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Impaired Self-Awareness in Pathological Gamblers

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Abstract Lack of self-awareness of one's decisions remains an understudied and elusive topic in the addiction literature. The present study aimed at taking a first step towards addressing this difficult subject through the use of a combination of behavioral procedures. Here, we explored the association between a metacognitive process (the ability to reflect and evaluate the awareness of one's own decision) and poor performance on the Iowa Gambling Task (IGT) in a group of pathological gamblers (PG; $n = 30$), and in a comparison group ($n = 35$). This metacognitive process was assessed during the IGT with the post-decision wagering procedure, while a number of potential confounds (i.e., reward/loss sensitivity, dual-tasking) were controlled for. Results showed that: (1) Initial performance enhancement of the control group on IGT occurred without explicit knowledge of the task, thus confirming its implicit character; (2) compared to controls, performance of PG on the IGT failed to increase during the task; (3) taking into account increased reward sensitivity and decreased loss sensitivity as well as poorer dual-tasking in pathological gamblers, PG tended to exhibit a bias in evaluating their own performance on the IGT by maximizing their wagers independently of selecting advantageous decks. Our findings suggest that biased metacognition may affect pathological gamblers, leading to disadvantageous post-decision wagering, which is in turn linked to impaired decision making under ambiguity. Perhaps this deficit reflects the impaired insight and self-awareness that many addicts suffer from, thus providing a novel approach for capturing and measuring this impairment, and for investigating its possible causes.

Keywords Pathological gambling · Decision-making · Uncertainty · Insight

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Introduction

One of the key hallmarks of addiction is the lack of insight or self-awareness of the affected individual that he or she has a problem, and the poor sense that the course of actions that they are taking in life is destructive and no longer advantageous (Goldstein et al. 2008). Despite the significance and prominence of such a problem in the clinical evaluation and treatment of the patient, understanding the neuropsychological mechanisms of this metacognitive process has received very little attention in studies of addiction (Goldstein et al. 2008). A potential difficulty with studying metacognitive processes in addicted individuals is the confounding effect of chemical substances that could alter the brain in many non-specific ways. However, Grant and Potenza (2005) have been one of the earliest voices who argued that perhaps one of the best approaches to understand addiction, without the confounds of chemical substances, is to study individuals with gambling addiction who are not necessarily addicted to substances. For this reason we chose to study pathological gamblers who were not addicted to substances.

Addiction to gambling reflects impaired decision-making since the addicted gamblers make the decision to gamble again and again instead of stopping or at least cutting down after suffering a series of negative consequences associated with money loss (APA 1994). According to Bechara (2003), addicted gamblers show "myopia for the future" where their behaviour becomes primarily guided by the potential of a short-term gain, at the expense of serious downfalls in the long-term.

Decision-making in pathological gambling has been essentially explored through different laboratory tasks that mimic real-life decisions (Goudriaan et al. 2004; van Holst et al. 2010). For instance, on the Iowa Gambling Task (IGT; Bechara et al. 1994), while healthy participants tend to gradually enhance their performance by making more advantageous choices while playing the task, a high proportion of problem gamblers (Lakey et al. 2007) and of pathological gamblers (PG) with (Cavedini et al. 2002; Petry 2001) or without (Lakey et al. 2007; Goudriaan et al. 2005, 2006; Roca et al. 2008) co-morbid substance abuse perform poorly on the IGT—they make choices that bring immediate reward but that ultimately result in severe delayed punishment. Other co-morbidities could also cause impairments on pathological gamblers' decision-making processes. For instance, it has been reported that ADHD, depression and anxiety, which are frequently associated with gambling addiction (e.g., Kerber et al. 2008), could alter performance on the IGT (ADHD: e.g., Bubier and Drabick 2008; depression: e.g., Cella et al. 2010; anxiety: e.g., Mueller et al. 2010). In this study, potential confounding effects of ADHD, anxiety and depression on decision-making were controlled. Poor decision-making by PG during the IGT was also associated with lower anticipatory skin conductance responses and with heart rate decrease prior to choices of disadvantageous card decks (Goudriaan et al. 2006). Besides, an absence of heart rate increase after wins suggests that reward sensitivity is decreased in PG (Goudriaan et al. 2006).

Though these previous studies have provided significant findings that advanced our understanding of some of the underlying neurocognitive processes behind gambling behaviour, here, we aimed at investigating how introspective or "metacognitive" sensitivity may influence gamblers' decision-making during the IGT. In this context, metacognitive sensitivity refers to one's ability to be cognizant and have insight about the quality of their decision, and to accurately judge whether the decision is surely a good one or not (Persaud et al. 2007; Fleming et al. 2010; Cleeremans et al. 2007). According to behavioural economics research (Kahneman et al. 1982), intuitive predictions and judgments under conditions of uncertainty are often mediated by judgment heuristics that sometimes result in biases. For instance, Cassotti and Moutier (2010) observed that poor performance on the IGT was associated with a high sensitivity to reasoning bias. Regarding pathological gambling, several studies (Lakey et al. 2007; Goodie 2005) have shown that frequent gamblers tend to be overconfident and to exhibit more risk-taking behaviors prior to making what are considered as wrong choices. Furthermore, it has been shown that gamblers, and in particular pathological gamblers, are prone to erroneously hold the belief that he or she can exert some control over the events that the bets are placed on (Breen and Frank 1993; Toneatto 1999). These findings led us to hypothesize that metacognitive impairments could be associated with poor decision making during the IGT.

One way of assessing metacognition during the IGT consists of using the post-decision wagering (PDW) procedure recently introduced (Persaud et al. 2007). By this method, participants are required to make a wager of either 10 euros or 20 euros of imaginary money after deck selection during the IGT. On each trial, the win or the loss is expressed as a multiple of the chosen wager. Consequently, advantageous wagering is defined as either a wager of 20 euros after having chosen an advantageous deck (low wins but low losses) or a wager of 10 euros after having chosen a disadvantageous deck (high wins but high losses).

PDW was initially introduced with healthy participants as an objective measure of participant's awareness of IGT's rules. Persaud et al. (2007) showed that, between the onset of positive deck selection and advantageous wagering, normal control participants showed a preference for the positive decks but failed to maximize their earnings by placing the maximum wagers. These authors took this pattern of performance as indicating a lack of awareness that participants had chosen positive decks (for if participant has been aware of their strategy, they would have consistently wagered 20 euros after selecting a positive deck).

However, PDW, as objective measure of awareness, has been challenged. Indeed, PDW could be significantly influenced by sensitivity to loss and reward (Fleming and Dolan 2010; Schurger and Sher 2008). The feedback sensitivity could impact post-decision wagering performance by modulating the link between the assessment of sensory evidence (i.e., potential loss and reward) and subjective confidence (Schurger and Sher 2008). Since reward and punishment sensitivity are also known as risk factors in the development of gambling addiction (Goudriaan et al. 2006; Petry 2001), the effect in these psychological constructs on PDW was controlled in the present study.

In summary, our main goal was to explore in pathological gamblers the nature of the metacognitive capacities involved in decision-making under uncertainty (IGT) with post-decision wagering. We present two primary hypotheses: First, control participants would show a preference for the positive decks before maximizing their earnings by placing the maximum wager. Second, pathological gamblers would exhibit more pronounced impaired making-decision processes than controls because they tend to overestimate their performance regardless their sensitivity to loss and reward.

Methods

Participants

Two groups participated in the study: a PG group ($n = 30$) and a normal control group ($n = 35$). All participants were adults (>18 years old) and provided informed consent that was approved by the appropriate human participant committees at the Brugmann University Hospital. The demographic data of the two groups are presented in Table 1.

Table 1 Mean and standard deviations for demographics and current clinical status in pathological gambling (PG) and normal control (CONT) groups

	Normal control	Pathological gamblers	Test statistics	Bonferroni-corrected pairwise comparisons
n	35	30		
Age (SD)	44.14(11.01)	39.93(11.35)	$F(1, 64) = 2.60$, $P = 0.11$	Control = Gambler
Male/Female	29/6	27/3	$\chi^2(1, 64) = 0.41$, $P = 0.49$	Control = Gambler
WAIS VOC	44.34(6.21)	43.37(7.21)	$F(1, 64) = 0.34$, $P = 0.56$	Control = Gambler
WAIS BLOC REP	15.26(2.12)	14.33(2.78)	$F(1, 64) = 2.89$, $P = 0.14$	Control = Gambler
WAIS BLOC TR	19.91(5.99)	22.75(5.54)	$F(1, 64) = 3.82$, $P = 0.06$	Control = Gambler
Ospan	0.79(0.13)	0.66(0.19)	$F(1, 64) = 10{,}47$, $P = 0.002$	Control > Gamblers
ASRS	7.63(3.02)	12.47(4.03)	$F(1, 64) = 27{,}60$, $P < 0.001$	Control < Gamblers
BDI	2.33(2.47)	11,73(5,45)	$F(1, 64) = 81{,}04$, $P < 0.001$	Control < Gamblers
STAI-E	31.20(9.86)	44,97(14,39)	$F(1, 64) = 20.69$, $P < 0.001$	Control < Gamblers
STAI-T	36.38(7.79)	50.34(9.54)	$F(1, 64) = 40.90$, $P < 0.001$	Control < Gamblers
SOGS	0.00	9.16(3.38)		
BIS	18.15(3.20)	19.93(3.06)	$F(1, 64) = 5.44$, $P < 0.043$	CONT < PG
BAS	36.59(3.31)	38.07(7.81)	$F(1, 64) = 0.85$, $P = 0.36$	CONT = PG
BAS drive	11.00(2.20)	11.16(3.20)	$F(1, 64) = 0.60$, $P = 0.81$	CONT = PG
BAS fun seeking	10.00(1.95)	11.25(1.98)	$F(1, 64) = 6.28$, $P = 0.034$	CONT < PG
BAS reward	15.58(2.15)	15.93(3.43)	$F(2, 98) = 1.14$, $P = 0.32$	CONT = PG

Values shown are the mean and standard deviations on each measure. The South Oaks Gambling Screen was administered only in the PG groups. *WAIS VOC* WAIS vocabulary, *WAIS BLOC REP* WAIS block design correct responses, *WAIS BLOC TR* WAIS bloc design reaction time, *Ospan* Operation span task, *ADHD* attention deficit hyperactivity disorder, *BDI* Beck Depression Inventory, *STAI-E* state version of the state-trait anxiety inventory, *STAI-T* Trait version of the State-Trait Anxiety Inventory, *SOGS* South Oaks Gambling Screen

Recruitment and Screening Methods

The PG group was recruited from the Dostoïevski Clinic of Gambling Addiction, Brugmann Hospital, Université Libre de Bruxelles (ULB), Brussels, Belgium. Participants had to meet *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; *DSM–IV*; APA 1994) criteria for gambling dependence (administered by a board-certified therapist). Furthermore, a French version of the South Oaks Gambling Screen (SOGS; Lesieur and Blume 1987) was administered to obtain a sensitive measure of gambling severity (Strong et al. 2003). Control participants were recruited by word of mouth from the community.

Exclusion criteria for the PG group included current co-morbid disorders on the basis of *DSM–IV* Axis I diagnoses, a history of significant medical illness, head injury resulting in a loss of consciousness for longer than 30 min that might have affected the central nervous system, use of other psychotropic drugs or substances that influence cognition, and overt cognitive dysfunction (participants had to score ≥25 on the Mini Mental State Examination; Folstein et al. 1975).

We excluded any control subject who met an Axis I psychiatric diagnosis assessed by the Structured Clinical Interview for *DSM–IV* (First et al. 2002), who had experienced a drug use disorder during the year before enrolment in the study, or who had consumed more than 54 g/day of alcohol for longer than 1 month. On the basis of the results of their medical history and physical examination, they were judged to be medically healthy. Participants were asked to avoid the use of drugs, including narcotic pain medication, for the 5 days prior to testing and to avoid alcohol consumption for the preceding 24 h.

Current Clinical Status

Current clinical status was rated with the Beck Depression Inventory (BDI; Beck et al. 1961) the Adult ADHD Self-Report Scale (ASRS-v1.1; Kessler et al. 2005) and the Spielberger State–Trait Anxiety Inventory (STAI; Spielberger 1983).

Intelligence and working memory were also examined in order to obtain an estimation of neuropsychological functioning. We assessed intelligence with two subtests of the WAIS, block design and vocabulary (Wechsler 2000). This short form of the WAIS correlates with the full scale WAIS IQ in the 0.90 range (Groth-Marnat 1997). Working memory was assessed with the Operation-span Task (Ospan; Engle et al. 1992; Turner and Engle 1989). In the Ospan, subjects are requested to solve mathematical operations while simultaneously remembering a set of unrelated words. The Ospan score was calculated according to the partial credit unit scoring procedure (PCU; Conway et al. 2005).

The French version of the BIS/BAS self-report scale (Carver and White 1994) was administered as a measure of sensitivity to loss and reward. This scale measures affective responses to impending rewards (BAS) or punishments (BIS) and contains 20 items with a four-point Likert scale ranging from “strongly agree” to “strongly disagree”. The BAS items are divided in three subcategories: BAS drive (4 items; e.g., “If I see a chance to get something I want, I move on it right away”), BAS rewards sensitivity (5 items; e.g., “When good things happen to me, it affects me strongly”), and BAS fun seeking (4 items: e.g., “I’m always willing to try something new if I think it will be fun”). The BIS subscale (7 items; e.g., “Once I start a project, I almost always finish it”) has no subcategories and measures punishment sensitivity.

The Iowa Gambling Task with Post-Decision Wagering

We used the procedure described by Persaud et al. (2007), where participants sat in front of four decks of cards that were identical in appearance, except for their labels A, B, C and D. They were told that the game involved a long series of deck selections and wagers and that the goal was to earn as much money as possible. Participants were informed that each trial would consist of (1) a deck selection, (2) a wager of either €10 or €20 of pretend money and (3) the turning over of one card from the selected deck to reveal the yield as a multiple of the wager. Participants were informed that they were free to switch between decks at any time, and as often as desired. Every deck included both losses and wins. The net outcome of choosing from either decks A or B (referred to as advantageous decks) was a gain of five times the average wager per ten cards and the net outcome of choosing from either decks C or D (referred to as disadvantageous decks) was a loss of five times the average wager per ten cards. The total number of trials was set to be 100 card selections. The dependent measure for advantageous choices was the number of cards picked from the advantageous decks in each block of 20 cards. Advantageous wagering was defined as either a wager of €20 after choosing a positive deck or a wager of €10 after choosing a negative deck. Advantageous wagers were summed across each block of 20 trials.

Procedure

Participants were tested individually in a quiet room, located in the Medical Psychology Laboratory, Brugmann Hospital. Participants performed the IGT wagering first. They then filled out self-reported measures and performed IQ level and working memory estimations. The succession between BDI, STAI-S, STAI-T, ASRS-v1.1, WAIS block design, WAIS vocabulary and the OSPAN task was counterbalanced. No significant correlations between administration order and performance on self-reported measure, IQ level and working memory estimations were observed. Participants received €15 for their participation and were not paid according to their performance on the IGT.

Statistical Analyses

One–way analysis of variance (ANOVAs) was performed on demographic data, current clinical status measures, Ospan task performance and BIS/BAS scores. Chi-square analyses were undertaken to examine sex distribution.

ANOVAs with repeated measurements were undertaken to detect overall group differences or group by factor interactions in the profile of the IGT performance. Specifically, a repeated measures ANOVA was performed, with group as a between-subjects factor; block (5 blocks of 20 trials) and type of choice (deck selection versus post-decision wagering) as within subjects factors; and the net score of advantageous choice (choice of deck A or B for deck selection; wagers of €10 for decks C and D & wagers of €20 for decks A and B for post-decision wagering), as the dependent measure.

The significance level was fixed at $P \leq 0.05$ throughout the paper. Results were corrected for multiplicity using Bonferroni correction.

Results

Demographics, Current Clinical Status

A description of demographic variables, working memory (Ospan), estimated IQ, ADHD (ASRS), depression (BDI) and State-Trait (STAI-S; STAI-T), is presented in Table 1.

ANOVA revealed that PG and control groups were similar in terms of age and estimated IQ, as measured by the Block Design and Vocabulary subtests of the Wechsler Adult Intelligence Test. Chi square analyses revealed no differences in the distribution of male and female participants. Compared to PG, control participants had a higher score on the Ospan, $F(1, 64) = 10{,}47$, $P = 0.002$. ANOVA revealed that the PG group had a higher score of ADHD compared to controls, $F(1, 64) = 27{,}60$, $P < 0.001$. Depression was higher, $F(1, 64) = 81{,}04$, $P < 0.001$, in PG than in controls. State and Trait Anxiety were higher in the PG group compared to the control group, $F(1, 64) = 20.69$, $P < 0.001$; $F(1, 64) = 40.90$, $P < 0.001$, respectively. Finally, we observed that PG scored higher than controls on the BIS and the BAS fun seeking scales, $F(1, 64) = 5.44$, $P = 0.043$; $F(1, 64) = 6.28$, $P = 0.034$, respectively. Importantly, comparisons between PG and CONT on IGT wagering performances remained statistically significant when potentially confounding variables (working memory, ADHD, depression, trait and state anxiety and sensitivity to loss and reward) were individually entered as covariate into the statistical model.

IGT Decision-Making Performance

A repeated measures ANOVA was performed, with group as a between-subjects factor; block (5 blocks of 20 trials) and type of choice (deck selection versus post-decision wagering) as within subjects factors; and the net score of advantageous choice (choice of deck A or B for deck selection; wagers of €10 for decks C and D & wagers of €20 for decks A and B for post-decision wagering), as the dependent measure. This analysis revealed an effect of block, $F(4, 61) = 4.53$, $P = 0.02$, $\eta^2 = 0.07$, indicating that task performance increased over time. There was a Group X Type of choice interaction, $F(4, 61) = 7.34$, $P = 0.009$, $\eta^2 = 0.11$, indicating that control participants performed better than gamblers on the total number of advantageous deck selections (Control: $M = 12.05$, $SD = 4.01$; PG: $M = 8.88$, $SD = 4.26$, $t(64) = 3.75$, $P < 0.001$) but not on advantageous post-decision wagering (Control: $M = 10.75$, $SD = 5.32$; PG: $M = 9.85$, $SD = 4.67$, $t < 1$). More importantly, the repeated measures ANOVA yielded a significant interaction between Block, Type of choice, and Group, $F(4, 61) = 2.68$, $P = 0.032$, $\eta^2 = 0.04$ (see Fig. 1). To further explore the three-way interaction, we performed separate analyses for the two groups.

Control Group

There was a main effect for Block, $F(1, 34) = 5.26$, $P < 0.001$, $\eta^2 = 0.15$, reflecting the fact that task performance increased over time; a main effect for Type of choice, $F(1, 34) = 4.34$, $P < 0.001$, $\eta^2 = 0.12$; and an interaction between Block and Type of choice, $F(4, 31) = 2.44$, $P < 0.048$, $\eta^2 = 0.08$, revealing that control participants exhibit higher performance on advantageous deck selection compared to advantageous post-decision wagering for blocks 3, $F(1, 34) = 9.08$, $P = 0.006$, $\eta^2 = 0.23$, but not for the others blocks, $F < 1$. This indicates that between the onset of positive deck selection and advantageous wagering, controls showed a preference for the positive decks but did not maximize their earnings by placing the maximum wager. According to Persaud et al. (2007), these results indicate, amongst control participants, a lack of awareness that they

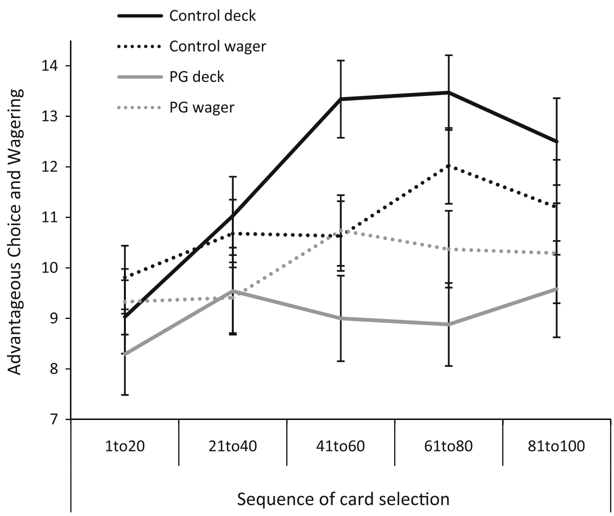

Fig. 1 Means of the total number of cards selected from the advantageous decks and total number of advantageous wagers for each block of 20 card choices on the Iowa Gambling Task by pathological gamblers (PG) and control participants. Error bars are the standard errors of the mean

had chosen positive decks during stage three of the IGT. At the end of the experiment (blocks four and five), controls tended to select from the positive decks and to wager high, consistent with awareness of their decisions.

PG Group

There was no main effect of Block, $F < 1$. However, we observed a main effect for Type of choice, $F(1, 34) = 3.57$, $P < 0.043$, $\eta^2 = 0.11$, indicating that PG participants scored higher on the total number of advantageous wagering ($M = 9.85$, SD $= 4.67$) compared to advantageous deck selection, $M = 8.88$, SD $= 4.25$.

Additional Analyses

By taking into account that PG selected more disadvantageous decks than controls, the finding that PG participants have a higher total number of advantageous wagering compared to advantageous deck selection could be due to a high level of €10 wagers selection after picking decks C and D. Consequently, as additional analyses, we performed a breakdown of the PDW results, in order to investigate whether PGs bet more heavily on the bad decks than the controls do, and whether the controls bet more heavily on the good decks as or than the PGs do, when the two groups respectively choose good and bad decks.

A repeated measures ANOVA was performed, with group as a between-subjects factor; block (5 blocks of 20 trials) and type of deck (decks A and B versus decks C and D) as a within subjects factors; and the percentage of €20 wagers, as the dependent measure. There was no main effect of type of deck and block, $F < 1$. There was a significant interaction between type of deck and group, $F(4, 61) = 4.10$, $P < 0.05$, $\eta^2 = 0.06$, indicating that the percentage €20 wagers is greater in PG compared to CONT on disadvantageous decks (CONT: $M = 48.05$, SD $= 18.73$; PG: $M = 63.08$; SD $= 14.97$), but not on advantageous decks (CONT: $M = 56.61$, SD $= 16.73$; PG: $M = 61.65$; SD $= 17.12$).

Discussion

In this study, we examined metacognition capacities in pathological gamblers through decision making under uncertainty, as measured by the (IGT). Metacognition was assessed by asking participants to wager on their own decisions (post-decision wagering; Persaud et al. 2007). Our main finding is that problem gamblers tend to wager high while performing poorly on the (IGT) and this difference was not due to reward/loss sensitivity, current clinical or cognitive status.

Consistent with other studies (Goudriaan et al. 2005; Goudriaan et al. 2006; Roca et al. 2008), pathological gamblers performed worse than controls by selecting more cards from the disadvantageous decks during the (IGT). Besides, as Fig. 1 shows, the difference between the two groups is even more striking insofar as wagering is concerned. While normal controls' wagering lags their performance, so reflecting conservative bets in the face of uncertain decisions, pathological gamblers systematically overshoot their performance, thus suggesting that their own assessment about the quality of their already poor decisions is itself impaired.

Overall our results suggest that pathological gamblers exhibit impairments not only in their ability to correctly assess risk in situations that involve ambiguity, but also in their ability to correctly express metacognitive judgments about their own performance. That is, pathological gamblers not only perform poorly, but they also erroneously think that they are performing much better than they actually are (see compatible results in PG's meta-cognitive judgments while making risky decision) (Goodie 2005; Lakey et al. 2007). This "double impairment" pattern of performance is important both for our understanding of the disorder exhibited by pathological gamblers, but also for our understanding a couple of important issues regarding addictive behaviors. On the one hand, our study provides a window for future studies concerning the issue of insight and self-awareness mentioned earlier (Goldstein et al. 2008). Our results also offer some understanding of the complex relationship between what could be called, from a signal-detection perspective, first-order performance (in this case, deck selection in the IGT) and second-order performance (in this case, the wagers placed by participants on their own decisions (Pasquali et al. 2010).

There are several limitations to the interpretations of the results of our study. First, the idea that PDW represent an objective measure of awareness has been recently challenged. Indeed, some studies (Fleming and Dolan 2010; Schurger and Sher 2008) have reported that PDW could be significantly influenced by sensitivity to loss and reward. However, we found no effect of either self-reported sensitivity to reward or loss on PDW. Nevertheless, there remains possible that biased cognitive processes uncontrolled in the present study might also modulate PDW performance. For instance, pathological gamblers might exhibit an "illusion of control" (Langer 1975), that is, they often think that they have control over the outcome of gambling, although the outcome is random (Myrseth et al. 2010). This illusion of control could have led PG to place high post-decision wagers on disadvantageous decks.

Second, we cannot rule out the possibility that advantageous wagering itself may be learned in the absence of awareness, that is, as an implicit skill, thus further questioning its use as a measure of awareness (Langer 1975).

Third, it would also seem helpful to replicate this study with a larger sample of gamblers which has both extreme ends of the spectrum of gambling dependence well represented, including healthy non-problem gamblers (e.g., usual lottery players) as well as problem and pathological gamblers not in treatment, in order to compare subgroups of gamblers that do not attempt to stop gambling. Moreover, while common comorbidities were tolerated in our sample, exclusion criteria would lead to a poorly representative sample of gamblers population. This restricts generalization of the current findings to the general population of gamblers.

Finally, performance on the IGT could be a function of a range of cognitive (e.g., reversal learning; Fellows and Farah 2005a) and emotional (e.g., apathy; Fellows and Farah 2005b) factors (for a review see, Dunn et al. 2006). Therefore, further studies are needed to disentangle these processes and also to assess their respective influence on the metacognitive level and vice versa.

In summary, PG exihbit a double abnormal pattern of decision making under uncertainty; (1) disadvantageous decks selection (2) impaired insight on this selection.

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