

Towards a Validation of the Three Pathways Model of Pathological Gambling

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Abstract With the aim of validating the three pathways hypothesis of pathological gambling (Blaszczynski and Nower in *Addiction* 97:487–499, 2002) 372 pathological gamblers meeting DSM IV (2000) criteria were assessed via a structured clinical interview as well as being subjected to personality tests and evaluation of their gambling practices. Our results show that it is possible to identify three subgroups corresponding to the three pathways: behaviourally conditioned problem gamblers, emotionally vulnerable problem gamblers and antisocial impulsivist problem gamblers. Our results particularly demonstrate that impulsivist gamblers preferentially choose semi-skilful gambling (horse racing and sports gambling) whereas emotionally vulnerable gamblers are significantly more attracted to games of chance (one-armed bandits, scratch cards, etc.) This led us to propose a functional presentation of the three pathways model which differs somewhat from the Blaszczynski and Nower presentation.

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Introduction

The recent classification of pathological gambling in the nosographic category of “substance-related and addictive disorders” (D.S.M.V 2013) is new and marks a return to a very old tradition: the passion for gambling was considered to be a disease in the sixteenth century (Nadeau and Valleur 2014), after amorous passion and before drunkenness and the various drug addictions. According to this ancient point of view addictions “with drugs” may only form a particular subgroup of these invasive passions, each of which asks both the question of the specific “toxicity” of the subject of addiction and that of individual vulnerability. Concerning gambling, factors concerning individuals are very important, since only a small proportion of “consumers” are affected, whereas it is a widespread activity in society as a whole.

Studies of the prevalence of pathological gambling in the general population certainly show a certain disparity according to country, from 0.2 % in Norway to 2.1 % in Australia (INSERM 2008; Shaffer and Hall 2001). But generally speaking, in spite of cultural differences, gaming offers and terms of regulation, this disparity is quite relative: in most European countries, its prevalence is around 0.5 % of the adult population (mean prevalence rate 0.6 %, from 28 studies analysed by Planzer et al. 2014). France is therefore within the average, with 0.4 % of pathological gamblers and 0.9 % of problem gamblers (Costes et al 2011). Despite great differences in gambling offers and regulation, France and United Kingdom are for instance very close in terms of pathological gambling prevalence: in U.K., rate was 0.5 % in 2000 (Sproston et al.), 0.4 % in 2007 (Wardle et al.), 0.55 % in 2011 (Wardle et al.). Big changes in gambling offers in Sweden did not lead to long lasting changes in pathological gambling prevalence, and Binde (2013) describes this fact as a «homeostatic system».

This relative stability in prevalence is at least partly due to the fact that some people are more inclined than others to become addicts, and leads to highlighting not only regulatory methods and the addictiveness of different games, but also individual vulnerability factors and motivations not only to gamble, but to gamble excessively. It is therefore very important to know the various pathways which lead someone to dependence on gambling.

In an article published in 2002, Alex Blaszczynski and Lia Nower suggested separating pathological gamblers into three groups, depending on the pathway involved (Blaszczynski and Nower 2002):

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- **“Behaviourally conditioned” gamblers** (Group 1), who gamble for family, cultural or subcultural reasons, and because of their gambling history itself.
- **“Emotionally vulnerable” gamblers** (Group 2), who have particular vulnerability factors as well as gambling conditioning: anxiety or depression, negative life events, poor coping strategies.
- **“Antisocial, impulsivist” gamblers** (Group 3), who add impulsiveness and antisocial type personality disorders to the previous group’s factors.

The authors therefore provide a classification in three groups, which differs particularly in the associated comorbidities: “behavioural conditioning” is common to all pathological gamblers and group 1 therefore comprises “pure” gamblers. Group 2 adds emotional vulnerability to this conditioning. Group 3 has the same characteristics as group 2, but with an additional impulsiveness factor, sometimes antisocial in nature.

A number of articles (in Pubmed, the Nower and Blaszczynski article is cited in 261 articles; in Google Scholar, in 489 articles) referring to this classification as a fact, no doubt because it corresponds to elements which are regularly observed clinically (Bonnaire, 2011; Martins et al. 2011; Ledgerwood and Petry 2010; Milosevic and Ledgerwood 2010...). Milosevic and Ledgerwood (2010) have inventoried all the literature concerning the classification of pathological gamblers into separate subgroups. Their analysis shows that, from the first study by Moran (1970), to the recent publication by Ledgerwood and Petry (2010), there is a coherence, compatible with the Blaszczynski and Nower model.

By studying all this literature, it is indeed possible to distinguish three groups:

- **The first group** is classified as subcultural (Moran 1970), normal (Lesieur 2001), conditioned (Blaszczynski and Nower 2002; Ledgerwood and Petry 2010), social (Stewart and Zack 2008), simple gambler (Vachon and Bagby 2009). This group is the Blaszczynski and Nower group 1, “Behaviourally conditioned”.
- **The second group** is called neurotic (Moran 1970), depressive or anxious (Graham and Lowenfeld 1986), repetitively depressive (McCormick 1987), tending to depression (Blaszczynski et al. 1990), seeking escape (Lesieur and Blume 1991; Ledgerwood and Petry 2006), psychologically anxious (Steel and Blaszczynski 1996), emotionally vulnerable (Blaszczynski and Nower 2002; Ledgerwood and Petry 2010), confronting situations (Stewart and Zack 2008). This group therefore meets the criteria for Blaszczynski and Nower’s group 2.
- **The third group** has been classified, according to authors, as impulsive (Moran 1970), passive-aggressive or emotionally unstable (Graham and Lowenfeld 1986), chronically under-stimulated (McCormick 1987), tending to boredom (Blaszczynski et al. 1990), action seeker (Lesieur 2001; Lesieur and Blume 1991), anti-social impulsive (Steel and Blaszczynski 1996), impulsive anti-social (Blaszczynski and Nower 2002; Ledgerwood and Petry 2010)... This group thus corresponds to Blaszczynski and Nower group 3.

Attempts to validate these groups however, according to the meta-analysis of Milosevic and Ledgerwood (2010) have not been quite conclusive to date. Our research thus aims to verify the validity of this typology in three groups for a large cohort of problematic gamblers. Indeed, we assume that groups can be constituted on the basis of variables identified as the most “typical” of the three groups (e.g. the presence of anxiety or mood disorders prior to the gambling problem, for the “emotionally vulnerable” group, the presence of an antisocial personality disorder or a high level of novelty seeking for the “antisocial impulsive” group, the others forming the “behaviourally conditioned” group, and that these groups are close to the description given by Blaszczynski and Nower (2002).

We would also like to go beyond this model and describe the three types more functionally. Our main hypothesis is that:

- Blaszczynski's group 2 subjects (emotionally vulnerable) present more anxiety-depressive disorders, even apart from those preceding the gambling problem. It is also expected that this group will contain proportionally more women and elderly people, that the age at which gambling started is higher and that they gamble more often to escape from or relieve problems.
- Group 3 subjects (antisocial impulsivists) lie more often to hide the extent of their gambling and more often endanger their personal relationships or their work. We also expect to find more men and younger people in this group, who began gambling early in life. We would also expect to find evidence of other addictive behaviour.
- Group 1 subjects ("behaviourally conditioned") show intermediate scores for most of the dimensions evaluated. According to some authors (Turner et al. 2008), we may expect this group to have higher scores for gambling-related cognitions. Moreover, these subjects are more likely to have a family history of excessive gambling.

We add to this criteria the fact that the type of gambling involved are supposed to differ between groups. Indeed, the different types of gambling match particular motivations. The gambling opportunities available on the market include games of pure chance (lottery, scratch cards, one-armed bandits, roulette, video lottery machines...), games of chance requiring some skill (sports betting, horse racing, blackjack) and skilful games of chance (poker), depending on whether the game involves some skill and is played against an operator or other players (Boutin 2010). We have also highlighted the strict opposition between "dream games" such as big lotteries, which are not very addictive, and "excitement games" such as one-armed bandits or horse racing, which often lead to gambling problems (Sharpe 2002; Valleur and Bucher 2006; Bonnaire et al. 2009). It would seem logical that "antisocial impulsivist" gamblers prefer games with a competitive component (Caillois et al. 1957) and thus mainly invest in skilful or semi-skilful games where tension is high and the feeling of mastering or controlling the game is very high. "Behaviourally conditioned" gamblers are more likely to go for games with a high illusion component: "Rapido", one-armed bandits, in fact games of pure chance, but in which the illusion of control is very present. Emotionally vulnerable gamblers are more likely to agree to play games of pure chance, choosing "hypnotic" or "anaesthetic" games promoting dissociation as described by Jacobs (1988), such as one-armed bandits or lotteries which promote dreams and escape.

Methods

Participants

The participants were 372 problem gamblers who took part in the *JEU* cohort study that is currently taking place. The *JEU* study is a 5-year longitudinal case-control cohort performed at national level. It includes, more broadly, 628 gamblers, divided into three groups: non-problem gamblers (NPG), problem gamblers without treatment (PGWT) and problem gamblers seeking treatment (PGST) (for more information, please refer to the study protocol of the *JEU* cohort: Challet-Bouju et al. 2014). The present study was performed on the baseline data of the *JEU* cohort and on problem gamblers only [that is PGWT ($n = 203$) + PGST ($n = 169$)]. PGWT were recruited in various gambling places

(casinos, cafés, smoke shops, etc.) and via the press, in order to cover the broadest possible range of gambling activities. PGST were recruited in seven care centres, among patients who started treatment <6 months before. Only participants who reported gambling on at least one occasion in the previous year and who were between 18 and 65 years old were included in the study.

Assessment Procedure

The proposed assessment includes a clinical structured interview, carried out with a trained researcher or psychologist, with a set of standardized self-report questionnaires. The assessment comprised socio-demographic, gambling-related and clinical data, which are described below.

Socio-Demographic Characteristics

A short questionnaire included a few questions about gender, age, marital status, professional activity, educational level and level of income.

Gambling Habits

A detailed interview was created to explore the gambling habits. Participants were asked about their participation in various forms of gambling over the past year, their preferred gambling activity (i.e. the gambling form which they preferred to play out of all the gambling activities they had tried in their lives), monthly gambling expenditure especially in relation to income, maximum wagering in a single day, the age at which they were initiated into gambling and their family history of problem gambling.

Pathological Gambling Section on the DSM-IV (APA 2000)

Problem gamblers were identified through an interview based on the 10 diagnostic criteria for PG in the DSM-IV. Gamblers who met at least three DSM-IV criteria were classified as problem gamblers (including both gamblers “at risk” for pathological gambling and gamblers with a diagnosis of PG). We used a non-standard threshold of three instead of five to include subclinical forms of problem gambling, which could be considered as forms of “abuse of gambling” similar to the notion of substance abuse. Previous literature supported the relevance of this categorization (Potenza 2006; Toneatto and Millar 2004).

South Oaks Gambling Scale (SOGS) (Lesieur and Blume 1987; Lejoyeux 1999)

The SOGS is a 20-item self-report questionnaire used to assess the severity of gambling problems.

Gambling Attitudes and Beliefs Survey—Revised Version (GABS-23) (Breen and Zuckerman 1999; Bouju et al. 2014)

The GABS is a self-report questionnaire which assesses irrational beliefs and attitudes about gambling. The GABS-23 is a revised version of the original GABS which consists of 23 items divided into 5 dimensions: Strategies, Chasing, Attitudes, Luck and Emotions.

Mini International Neuropsychiatric Interview—Fifth Version (MINI) (Lecrubier et al. 1997)

This short diagnostic structured interview explores the main axis-I psychiatric disorders (plus current risk of suicide and antisocial personality disorder) of the DSM. It includes assessment of the major anxiety disorders, mood disorders, addictive disorders and to a lesser extent psychotic disorders. Once a diagnosis was validated, the age at which the first episode occurred was compared with the age at which the gambling problem began, to define whether the disorder existed before or after the gambling problems.

Wender-Utah Rating Scale-Child (WURS-C) (Ward et al. 1993; Baylé et al, 2003)

The WURS-C is a self-report questionnaire used in adults to make a retrospective assessment of Attention Deficit/Hyperactivity Disorder (ADHD) in childhood. Authors recommended using a threshold of 46/100 to make a retrospective screening of ADHD in childhood.

Temperament and Character Inventory—125 (TCI-125) (Chakroun-Vinciguerra et al. 2005; Cloninger 1992; Pélissolo and Lèpine 2000)

The shorter 125-item version of the TCI is a self-report questionnaire used to rapidly explore the seven dimensions of personality defined by Cloninger's psychobiological model (Cloninger et al. 1993). The TCI-125 assesses four temperament traits (Novelty Seeking, Harm Avoidance, Reward Dependence and Persistence) and three character traits (Self-Directedness, Cooperation and Self-Transcendence).

Constitution of Typical Groups

Three groups were set up based on the characteristics described by Blaszczynski and Nower (Blaszczynski and Nower 2002). For group 2 (which we set up to resemble Blaszczynski and Nower's "emotionally vulnerable" group), we chose a single criterion: the fact that the subject had suffered at least one episode of anxiety or depression before having a gambling problem. For group 3 (which we set up to resemble Blaszczynski and Nower's "antisocial impulsivist" group), we isolated: (1) gamblers suffering from antisocial personality disorder, (2) gamblers with a particularly high score for the TCI "novelty seeking" component (i.e. for those in whom "novelty seeking" is predominant amongst the other personality components). Finally for group 1 (which we set up to resemble Blaszczynski and Nower's "behaviourally conditioned" group), in the absence of obvious classification criteria, we decided to group all the subjects who did not belong to group 2 or group 3 in this group.

Statistical Analysis

The first stage of the analysis consisted of describing the three groups thus formed, notably to check that apart from the variables used to set up the groups, they also displayed characteristics matching the theoretical model described by (Blaszczynski and Nower 2002).

Then, since the pathway model is an evolutionary model (group 2 is equivalent to group 1 plus emotional and biological vulnerability, and group 3 is equivalent to group 2 plus

impulsive traits), we conducted two analyses: the first one to study the differences between group 1 and group 2, and the other one for the differences between group 2 and group 3. (We also compared group 1 to group 3, but as this did not add new data to the results, we do not present it here). We used logistic regression to compare the characteristics of the groups. At first, bivariate analyses were performed by introducing the variables one by one. Only variables which were significant at 20 % were then included in a multivariate logistic regression. Non-significant variables at 5 % were removed one at a time, starting with the least significant variable (backward procedure), in order to select only the variables which provided significant information in the model.

Ethical Considerations

Participants gave their written informed consent. This study was approved by the French Research Ethics Committee.

Results

The Existence of Three Separate Groups of Gamblers

Description of the Groups

Firstly, we would like to describe the three groups constituted, in order to make sure that they resemble the theoretical typologies described by (Blaszczynski and Nower 2002). In spite of the very limited criteria, we obtained three very distinct groups:

Group 1 (Supposed “Behaviourally conditioned”) included 162 subjects (43.6 % of the total sample). Men were over-represented (72.8 %) and the average age was 43.5 (sd = 12.6). Nearly half the gamblers in this group lived alone (43.8 %) and most had an education level below ‘A’ level (55.3 %). Most were working (64.8 %) and had a regular income at least equivalent to the minimum wage (74.7 %). Concerning comorbidities, this group recorded 30.9 % of subjects with a history of mood disorders, 20.4 % a history of anxiety disorder, 30.3 % with an addictive disorder (other than excessive gambling) and 3.1 % with a history of psychotic syndrome.

Group 2 (“Emotionally vulnerable”) included 111 subjects (29.8 % of the total sample). Men were overrepresented here also, but to a lesser extent than in group 1 (67.6 %). The average age was 44.1 (sd = 13.1). The gamblers in this group were more likely to live alone (55.9 %) and they were almost as many to have a level of education level below ‘A’ level (49.1 %) as higher or equal to it (50.9 %). Most gamblers in this group were working (59.5 %) and had a regular income at least equal to the minimum wage (68.5 %). Naturally, because of the group constitution criteria, most of the subjects had a history of mood disorders (80.2 %) or anxiety disorders (74.8 %). Furthermore, 46.0 % had a history of addictive disorders (other than excessive gambling) and 20.7 % a history of psychotic syndrome.

Finally, group 3 (“Impulsivist”) included 99 subjects (26.6 % of the total sample). There was a distinct male predominance (83.8 %) and the average age was 41.8 (sd = 11.6). They mainly lived as a couple (55.1 %) and usually had an education level below that of ‘A’ level (56.6 %). They were usually working (69.7 %) and had regular incomes at least equal to the minimum wage (63.6 %). Concerning associated

psychiatric comorbidities, 53.5 % of the gamblers in this group had a history of mood disorders, 36.4 % a history of anxiety disorders, 50.5 % a history of addictive disorders other than excessive gambling, and 9.1 % a history of psychotic syndrome.

Comparisons Between the Groups (Socio-Demographic, D.S.M. Items, Comorbidity, Personal History)

Comparison of Group 1 (Behaviourally Conditioned) and Group 2 (Emotionally Vulnerable): The results of the multivariate logistic regression comparing gamblers in group 2 (emotionally vulnerable) to gamblers in group 1 (behaviourally conditioned) are given in Table 1. They show that group 2 gamblers are more likely to meet DSM criteria 4 (irritation during attempts to reduce their gambling practice) and 8 (illegal acts to finance the practice). They give a lower score to GABS-23 “strategies” and a lower score to the TCI-125 “determination” dimension. They are more likely to display addictive or psychotic disorders before developing the gambling problem, and more of them have a “moderate” risk of suicide.

Comparison of Group 2 (Emotionally Vulnerable) and Group 3 (Antisocial Impulsivist): Proportion of the Antisocial-Impulsive Characteristic The results of the multivariate logistic regression comparing group 3 gamblers (antisocial impulsivist) with those in group 2 (emotionally vulnerable) are given in Table 2. They show that group 3 gamblers are more likely to meet DSM criterion 9 (endangering personal or work relationships). For group 3 gamblers, the gambling problem was usually discovered by the family by accident. They are therefore subjects who gamble in a solitary fashion, with very little socialisation or sharing. They are more often found to have a “high” risk of suicide, which confirms a marked trend towards an actual attempt, depression not being significantly higher than in the other groups (depression: group 1: 29.81 %; group 2: 74.77 %; group 3: 46.46 %). Finally they have lower scores for inclination to avoid danger, dependence and reward, and persistence.

Comparisons Between the Groups (Choosing the Preferred Game)

As shown in Table 1, the multivariate logistic regression comparing group 1 gamblers with group 2 shows that group 2 gamblers (emotionally vulnerable) are more likely to choose games of pure chance as their favourites, compared with group 1 gamblers (behaviourally conditioned). Although the other regression comparing group 2 to group 3 did not show any evidence of difference in the game of choice between group 3 (antisocial impulsivists) and group 2 (emotionally vulnerable) gamblers, the descriptive elements still seem to confirm our hypotheses.

Indeed, if you look at the proportions of gamblers playing the three main types of game (pure chance, semi-skilful and skilful) depending on the group to which the gambler belongs, you can see that:

- 48.5 % of gamblers in group 3 (“antisocial impulsivists”) prefer semi-skilful games, 38.4 % pure chance games and finally 13.1 % for games requiring skill.
- On the other hand, 64.0 % of gamblers in group 2 (“emotionally vulnerable”) prefer games of pure chance, 27.9 % semi-skilful games and finally 8.11 % of games requiring skill. The proportions are thus reversed.

Table 1 Results of logistic regression comparing group 1 (behaviourally conditioned) and group 2 (emotionally vulnerable): the contribution of emotional and biological vulnerability

| Variables | Group 1 % or M (sd) | Group 2 % or M (sd) | OR | <i>p</i> |
|---|------------------------|------------------------|---------|----------|
| DSM criterion 4 (irritation) | 38.9 % | 61.3 % | 3.04*** | <0.001 |
| DSM criterion 8 (illegal acts) | 12.4 % | 22.5 % | 2.39* | 0.044 |
| Type of gambling ¹ | | | | 0.008 |
| Pure chance | 47.8 % | 64.0 % | – | – |
| Semi-skilful | 37.1 % | 27.9 % | 0.47* | 0.035 |
| Skilful | 15.1 % | 8.1 % | 0.21** | 0.006 |
| GABS “strategies” | 48.0 (23.6) | 43.0 (23.0) | 0.98** | 0.001 |
| TCI “determination” | 66.5 (18.0) | 56.1 (20.0) | 0.98** | 0.007 |
| Presence of an addictive disorder (other than excessive gambling) before the start of gambling problems | 80.0 % | 82.9 % | 3.67** | 0.002 |
| Presence of a psychotic problem before the start of gambling problems | 100.0 % | 81.0 % | 17.08** | 0.002 |
| Level of risk of suicide ² | | | | 0.043 |
| Low | 56.7 % | 58.3 % | – | – |
| Moderate | 3.3 % | 22.9 % | 14.66* | 0.013 |
| High | 40.0 % | 18.8 % | 0.90 | 0.862 |

The ORs are given in reference to group 1, i.e. if the OR is greater than 1, the characteristic evaluated is found more in group 2 than group 1

OR = odds ratio

% = proportions of the procedure studied within the group (qualitative variables)

M (sd) = mean and standard deviation of the variable studied within the group (quantitative variables)

¹ Games of pure chance are used as reference for the comparison of types of gambling (i.e. the figures corresponding to “semi-skilful” reflect the comparison of “semi-skilful” versus “pure chance” and those corresponding to “skilful” reflect the comparison of “skilful” versus “pure chance”)

² The “low” level is used as reference for the comparison of levels of suicide risk (i.e. the figures corresponding to “moderate” reflect the comparison of “moderate” versus “low” and those corresponding to “high” reflect the comparison of “high” versus “low”)

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

- And group 1 (“behaviourally conditioned”) is intermediate between the other two, with 47.8 % preferring games of pure chance, 37.1 % for semi-skilful games and 15.1 % for skilful games.

By detailing the games involved a little more, the differences are underlined more clearly:

- Scratch cards (“pure chance”) were preferred by 13.8 % of group 2, versus only 7.2 % in group 3 and 7.0 % in group 1.
- One-armed bandits (pure chance, with often illusion of control) were preferred by 37.6 % in group 2, versus 20.6 % in group 3 and 26.0 % in group 1.
- Instant lotteries were preferred by 4.1 % in group 3, versus 3.7 % in group 2 and 1.3 % in group 1.

Table 2 Results of the logistic regression comparing group 2 (emotionally vulnerable) and group 3 (antisocial impulsivists): the contribution of the antisocial-impulsive component

| Variables | Group 2 % or M (sd) | Group 3 | OR | <i>p</i> |
|--|---------------------|-------------|---------|----------|
| DSM criterion 9 (endangerment) | 40.5 % | 57.6 % | 3.04** | 0.009 |
| Accidental discovery of the gambling problem by the family | 29.2 % | 65.1 % | 4.90*** | <0.001 |
| TCI “danger avoidance” | 57.6 (25.4) | 36.7 (19.1) | 0.95*** | <0.001 |
| TCI “reward dependence” | 61.0 (18.0) | 53.4 (15.3) | 0.97** | 0.003 |
| TCI “persistence” | 59.6 (27.4) | 38.4 (23.6) | 0.96*** | <0.001 |
| Level of suicide risk ¹ | | | | 0.014 |
| Low | 58.3 % | 51.5 % | – | – |
| Moderate | 22.9 % | 9.1 % | 0.27 | 0.121 |
| High | 18.8 % | 39.4 % | 5.37 | 0.018 |

The ORs are given in reference to group 2, i.e. if the OR is greater than 1, the characteristic evaluated is found more in group 3 than group 2

OR = odds ratio

% = proportions of the procedure studied within the group

M (sd) = mean and standard deviation of the variable studied within the group

¹ The “low” level is used as reference for the comparison of levels of suicide risk (i.e. the figures corresponding to “moderate” reflect the comparison of “moderate” versus “low” and those corresponding to “high” reflect the comparison of “high” versus “low”)

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

- Roulette was preferred by 4.4 % in group 1, versus 4.1 % in group 3 and 3.7 % in group 2.
- Draws were preferred by 8.9 % in group 1, versus 5.5 % in group 2 and 3.1 % in group 3.
- Horse race betting was preferred by 34.0 % in group 3, versus only 19.3 % in group 2 and 26.0 % in group 1.
- Sports betting was preferred by 12.4 % in group 3, versus 8.3 % in group 2 and 10.8 % in group 1.
- Finally, poker (considered as a “skilful game”) was preferred by 13.4 % in group 3, versus 8.3 % in group 2 and 15.2 % in group 1.

Group 1 was usually situated in an intermediate position between the other two groups, as predicted.

Discussion

From a purely descriptive point of view, the results of our study seem to indicate that our group 2, defined by the existence of at least one episode of anxiety or depression before gambling, is similar to Blaszczynski and Nower groups 2 (“emotionally vulnerable”).

Our group 3 (defined by “novelty seeking”, or presence of A.P.D) is similar to Blaszczynski & Nower group 3 (“antisocial impulsivists”).

Thus, these two groups appear to be quite well individualised.

On the other hand, it is difficult to isolate the specific characteristics of group 1 (“behaviourally conditioned”), which seems to be intermediate between the other two. Our

results are therefore mixed: descriptively, the groups match our expectations, but the statistical arguments designed to validate the groups' solidity are not very strong: the socio-demographic and personal history data are not sufficient. On the other hand, the differentiation between these groups is clearly affected by the different types of gambling practised, and by this fact, the distinction between groups is distinctly established.

These elements force us to highlight a "functional" interpretation of the different groups of excessive gamblers.

The results of the "open-ended" comparisons between the three groups ("behaviourally conditioned" vs "emotionally vulnerable" and "emotionally vulnerable" vs "antisocial impulsivists") seem to delineate a particular table for group 3 ("antisocial impulsivists"): subjects in this group seem to be distinctly more "active", less sensitive to reward, but more inclined to take risks. They are more likely to suffer from antisocial personality disorders (APD). This criterion having been used to set up the group, it cannot be used as a point of comparison. But, incidentally, it should be noted that APD appears to be an important indicator of excessive gambling: of the 628 gamblers in the cohort (i.e. 256 non-problem gamblers and 372 problem gamblers), only 25 met the DSM-IV criteria for antisocial personality disorder (3.98 %), which is only slightly more than the general population, according to the D.S.M 3 % of men and 1 % of women (DSM IV-R 2003). But of these 25 subjects, 21 (84 %) met the criteria for probable pathological gambling (results not given). Although these figures are too low to assert a solid statistical correlation, this impressive percentage acts as a stimulus to research into excessive gambling in subjects presenting APD.

We therefore have the impression, with group 2 ("emotionally vulnerable"), of dealing with a group which validates the hypothesis of gambling as escape, avoidance, self-medication, and with group 3 ("antisocial impulsivists") with another set who use gambling as a stimulant, risk taking, a way of obtaining excitement. On the other hand, in accordance with the publication by Blaszczynski and Nower (2002), but contrary to that of Turner et al (2008), there are no arguments to support the contention that group 1 gamblers are more vulnerable to conditioning. They simply have fewer psychopathological characteristics than the others. The members of this group did not start earlier than the others and did not have a family history either. Moreover, a study of beliefs and attitudes relative to gambling, via the GABS questionnaire, tends rather to disprove the idea that these gamblers have more beliefs or cognitive distortions than the others.

It may be thought that, for most of the items concerned, we are dealing with data which is part of a continuum, dimensionally rather than categorically. The categories we form could be an arbitrary classification. This problem occurs with most statistical studies, and for most of the categories used here (impulsivity, neuroticism, etc. are measured dimensionally). This acts as a reminder of the need for a certain amount of care regarding the "ontological" status of the categories we study: for at least two of them, the "pathways" definitely exist, but this doesn't mean that they constitute solid diagnostic entities, carved in stone biologically, for example. In what may be seen as a continuum between "impulsiveness" on the one hand and "self-medication" on the other, we have set up frontiers to help visualise three separate groups, but there may be intermediate forms between these. This hypothesis is illustrated in Fig. 1. This diagram which takes our results into account, leads us to confirm the pertinence of Blaszczynski and Nower's groups. Indeed, in accordance with our results, we isolate a group 1 which should be in regression for most of the time, at psychopathological level. This is an intermediate group and a number of these gamblers may display characteristics belonging to the other two groups, but to a lesser extent. We therefore propose a new graphic presentation which is purely descriptive, and

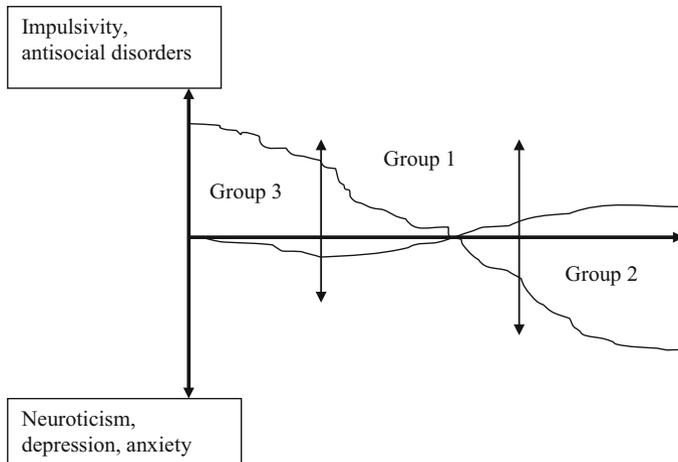


Fig. 1 The three “pathways”: a functional presentation. This diagram offers a new graphic presentation of the three pathways of Blaszczynski and Nower’s (2002). This presentation is purely descriptive and is not intended to incorporate hypothetical etiological data, either genetic or environmental. This presentation suggests a “functional” interpretation of the “pathways”, according to which what people are looking for in gambling differs according to their impulsivity and neuroticism. Group 1 corresponds to “conditioned gamblers”, group 2 to “emotionally vulnerable” gamblers and group 3 to “antisocial impulsivist” gamblers, as proposed by Blaszczynski and Nower (2002)

which is not intended to incorporate hypothetical etiological data which is genetic or environmental. This presentation suggests a “functional” interpretation of the “pathways”, according to which what people are looking for in gambling differs according to their impulsiveness and neuroticism: it therefore clouds Blaszczynski and Nower’s interpretation according to which group 3 is group 2 “plus” impulsivity, group 2 is group 1 “plus” emotional vulnerability, whereas group 1 is only “simple” conditioning to gambling.

Conclusion

This study has several limits. Firstly, for reasons linked to data collection (begun in 2009, when online poker was officially forbidden), poker players (“skilful game players”) are almost not represented. Moreover, the elements of differentiation between the three groups descriptively (gender, age, gambling history, etc.) are not very significant. However, our results tend to support the three pathways model, particularly because “antisocial impulsivist” gamblers preferentially choose semi-skilful games (horse or sport betting), whereas “emotionally vulnerable” gamblers are more attracted to games of pure chance (especially slot machines). The group of “conditioned gamblers” appear to be an intermediate group, without a different history of gambling, beliefs or cognitive distortions, contrary to the paper by Turner et al. in (2008).

We therefore support a functional interpretation of gambling addiction: it will affect impulsive, “active” people on the one hand, who are novelty seekers or transgressors. On the other hand are subjects who gamble for reasons of “self-medication”, for whom gambling can act as an anti-depressant, a means of escape and avoidance, or a magical expectation of restoration through fate. The comorbidities which preceded gambling are

mostly involved in the “self-medication” or “emotionally vulnerable” group and are depression and anxiety.

More targeted research could thus target excessive gambling in people suffering from an APD on the one hand, and excessive gambling in depressed or anxious people on the other: these factors should be considered to be factors for vulnerability to excessive gambling.

Moreover, this classification in “pathways” is close to other classifications used for other addictive behaviour, notably alcoholism. Impulsiveness, self-medication and conditioning can be decisive factors in all kinds of addictive behaviour. We think that other studies should be performed to explore this “functional” view of pathways for pathological gambling and also for other types of addiction, with or without drugs.

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Conflict of interest M.G.B., J.L.V. and G.C.B. declare that the University Hospital of Nantes has received funding from gambling industry (Française Des Jeux and Pari Mutuel Urbain) in the form of a sponsorship which supports the gambling section of the *BALANCED* Unit (the Reference Centre for Excessive Gambling). Scientific independence towards gambling industry operators is warranted. MV, IC, CL, DM, MF, ICB, MAG and AG declare that they have no conflicts of interest. There were no constraints on publishing.

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