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Investigation of impulsivity in a sample of treatment-seeking pathological gamblers: A multidimensional perspective

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A R T I C L E   I N F O
Article history:
Received 25 March 2011
Received in revised form 10 November 2011
Accepted 2 January 2012

Keywords:
Pathological gambling
Problem gambling
Impulsivity
Inhibition
UPPS Impulsive Behaviour Scale
Emotion

A B S T R A C T
Numerous studies have shown that problem gambling is characterised by lack of impulse control. However, they have often been conducted without considering the multifaceted nature of impulsivity and related psychological mechanisms. The current study aims to disentangle which impulsivity facets are altered in pathological gambling. Twenty treatment-seeking pathological gamblers (PGs) and 20 matched control participants completed a self-reported questionnaire measuring the various facets of impulsive behaviours (UPPS Impulsive Behaviour Scale), as well as two laboratory tasks assessing inhibitory control (the go-stop task) and tolerance for delayed rewards (single key impulsivity paradigm). Compared with matched controls, PGs exhibited higher urgency, lower premeditation, impairment in prepotent inhibition, and lower tolerance towards delayed rewards. Nevertheless, complementary profile analyses showed that impulsivity-related deficits found in PGs are highly heterogeneous, and that some PGs are neither impulsive in the impulsivity facets assessed nor impaired in the cognitive mechanisms measured. These findings underscore (1) the necessity to disentangle the construct of impulsivity into lower-order components and (2) that further studies should take into account, in addition to impulsivity-related mechanisms, other psychological factors potentially involved in pathological gambling.

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1. Introduction

When included in the third edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-III) (American Psychiatric Association, 1980), pathological gambling was defined as an impulse control disorder. Pathological gambling involves an inability to resist overwhelming and irrational gambling-related drives, resulting in adverse consequences in daily life (Raylu and Oei, 2002). The nosography of pathological gambling has been debated, mainly because of its high comorbidity with substance use disorders (Petry et al., 2005). Nowadays, pathological gambling is increasingly considered as part of an addictive spectrum sharing the same underlying risk factors as those of substance addictions (Goodman, 2008). As a consequence, a growing number of studies are being conducted to determine whether established risk factors for substance addictions are also involved in the aetiology of pathological gambling. Both the early conceptualization of pathological gambling as an impulse control disorder and its affiliation with a broader addictive disorder spectrum have contributed to the emergence of studies investigating the role of impulsivity in the aetiology, maintenance, and relapse of pathological gambling (Blaszczynski and Nower, 2002; Goudriaan et al., 2004; Nower and Blaszczynski, 2006). The great majority of these studies found that pathological gamblers (PGs) have higher levels of impulsivity than control participants (Blaszczynski et al., 1997; Steel and Blaszczynski, 1998; Kim and Grant, 2001; Petry, 2001b; Potenza et al., 2003; Fuentes et al., 2006; Forbush et al., 2008). Impulsivity was also highlighted as a predictor of the severity of pathological gambling symptoms (Moore and Ohtsuka, 1997; Vitaro et al., 1999; Lightsey and Hulsey, 2002; Krueger et al., 2005; Slutske et al., 2005; Mackillop et al., 2006). Crucially, impulsivity in PGs is related to a poor prognosis, as reflected by higher dropout ratios (Leblond et al., 2003) and a global lower likelihood of success in psychological treatments (MacCallum et al., 2007). Some studies, however, found no difference in impulsivity traits between PGs and matched control participants (Langewisch and Frisch, 1998; Lejoyeux et al., 1998).

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Despite having established a clear relationship between pathological gambling and high impulsivity levels, these studies bring about limited comprehension of the psychological mechanisms involved, as they have been too often conducted without considering the multifaceted nature of impulsivity. Indeed, it is now established that impulsivity encompasses a combination of multiple and separable psychological dimensions (Evenden, 1999; Ettinott and Ogloff, 2006). Whiteside and Lynam (2001) clarified the multidimensionality of impulsivity by subdividing it into four dimensions, which are related but also independent. These four dimensions are defined as follows: urgency, the tendency to act rashly when experiencing negative affect (e.g., individuals with high urgency often engage in behaviours they later regret when they are upset or in a bad mood, whereas individuals with low urgency tend to keep calm in these situations); premaditation, the tendency to take into account the consequences of an act before engaging in that act (e.g., individuals with low premaditation generally do not consider all of the advantages and inconveniences before acting, in contrast to individuals with high premaditation who are more careful and purposeful); perseverance, the capacity to remain focused on a boring and/or difficult task (e.g., individuals with low perseverance often procrastinate and give up tasks, in contrast to individuals with high perseverance who generally finish what they start); and sensation seeking, the tendency to enjoy and pursue new and exciting activities (e.g., individuals with high sensation seeking often engage in potentially risky activities such as extreme sports, in contrast to individuals with low sensation seeking who do not like these types of activities). Notably, a growing number of studies have highlighted specific links between these impulsivity facets and various dimensions of problematic behaviours and/or psychopathological states (Miller et al., 2003; Billeux et al., 2007, 2008; Smith et al., 2007; Verdejo-Garcia et al., 2007). With regard to problem gambling, a few studies conducted on gamblers from the community (non-clinical participants) have shown that adverse consequences resulting from gambling (e.g., financial problems, changing behaviours) are predicted by high urgency and low premaditation, whereas high sensation seeking predicts only gambling frequency (Smith et al., 2007; Cyders and Smith, 2008). The last impulsivity factor, namely, lack of perseverance, has not yet been shown to be related to problem gambling.

The urgency and lack of premaditation components of impulsivity, which seem to play a role in problem gambling, have been related to specific cognitive mechanisms (Bechara and Van der Linden, 2005). First, recent data suggested that urgency is at least partly underlain by poor prepotent response inhibition (Gay et al., 2008; Billeux et al., 2010). In these studies, inhibition capacities were assessed with laboratory tasks measuring the ability to refrain or interrupt a motor response that was activated beforehand (go/no-go or stop-signal paradigms) (Verbruggen and Logan, 2008). Crucially, a growing number of studies found prepotent inhibition to be impaired in PGs (Goudriaan et al., 2005, 2006; Fuentes et al., 2006; Kertzman et al., 2008; Roca et al., 2008), and poor inhibition was highlighted as a predictor of relapse in pathological gambling (Goudriaan et al., 2008). Despite almost all published studies found inhibition impairment in PGs, some PGs have also been shown to have inhibition capacities that were comparable to (and sometimes even better than) those of matched controls (Carlton and Manowitz, 1992).

Second, lack of premaditation has been shown to be related to difficulty in balancing immediate benefits with future ones (Lynam and Miller, 2004). More precisely, low premaditators were shown to make less advantageous choices than high premaditators in a “delay discounting” procedure in which they had to choose between a small amount of fake money that was immediately available or a much higher amount of fake money that was delayed. Of note, some studies conducted with delay discounting tasks found that PGs are characterised by similar short-term-based choices (Petry, 2001a; Alessi and Petry, 2003). Although the urgency and lack of premaditation facets of impulsivity rely on specific cognitive processes, they also significantly correlate with each other (Whiteside and Lynam, 2001; Van der Linden et al., 2006), suggesting that they are not totally independent and may be at least partly underlain by shared psychological mechanisms.

The aims of the current study were twofold. First, we wanted to replicate previous findings regarding urgency and lack of premaditation in a sample of PGs rather than in community participants. Second, we sought to determine at the individual level whether heterogeneous “impulsivity profiles” could be highlighted among PGs. Indeed, from a multidimensional view of impulsivity, it can be supposed that the altered impulsivity components (and related psychological mechanisms) possibly diverge from one PG to another. Moreover, some studies have shown that PGs are not necessarily impulsive (Lejoeuex et al., 1998) or characterised by poor response inhibition (Carlton and Manowitz, 1992), implying that at least part of the PGs included in the study may not be impaired with regard to the measures used in the study. To investigate these topics, we conducted a study in which a group of treatment-seeking PGs (n = 20) and a matched group of control participants (n = 20) who do not gamble were compared for (1) impulsivity facets, (2) inhibitory control, and (3) delayed reward tolerance. We found it important to use both self-reported measures and laboratory tasks. Indeed, these two types of measures cannot be considered as isomorphic. More precisely, self-reported questionnaires generally assess broader constructs (the various items of the same dimension often refer to a wide range of situations) and are influenced by a certain bias (e.g., social desirability, lack of insight), whereas laboratory tasks sometimes lack ecological validity (the generalisation from the context of the laboratory to real-life situations).

2. Methods

2.1. Participants

Two groups participated in the study: a group of PGs (n = 20) and a group of control participants (n = 20). Demographic data are presented in Table 1.

The PGs were recruited from outpatients of a gambling addiction treatment centre in the psychiatric service of the Saint-Marguerite Hospital in Marseille, France. They were tested on their arrival in the centre and were thus free from any psychological treatment or psychoactive drugs. Each PG was diagnosed according to DSM-IV criteria and completed the French version of the South Oaks Gambling Screen (SOGS) (Lejoeux, 1999). The SOGS is a 16-item questionnaire based on the symptoms of pathological gambling in the third edition of the DSM. All PGs have a SOGS > 5, which is a common cut-off used to diagnose pathological gambling (Lesieur and Blume, 1987). Exclusion criteria were substance use

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*Comparisons significant at P < 0.05, corrected for multiple comparisons using the false discovery rate procedure. PGs: pathological gamblers; CPs: control participants; M: male; F: female; UPPS: UPPS Impulsive Behaviour Scale; Go-stop (SSRT): stop signal reaction time in the go-stop impulsivity paradigm; SKIP-delay: mean delay between two responses in the single key impulsivity paradigm.
disorder (except tobacco dependence) and any reported history of neurological disorders. Comorbidity screening, not used as an exclusion criterion, was assessed with the mini-IQ (Block et al., 1998) and the French version of the Mini-International Neuropsychiatric Interview (MINI) (Sheehan et al., 1998) and a deviance criterion at a threshold of 1.65 S.D. of the mean of the control group. In a fixed-effects model, all PGs and control participants were characterised by deviant scores on both UPPS facets and inhibition tasks for each PG, the proportions were as follows: UPPS-urgency, 45%; UPPS-lack of premeditation, 30%; UPPS-lack of perseverance, 45%; and a matched group of control participants. Compared with controls, PGs exhibited high urgency and low premeditation, and were found to be impaired in two tasks assessing inhibitory control and preference for immediate rewards. Nonetheless, complementary pro-

test scores were corrected for multiple comparisons between conditions (Cronbach’s alpha) = 0.79). The study protocol was approved by the human subject committee of the Sainte-

3. Results
3.1. Preliminary and descriptive analyses
Data for the stop-signal task are missing for one control participant because of technical problems. No other missing data were identified. The SSRT on the go-stop task and the mean delays on the SKIP were transformed by using natural logarithm to decrease the skewness of their distribution. Means and standard deviations for demographic and psychological variables, as well as for gambling-related information for the PG group (SOGS scores, number of different gambling activities practised, maximum expenditures in a single gambling session), are reported in Table 1. The reliability coefficients (Cronbach’s alpha) were high for the various impulsivity facets assessed, namely, urgency ($\alpha=0.84$), lack of premeditation ($\alpha=0.81$), lack of perseverance ($\alpha=0.83$), and sensation seeking ($\alpha=0.79$).

3.2. Comparisons between groups
We computed t-tests corrected for multiple comparisons between groups, as reported in Table 1. Concerning impulsivity facets, PGs were found to have higher levels of urgency (UPPS) and lower levels of premeditation (UPPS). Nevertheless, no significant difference took place between groups concerning the perseverance and sensation-seek- ing facets of impulsivity (UPPS). With regard to the go-stop task, PGs were characterised by a lower capacity than control participants for prepotent response inhibition. For the SKIP, PGs demonstrated a lower ability than control participants to delay a reward.

3.3. Individual profile analyses
Further analyses were then performed to identify, at the individual level, which impulsivity facets and inhibitory functions were deviant in PGs in comparison with the data obtained from control participants. These analyses revealed that the impairments (and their associations) were highly heterogeneous among PGs. More precisely, the proportions of PGs characterised by deviant scores were as follows: UPPS-urgency, 15%; UPPS-lack of premeditation, 45%; UPPS-lack of perseverance, 30%; UPPS-sensation seeking, 5%; go-stop inhibition task, 40%; and SKIP inhibition task, 30%. When considering the number of deviant scores on both UPPS facets and inhibition tasks for each PG, the proportions were as follows: none, 30% of the PGs; one, 20%; two, 20%; three, 20%; four, 5%; and five, 5%. The individual profiles obtained for all PGs included in the study are reported in Table 2.

4. Discussion
In the current study, we investigated impulsivity facets and related psychological mechanisms in a sample of treatment-seeking PGs and a matched group of control participants. Compared with controls, PGs exhibited high urgency and low premeditation, and were found to be impaired in two tasks assessing inhibitory control and preference for immediate rewards. Nonetheless, complementary profile analyses showed that impulsivity-related impairments found in PGs are highly heterogeneous.

The current study primarily confirms, in a clinical sample of PGs, previous findings obtained for a community sample of gamblers.
From this perspective, and in according a seeking stimulation, or for more idiosyncratic purposes such as improving immediate rewards are displayed when a gambler is not able to refrain ing. Thus, we argue that diminished impulse control and preference for pathological gambling, both inhibition impairment and poor ability to delay discounting capacities (Petry, 2001a; Alessi and Petry, 2002). The present results eventually empha the dance with the explanations outlined earlier, we postulated that in pathological gambling, both inhibition impairment and poor ability to postpone reward seeking contribute to short-term-based decision making. Thus, we argue that diminished impulse control and preference for immediate rewards are displayed when a gambler is not able to refrain from gambling (for a variety of reasons, such as regulating affect or seeking stimulation, or for more idiosyncratic purposes such as improving a financial situation) in order to shift from pursuing this behaviour to another one that is not maladaptive in the long term.

Another important finding of the current study is the heterogeneity of the deficits presented by the PGs. Indeed, individual profile analyses demonstrated, on the one hand, that the impairments found are either relatively specific (i.e., restricted to certain components of impulsivity) or are representative of a more global self-control impairment, and, on the other hand, that some PGs included in the study (30%) have no or are prone to gambling-related cognitive distortions (e.g., Blassczynski and Nower, 2002). The present results eventually emphasised that the current nosography of pathological gambling as an impulse control disorder is unsatisfactory, as some of the persons with this diagnosis are not impulsive. From a clinical point of view, the diversity of impulsivity-related impairments highlighted herein supports the development of personalised (custom-made) interventions targeting specific psychological mechanisms. For example, a PG presenting a high level of urgency and inhibition impairment, but whose other facets of impulsivity are not altered, could benefit from a psychological intervention designed to improve emotion regulation strategies and to increase inhibition capacities (see Fries et al., 2011, for techniques devoted to improvement of self-control abilities).

No significant difference was found between the sensation seeking level of PGs and that of control participants (and only one PG was characterised by excessive sensation seeking based on individual profile analysis). This observation adds to the debate surrounding the role of sensation seeking in problematic gambling. Indeed, published results on this topic are inconsistent: some emphasised a high level of sensation seeking in PGs, whereas others found no difference in sensation seeking between PGs and matched controls. Of note, a few studies highlighted a lower level of sensation seeking in PGs (see Hammelstein, 2004, for a review about the role of sensation seeking and gambling). In fact, growing evidence supports sensation seeking as relying more on actual gambling (e.g., frequency of gambling, preferences for certain types of games; Bonnaire et al., 2006; Smith et al., 2007) than on problematic gambling. It can thus be supposed that in PGs with high sensation seeking, the main cause of the problems is not the degree to which they look for exciting activities, but rather their inability to prevent excessive gambling as a way to satisfy their search for exciting sensations.

In conclusion, PGs exhibit alterations in specific impulsivity facets (urgency, lack of premeditation) and related cognitive mechanisms (inhibition, delayed reward tolerance), which underscores the necessity of disentangling the construct of impulsivity into lower-order components. Nevertheless, the heterogeneity of impulsivity-related impairments in PGs also implies that further studies should take into account other psychological factors involved in pathological gambling (e.g., cognitive distortions, gambling motives).

**Contributors**

Joël Billieux participated in the statistical analyses and their interpretations, and wrote the manuscript. Guillaume Lagrange carried out the data acquisition for both the PGs and control participants. Martial Van der Linden contributed to the interpretations of the results, as well as the editing and review of the final manuscript. Marc Adida assisted in the computer implementation of the behavioural tasks and participated in the preliminary statistical treatment of the data. Christophe Lançon contributed to the design of the clinical aspects of
the study as well as assisted in the recruitment of PGs. Régine Jea
ninson—gros provided the design of the study and managed the experimental data acquisition.

Acknowledgment

Funding for this study was provided by the National Center of Scientific Research (CNRS – French government).

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