, 19) = 6.57$, $p < .001$

Note. POGQ = Problematic Online Gaming Questionnaire; BART = Balloon Analog Risk Task.

Second, a comparison of the average number of key pressing in the high and low POGQ groups showed that the high POGQ group had average number of more key pressings than the low POGQ group [$t(1, 19) = 4.34$, $p < .001$]. The mean number of inflations of the high and low POGQ groups was 31.61 ($SD = 9.09$) and 19.89 ($SD = 8.4$), respectively.

Third, a comparison of the mean number of explosions between the groups showed that the high POGQ group made more explosions than the low POGQ group [$t(1, 19) = 4.24$, $p < .001$]. Figure 1 shows differences in performance on the BART between the high and low POGQ groups. It indicates higher number of overall key pressing and risky key pressing in the high POGQ group compared with the low POGQ group.

Delay discounting. There was a significant difference between the high and low POGQ groups in the k-value (slope of the delay discounting curve) [$t(2, 16) = 2.16$, $p < .05$].

Total mean k score of the high and low POGQ groups was 0.038 ($SD = 0.033$) and 0.019 ($SD = 0.016$), respectively. There was also a significant difference between the high and low POGQ groups in R^2 [$t(1, 16) = 2.26$, $p < .05$]. Total mean R^2 score of the high and low POGQ groups was 0.81 ($SD = 0.16$) and 0.65 ($SD = 0.22$), respectively. Cohen's *d* for R^2 was 0.81.

Figure 2 shows differences in average group performance on the delay discounting task between the high and low POGQ groups. It indicates a much steeper slope of delay discounting in the high POGQ group compared with the low POGQ group.

Rejection sensitivity. A comparison between the high and low POGQ groups on scores of the RSQ showed that the high POGQ group scored higher on the questionnaire than the low POGQ group [$t(1, 19) = 6.8$, $p < .001$]. The total mean R^2 score of the high and low POGQ groups was 9.29 ($SD = 1.64$) and 5.26 ($SD = 2.06$), respectively.

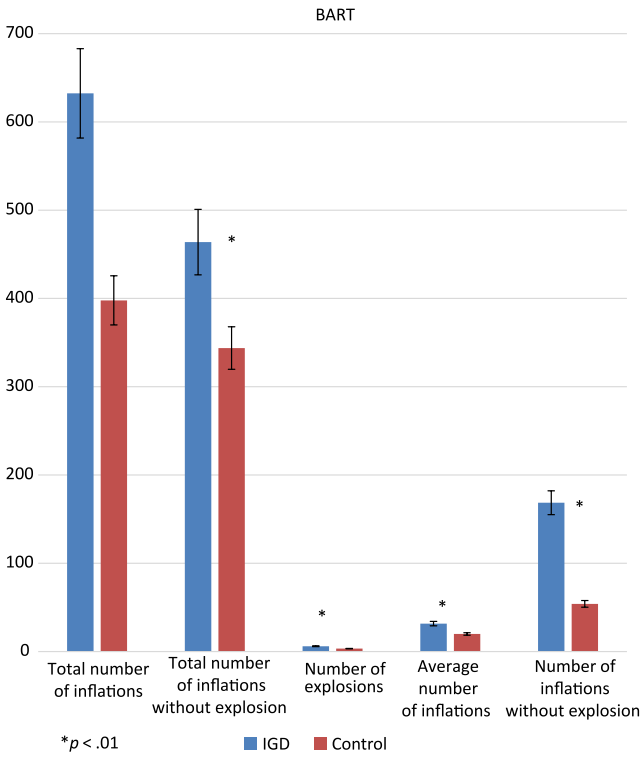

Figure 1. Differences in performance on the BART between the high and low POGQ groups

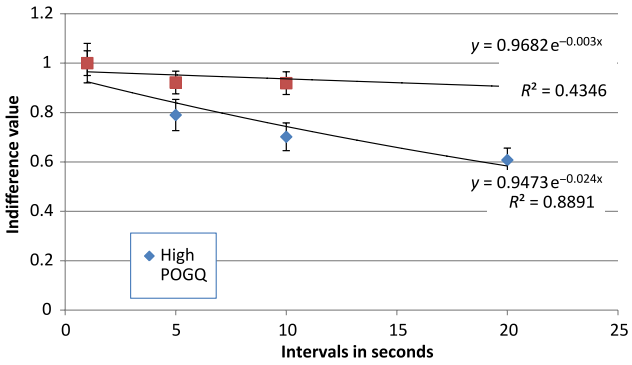

Figure 2. Differences in average group performance on the delay discounting task between the high and low POGQ groups

DISCUSSION

The results of the study demonstrated that participants with high problematic Internet and video game use compared with low problematic Internet and video game use had higher scores on all counts of risk-taking that were tested on the BART, namely higher number of total key pressing ("pumps"), higher score of the difference between explosion and non-explosion pressing, and total gains on the task. These results support the early findings of error processing and response inhibition in excessive computer game players by Littel et al. (2012). It is possible that IGD results in risk-taking behavior that indicates impulse control problems (Baumeister, Vohs, & Tice, 2007). Risk-taking behavior has also been strongly associated with sensation seeking and impulsivity (Lejuez et al., 2002, 2003).

Impulsivity is a multidimensional construct that can characterize the inclination of a person to succumb to urges or inability to plan or consider the possible options before making a decision (Kirby & Finch, 2010). Impulsivity has also been described as an inclination to look for excitement or adventure, impatience, and inability to evaluate the consequences of one's actions and to behave inappropriately without inhibition (Reynolds, Ortengren, Richards, & de Wit, 2006; Reynolds, Penfold, & Patak, 2008). The results of this study indicate that individuals with Internet and Video Gaming Disorder have risk-taking behavior that is an indication for vulnerability to mental disorders, a finding that has major clinical implications.

The previous studies have shown that impulsivity is enhanced in various psychiatric disorders including attention-deficit/hyperactivity disorder, substance dependence, obsessive–compulsive disorder, and eating disorders (Perry & Carrol, 2008; Robbins et al., 2012). Research using personality measures of impulsivity (a trait related to disinhibition, approach motivation, novelty seeking, and sensation seeking) points to the importance of impulsivity as a temperamental vulnerability factor for substance use (Acton, 2003). It was proposed that common genetic liability to behavioral disinhibition is expressed in part through brain mechanisms related to cognitive control, impulsivity, and sensitivity to reward, all of which are maturing during adolescence and during this period, problem behaviors emerge, including the initiation of substance use (Iacono, Malone, & McGue, 2008).

Among the behavioral addictions, Internet-addicted individuals are more impulsive than non-addicted individuals (Cao et al., 2007). A study using the IGT found that Internet-addicted individuals have deficits in decision-making function, chiefly a strategy learning lag rather than an inability to learn from task contingencies. They showed better performance on a Go/No-Go task, suggesting some dissociation between mechanisms of decision making and those of prepotent response inhibition in IGD (Sun et al., 2009). Contrary results were shown in another study that has investigated decision-making (IGT), potential to take risks (BART), and personality of college students with Internet addiction (Ko et al., 2010). Performance on the gambling task indicated better decision-making, and performance on the BART indicated less risk-taking behavior in Internet-addicted individuals. Their scores on Cloninger's (1994) Tridimensional Personality Questionnaire showed lower reward dependence and higher novelty seeking. These findings of higher performance on the IGT differentiate this Internet addiction group from substance use, pathological gamblers, and Internet-addicted individuals who have been shown to be deficient in decision-making on the Iowa test. There is further evidence for the association between excessive video game playing and impulsivity showing that those who spend more time playing video games subsequently have more attention problems (Gentile, Swing, Lim, & Khoo, 2012). IGD has also been associated with Attention Deficit Hyperactivity Disorder in school children (Weinstein, Yaacov, et al., 2015). These findings imply that IGD can result in faulty impulsive decisions with negative consequences for task completions on an information sampling and a delay discounting task (Irvine et al., 2013).

Consistent with the previous evidence (Irvine et al., 2013), participants of the high POGQ group also had impaired delay discounting, which is often described as the reduction in value of reward as a function of an increase in the delay time before getting it (Madden, Francisco, Brewer, & Stein, 2011). Extreme delay discounting exemplifies an impulsive choice that prefers small but immediate reward to a large delayed reward (Madden et al., 2011). On the other hand, self-control happens when an organism prefers the delayed but larger reward (Ainslie, 1975; Logue, 1988; Mischel & Ebbeson, 1970; Rachlin, 2000; Skinner, 1953). The inability to delay discounting or alternatively the subjective reduction in evaluation of reward when it is delayed is a mechanism that stands as the basis of impulsive behavior (Bickel & Marsch, 2001; Critchfield & Kollins, 2001; Green & Myerson, 2004; Logue, 1988). Our results are in conformity with the previous evidence for delay discounting in opiate-dependent patients (Madden et al., 1997), social and problem alcohol drinkers (Vuchinich & Simpson, 1998), nicotine smokers (Bickel et al., 1999), and pathological gamblers (Madden et al., 2011). It is also established that there is an association between IGD and delay discounting because Internet use gives immediate reward on the expense of social and professional activities that yield long-term rewards (Saville et al., 2011; Young, 2004) and that they prefer small immediate rewards to large delayed rewards (Irvine et al., 2013). Although participants with IGD preferred short-term gains to long-term higher rewards in this study, no causality can be inferred from the results. Nevertheless, we interpret the results as indicating that spending long periods of time in highly immediately rewarding games may affect the player inasmuch that they would prefer playing games that give immediate rewards to participate in activities that may only pay off in the long run, such as social and personal activities or relationships.

Although participants with high POGQ scores had high rates of risk-taking compared with those with low POGQ scores, they scored higher on the task and it seems that their risk-taking behavior paid off. On the other hand, lower delay discounting meant lower gains on the task. Xu et al. (2013) suggested that risk-related cognitive processing mediating the BART behavior may be different than the delay discounting. Delay discounting refers to the degree to which

the subjective value of a commodity decreases as a function of a delay in its delivery. However, the BART refers to risk-taking on a continuum in which risk is problematic only after a certain point, and that point varies across different trials. In other words, delay discounting depends on time delay, whereas risk-taking depends on a certain threshold to be crossed. It is difficult to extrapolate from these tasks to real life, but it is plausible that taking risks until a certain point may be advantageous for some situations, but the inability to delay gratification over a period of time may not.

Finally, the sensitivity to social rejection or interpersonal sensitivity in the high POGQ group indicated one of the consequences of IGD that is social isolation and impairment in interpersonal relationships. These two constructs describe a cognitive–affective worry of rejection, which can impair well-being and interpersonal function. They can result in avoidant personality disorder, social anxiety disorder, or borderline personality disorder (Downey & Feldman, 1996). Although people often report that the Internet connects them socially and enables communication, it also paradoxically reduces individual involvement in social relations and may lead into isolation and lack of social contact (Davis et al., 2002; Weinstein, Dorani, et al., 2015). Individuals lacking social skills who are being exposed to the Internet develop IGD that results in lack of face-to-face interactions (Caplan, 2002, 2003; Davis, 2001; Davis et al., 2002). Caplan (2003) has found that some people find online interaction to be safer, more efficient, and more convenient than real-life interaction, and this can be liberated to individuals who are socially inhibited. That in turn makes it harder for them to develop relationships outside the computer environment (Davis et al, 2002). Others argued that Internet and video games are acceptable means for social activity (Brus, 2013).

Studies showed that those who are addicted to the Internet spend more time playing multiplayer games rather than using other means for communication, such as email or social networks (Young, 1998). IGD results in behavioral and social problems as well as problems in academic achievements (Morahan-Martin & Schumacher, 2000; Scherer, 1997; Young, 1998). The higher scores of rejection sensitivity among the IGD group support the evidence so far the participants with IGD find Internet and video games as an escape from daily life into a virtual reality in which they control their social interactions that might lead to social rejection they fear most. Responses to social rejection include hostility, depression, emotional regression, and jealousy and on the hand over politeness. These responses are also typical of various psychiatric conditions, such as avoidant personality disorder, social anxiety, and borderline personality disorder (Downey & Feldman, 1996). Rejection sensitivity has also been shown to predict the course and outcome of depression. Greater interpersonal sensitivity is associated with more depressive symptoms (Ayduk et al., 2001; Downey & Feldman, 1996), greater severity and duration of current major depressive episodes (Posternak & Zimmerman, 2001), increased propensity toward depression over time (Boyce, Parker, Barnett, Cooney, & Smith, 1991), and among people with clinical depression, decreased likelihood of being clinically remitted at 1-year follow-up (Boyce et al, 1992). Recent studies have found that increased rejection sensitivity during depressive episodes was linked to increased physical pain in both unipolar and bipolar depressions (Ehnvall et al., 2011; Ehnvall, Mitchell, Hadzi-Pavlovic, Malhi, & Parker, 2009). Finally, people with bipolar I disorder reported higher rejection sensitivity scores than the control participants (Ng & Johnson, 2013). Within the bipolar sample, rejection sensitivity at baseline predicted increased depression but not mania, over the following 6 months; heightened rejection sensitivity was also correlated with poorer quality of life, social support, and psychological well-being.

Limitations

This study had several limitations including a relatively small sample of participants. Furthermore, participants were divided into IGD and non-IGD groups based on questionnaire ratings rather than placing the participants on a spectrum of Internet and video game addictions which may include those who are at risk for developing IGD. Finally, the participants knew that the tasks are only games and did not get monetary reward that would influence their decisions.

CONCLUSIONS

The results of this study demonstrated that individuals with a high score of measure of IGD display risk-taking, delay discounting and high measures of sensitivity to social rejection. These findings support the argument that IGD results in faulty decision-making and preference for short-term gains at the cost of long-term gains resulting from academic and social activities. The novelty of the study is using two different paradigms that assess two components of impulsivity – risk-taking and delay discounting, in individuals with high and low IGD together with a measure of rejection sensitivity. The clinical implication of the study is that IGD results in dysfunctional decision-making process and social–emotional interaction indicated by high rejection sensitivity. Favoring risk-taking and short-term gains together with rejection sensitivity is detrimental to long-term academic, work, and social life achievements and may result in propensity to have conduct disorders, drug and alcohol addiction, and mood disorders. It is difficult to determine whether individuals who are drawn into IGD have higher traits of risk-taking, delay discounting, and rejection sensitivity or that excessive playing of these games causes or enhances such traits. Perhaps a longitudinal study could answer these issues of causality.

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Authors' contribution: All individuals included as the authors of the paper have substantially contributed to the scientific process leading up to the writing of the paper. The authors have also contributed to the conception and design of the project, performance of the experiments, analysis and interpretation of the results, and preparing the manuscript for publication.

Conflict of interest: The authors have no interests or activities that might be seen as influencing the research (e.g., financial interests in a test or procedure and funding by pharmaceutical companies for research).

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