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RESEARCH ARTICLE

Profiles of problem and non-problem gamblers, depending on their preferred gambling activity

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ABSTRACT

Background and aims: The objective was to compare the gamblers' profiles and practices depending on their preferred gambling activity, especially for two structural characteristics: presence of skill and expected value linked to the game. Another objective was to compare the profiles between non-problem and problem gamblers, and especially to identify how they evolve once problem gambling has emerged. *Methods*: Six hundred twenty-eight non-problem and problem gamblers were assessed with a structured interview, including sociodemographic characteristics, gambling habits, DSM-IV criteria for pathological gambling, gambling-related cognitions, personality profile, psychiatric comorbidities and Attention Deficit Hyperactivity Disorder. We used a stepwise logistic regression with backward elimination to compare gamblers' profiles depending on: (1) the presence of skill in their favourite game, (2) the expected value of their favourite game. Each regression was performed twice, in non-problem and then in problem gamblers. *Results*: Contrary to what was expected, the gamblers' profiles did not differ in gambling-related cognitions according to their chosen game, even at a problematic level of gambling. Problem gamblers of bank games of pure chance showed high levels of persistence and higher frequencies of suicidal risk, problem gamblers of bank games with an element on skill displayed more illegal acts, and gamblers of social games lost their cooperativeness profile on reaching a problematic level of gambling. *Conclusions*: Significant differences in the profiles of gamblers were identified based on their preferred gambling activity, especially in problem gamblers. Specific therapeutic and protective approaches which could be developed for these different profiles are proposed.

Introduction

Previously known as "Pathological Gambling", Gambling Disorder has recently been included in the "Substance related and addictive disorders" section of the DSM-5 (American Psychiatric Association, 2013). The prevalence of lifetime pathological gambling has been estimated at around 0.4–1.0% (American Psychiatric Association, 2013). By extension from drug addiction concepts, the development and maintenance of pathological gambling is traditionally thought to be conditioned by the interaction between a specific person (more or less predisposed) and a specific gambling activity (more or less addictive), in a particular context (more or less promoting consumption) (Olievenstein, 1983). In the early 2000s, some major integrative models were proposed to explain the etiology of pathological gambling. The pathways model proposed by Blaszczynski and Nower (2002) postulates the existence of three subtypes of problem gamblers: behaviourally-

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conditioned, emotionally-vulnerable and antisocial-impulsivist gamblers. This reference model focused mainly on the individual, and to a lesser extent on the context, but left the gambling activity itself quite out of the addiction picture. Shortly after that, the biopsycho-social model proposed by Sharpe (2002) explained the development of pathological gambling as the interaction of a vulnerable individual with early experience of gambling and negative life situations. Although Sharpe took into account the type of gambling activities as a risk factor for pathological gambling, she identified a significant gap in the literature and highlighted that "different forms of gambling may represent different sets of problems with different etiologies". She regretted the lack of studies directly comparing different types of gambling, which has also been highlighted by other recent studies (Bjerg, 2010; Bouju, Grall-Bronnec, Landreat-Guillou, & Vénisse, 2011; Raylu & Oei, 2002; Toneatto & Ladouceur, 2003; Toneatto & Millar, 2004).

Some authors have suggested that different types of gambling may be more or less strongly related to pathological gambling (LaPlante, Kleschinsky, LaBrie, Nelson, & Shaffer, 2009; Petry, 2003; Sharpe, 2002; Welte, Barnes, Wieczorek, Tidwell, & Hoffman, 2007; Welte, Barnes, Wieczorek, Tidwell, & Parker, 2004), while others have shown that this effect was mediated by the gambling involvement (number of games played) (LaPlante, Nelson, & Gray, 2014; Phillips, Ogeil, Chow, & Blaszczynski, 2013). If gambling involvement seems to be a great indicator for screening gambling problems, leading to oust the interest of a work on the types of gambling activities, no study had attempted to understand the influence of game preference (rather than game participation) on the level of practice, with an underlying idea of differential pathways between the different forms of gambling.

Petry (2003) had attempted to answer this question, and demonstrated that gamblers differ in the severity of their gambling, alcohol and psychiatric problems depending on their preferred gambling activity. Although this study contributed some very interesting findings, it only focused on pathological gamblers seeking treatment and compared five different gambling activities with no attempt to classify them in a way that can explain the findings. It is unfortunate that the specificities of different types of gambling are not explored more, because it seems (clinically) that gamblers' profiles and behaviours differ depending on their preferred gambling activity. Moreover, it remains unclear whether these differing profiles are also relevant for non-problem gamblers, and if they would be similar for non-problem and problem gamblers. Beyond simple differences in profiles, we feel

that the prevention and care strategies should be tailor-made to each different type of gambling.

To explore the specificities of different types of gambling, it is necessary to have a pertinent classification of gambling games. Recently, Boutin (2010) and Bjerg (2010) both have suggested almost the same classification of gambling games based on the following two structural characteristics:

The respective proportions of chance and skill in the game, which can be used to distinguish between gambling games of pure chance and gambling games with an element of skill. The intervention of random and skill is variable from game to game. There are at first gambling games of pure chance, where the player's skills or experience cannot influence the outcome of the game, which is determined solely by chance. In contrast, gambling games with an element of skill have an outcome that can be influenced by the player's own competence or knowledge, although it still depends on random events.

The expected value linked to the game, which can be used to distinguish between bank games and social games. The expected value associated with a particular game is also variable from game to game and mainly depends on the nature of the adversary: another player, who is fallible, or a gambling industry which is programmed to be profitable in the long term. When the game is played against a gambling industry (bank games), the expected value is always negative, since the bank always has a statistical advantage over the players, which ensures fixed profitability in the long term. When the game is played against other players (social games), the expected value is variable, since the gamblers are statistically on an even footing. For games of pure chance, the expected value is always zero (since all players have statistically exactly the same chance to win). For games of chance and skill, Boutin (2010) introduced the notion of a dynamic and relative skill gap between players. When the skill difference is favourable for the player, the expected value is positive, and conversely. When every player plays at the same level of skill (no skill gap), the outcome of the game depends mainly on chance and the resulting expected value is around zero.

These two theoretical classifications can be used to compare types of games in two ways, thus facilitating understanding of between-game differences. Bjerg's (2010) and Boutin's (2010) classifications are shown in Figure 1.

The objective of this study was to compare gamblers' profiles and practices depending on their preferred gambling activity, and particularly two structural characteristics of a game: presence of skill and expected value linked to the game. Another objective was to compare

Reproduction of the Bjerg classification of gambling games

Table 1. Classification of gambling games

	Bank games	Social games
Pure chance	Roulette	Coin tossing
	Slot machines	Rock-paper-scissors
	Lottery	
	Bingo	
	Expected value < 0	Expected value = 0
Skill and chance	Blackjack	Poker
	Craps	Backgammon
	Sports- and horserace betting	Bridge
		Rummy
	Expected value < 0	Expected value variable below and above 0

Reproduced from Bjerg "Problem gambling in poker: money, rationality and control in a skilled-based social game" International Gambling Studies (2010 – page241) with the kind permission of Olé Bjerg.

Reproduction of Boutin classification of gambling games (*since the book was written in French, we have translated the contents of the figure*)

Games played against the bank		Games played against other players
1st class* Games of chance without skill	2nd class Games of chance with quasi-skill	3rd class Games of chance with skill
Lotteries	Sports betting	Poker Texas Hold'em
Bingo	Horserace betting	Several other Poker variants
Keno	Black Jack	
Roulette		
Slots		
Video Lottery Terminal (*including videopoker*)		

* The following games are included in the first class: craps, baccarat, sic bo, battle, wheel of fortune, Caribbean poker, 3 cards poker, Païy Gow poker and poker Grand Prix ; these four games require the player to know basic strategy, but beyond that, no player can acquire any supplementary skill

Reproduced from Boutin "Le jeu: chance ou stratégie. Choisir librement la place du jeu dans votre vie" Les éditions de l'homme (2010 – page 22) with the kind permission of Claude Boutin – translation into English by the first author.

Note that the 1st class of Boutin's classification exactly matches the category of bank games of pure chance in Bjerg's classification, the Boutin 2nd class exactly matches the Bjerg category of bank games of skill and chance, and the Boutin 3rd class exactly matches the Bjerg category of social games of skill and chance. Boutin does not include social games of pure chance in his classification. However, the Boutin classification has the advantage of introducing the notion of a dynamic and relative skill gap between players in social games of skill and chance.

Figure 1. Reproduction of Bjerg's and Boutin's classifications of gambling games.

these profiles between non-problem and problem gamblers, and especially to identify how they evolve once problem gambling has emerged.

The purpose of the present paper was thus not to identify types of gambling as predictors of problem gambling, but rather to compare the profiles of gamblers of distinct game types to identify potential differences, which could lead to developing "personalised" preventive or therapeutic interventions.

Methods

Participants

The participants were 628 non-problem gamblers (NPG) and problem gamblers (PG) who took part in the *JEU* cohort study that is currently taking place. The JEU cohort study is a 5-year longitudinal case-control cohort performed at a national level [for more information, please refer to the study protocol of the JEU cohort:

(Challet-Bouju et al., 2014a)]. The present study is performed on the baseline data of the JEU cohort. The sample was constituted based on an approximate equality of size between NPG and PG, because of the low prevalence of gambling problems in the general population. Participants 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. For recruitment in gambling places, participation in the study was proposed to each gambler at the outlet of the gambling venue (never during a gambling session). For those who were interested to participate, the study was presented in detail and eligibility was verified. The interview was then conducted either in a room or a private spot of the gambling venue, either at the offices of the research team (according to participants' preferences and possibilities of the venue). PG were also recruited in seven care centres, where they started their treatment less than 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.

Measures

The same assessment procedure was used for both gamblers recruited in care centres and gamblers recruited in gambling places.

Sociodemographic characteristics

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

Gambling habits

Participants were asked about their participation in various forms of gambling over the past year, 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. They were also invited to determine their preferred gambling activity, i.e. the one which they preferred among all the gambling activities they have experimented in their lives (gamblers with a multi-game profile were restricted to defining a single preferred gambling activity). The favourite game is not necessarily the most frequently played game (Challet-Bouju et al., 2014b), and includes an emotional connotation that is lacking in the concept of game participation (which is the most commonly used indicator in studies about types of gambling or involvement).

Temperament and character inventory – 125

The 125-item version of the temperament and character inventory – 125 (TCI-125) is a self-report questionnaire used to explore the seven dimensions of personality defined by Cloninger's psychobiological model (Chakroun-Vinciguerra, Faytout, Pélissolo, & Swendsen, 2005; Cloninger, Svrakic, & Przybeck, 1993). It assesses four temperament traits (Novelty Seeking, Harm Avoidance, Reward Dependence and Persistence) and three character traits (Self-Directedness, Cooperation and Self-Transcendence). The psychometric properties of this version of the TCI have been validated in a previous study (Chakroun-Vinciguerra et al., 2005; Cloninger et al., 1993) and the consistency of all the dimensions have been confirmed in the present sample (Cronbach's Alphas: 0.70 for Novelty Seeking, 0.83 for Harm Avoidance, 0.52 for Reward Dependence, 0.52 for Persistence, 0.83 for Self-Directedness, 0.75 for Cooperation and 0.82 for Self-Transcendence).

Pathological gambling section on the DSM-IV

The distinction between NPG and PG was made through a clinical interview based on the 10 diagnostic criteria for PG in the DSM-IV, which was conducted by trained and experienced staff (APA, 2000). Given that the recruitment was conducted in 2009-2011, the gambling disorder section of the DSM-5 could not have been used. Gamblers who met at least three DSM-IV criteria were classified as PG (including both gamblers "at risk" for pathological gambling and gamblers with a diagnosis of pathological gambling), and those remaining as NPG. We used a non-standard threshold of 3 instead of 5 to include subclinical forms of PG, which could be considered as forms of "abuse of gambling" similar to the notion of substance abuse. Previous literature supported the relevance of this categorisation (Potenza, 2006; Toce-Gerstein, Gerstein, & Volberg, 2003; Toneatto & Millar, 2004). Apart from the categorisation of problem gambling, the number of positive DSM-IV criteria for pathological gambling was used as a dimensional score for gambling problem severity, and the responses to each DSM-IV criterion were also taken into account to study the various symptoms of pathological gambling. This score showed great internal consistency with a Cronbach's Alpha of 0.85.

Gambling Attitudes and Beliefs Survey - Revised version (GABS-23)

The Gambling Attitudes and Beliefs Survey - Revised version (GABS-23) is a self-report questionnaire, which

assesses irrational beliefs and attitudes about gambling (Bouju et al., 2014; Breen & Zuckerman, 1999). The GABS-23 is a revised version of the original GABS, and consists of 23 items divided into five dimensions: Strategies, Chasing, Attitudes, Luck and Emotions. The GABS-23 displayed good psychometric properties (Cronbach's Alphas of 0.71 for the Luck dimension, 0.69 for Attitudes, 0.83 for Emotions, 0.68 for Strategies, 0.80 for Chasing and 0.89 for the overall score).

Mini International Neuropsychiatric Interview – fifth version (MINI)

This short diagnostic structured interview explores the main axis-I psychiatric disorders (plus current risk of suicide and antisocial personality disorder) defined in the DSM (Lecrubier et al., 1997). It includes an assessment of major anxiety disorders, mood disorders, addictive disorders and, to a lesser extent, psychotic disorders.

Wender-Utah Rating Scale-Child

The Wender-Utah Rating Scale-Child (WURS-C) is a self-report questionnaire used in adults to make a retrospective assessment of Attention Deficit and Hyperactivity Disorder (ADHD) in childhood (Caci, Bouchez, & Baylé, 2010; Ward, Wender, & Reimherr, 1993). It showed good internal consistency (Cronbach's Alpha of 0.93) in the present sample. A threshold of 46/100 was defined to identify ADHD in childhood.

Statistical analysis

General principle

We conducted two analyses to compare gamblers' profiles based on their preferred gambling activity. Distinction between gambling activities was based on two characteristics: the presence of skill in the game and the expected value of the game. As the category of social pure chance games was not represented in the cohort and to avoid introducing bias in the analyses, we compared games of pure chance with games of chance and skill only within the category of bank games, and we compared social games with bank games only within the category of games of chance and skill. In this way, we expected to avoid confusing the differences associated with the two factors (i.e. the presence of skill and the expected value).

Method of analysis

We used logistic regression to compare the characteristics of the groups (games of pure chance versus games of chance and skill on the one hand, and bank ersuss social games of change and skill on the other). At first, univariate analyses were performed by introducing the gamblers' characteristics one by one. Variables which were significant at 25% were then included in a multivariate logistic regression. This high threshold of significance allowed us to avoid dropping a variable having interactions with another variable during the first step. In the second multivariate step, non-significant variables at 5% were removed one at a time, starting with

Table 1. Distribution of the different types and categories of preferred gambling ($n = 615$).

Categories of gambling activity according to Bjerg's theoretical classification	Types of gambling activity	Whole sample ($n = 615$)		NPG ($n=251$)		PG ($n=364$)	
		N	%	N	%	N	%
Bank game Pure chance	Electronic gaming machines (EGM) *Slots, videopoker*	164	26.7	62	24.7	102	28.0
Bank game Skill and chance	Horse race betting	134	21.8	39	15.5	95	26.1
Social game Skill and chance	Poker	78	12.7	32	12.7	46	12.6
Bank game Pure chance	Scratch cards	78	12.7	45	17.9	33	9.1
Bank game Pure chance	Deferred lotteries *Loto®, Euromillions®, Kéno®*	70	11.4	47	18.7	23	6.3
Bank game Skill and chance	Sports betting	48	7.8	10	4.0	38	10.4
Bank game Pure chance	Roulette	24	3.9	9	3.6	15	4.1
Bank game Pure chance	Instant lotteries *Rapido®[a], online Bingo*	16	2.6	6	2.4	10	2.7
Bank game Skill and chance	Black Jack	3	0.5	1	0.4	2	0.5

[a]Rapido® is a French game available in bars. The goal is to find 8 out of 20 numbers in a first grid (grid A) and simultaneously one number out of 4 in a second grid (grid B). The draw frequency of the Rapido® is very high, with one draw every two and a half minutes.

Table 2. Univariate comparisons based on the presence of skill: Gamblers' profiles compared between bank games of pure chance and bank games of chance and skill.

	Non-problem gamblers N = 219			Problem gamblers N = 318		
	Bank games of pure chance N = 169 N (%) or M (SD)	Bank games of chance and skill N = 50	Univariate OR [95% CI]	Bank games of pure chance N = 183 N (%) or M (SD)	Bank games of chance and skill N = 135	Univariate OR [95% CI]
Sociodemographics						
Gender (Male)	43.2%	82.0%	5.97*** [2.73–13.06]	52.5%	96.3%	24.13*** [9.44–61.67]
Age	44.3 (13.4)	47.3 (12.6)	1.02 [0.99–1.04]	46.5 (12.6)	41.4 (11.4)	0.97*** [0.95–0.98]
Marital status (single)	50.3%	52.0%	1.07 [0.57–2.01]	51.9%	40.0%	0.62* [0.40–0.97]
Educational level (≥ high school graduation)	57.4%	54.0%	0.85 [0.45–1.61]	44.3%	43.0%	0.95 [0.61–1.48]
Professional activity (working)	63.3%	54.0%	0.69 [0.37–1.31]	60.7%	64.4%	1.20 [0.76–1.89]
Level of income (regular & >1100 €)	71.6%	74.0%	1.14 [0.56–2.33]	68.3%	68.1%	0.98 [0.61–1.57]
Severity of gambling problems						
Number of positive DSM criteria	0.6 (0.8)	1.2 (1.7)	1.58** [1.15–2.19]	5.7 (2.0)	6.2 (2.0)	1.13* [1.01–1.26]
• Preoccupation	5.3%	16.0%	3.07* [1.14–8.25]	71.6%	77.8%	1.35 [0.81–2.25]
• Increasing amounts of money	5.9%	8.0%	1.40 [0.42–4.67]	57.4%	65.2%	1.40 [0.89–2.20]
• Inability to reduce or stop gambling	7.7%	14.0%	1.98 [0.74–5.27]	76.0%	68.9%	0.71 [0.43–1.17]
• Withdrawal symptoms	6.5%	6.0%	0.85 [0.23–3.12]	49.2%	46.7%	0.92 [0.59–1.43]
• Escapism	16.0%	16.0%	1.02 [0.43–2.40]	71.0%	65.9%	0.80 [0.50–1.29]
• Chasing	12.4%	32.0%	3.36** [1.59–7.11]	75.4%	83.0%	1.65 [0.95–2.89]
• Lies	5.3%	16.0%	3.43* [1.25–9.42]	74.3%	85.2%	1.95* [1.10–3.45]
• Illegal acts	0.0%	6.0%	– [–]	14.8%	29.6%	2.37** [1.38–4.08]
• Jeopardising relations or job	0.6%	4.0%	7.08 [0.63–79.80]	38.3%	48.1%	1.47 [0.94–2.30]
• Borrowing to gamble	0.0%	2.0%	– [–]	43.2%	47.4%	1.17 [0.75–1.82]
Gambling habits						
Gamble preferentially on the Internet	2.4%	10.0%	4.59* [1.18–17.85]	9.3%	14.8%	1.95 [0.98–3.89]
Maximum frequency of gambling						
Less than once a month	20.7%	2.0%	4.04*** [2.09–7.80]	2.7%	0.0%	4.22*** [2.15–8.26]
Less than once a week	32.5%	18.0%	1.11 [0.53–2.32]	11.5%	3.7%	0.31** [0.13–0.74]
Once a week	22.5%	24.0%	0.45* [0.20–0.99]	14.8%	5.2%	0.29** [0.11–0.80]
More than once a week	24.3%	56.0%	0.08*** [0.01–0.57]	71.0%	91.1%	1.00 [0.61–0.96]
Money gambled per month (€)	102 (163)	192 (448)	1.13* [0.99–1.29]	911 (2215)	712 (745)	0.99 [0.98–1.01]
Higher money gambled in one day (€)	173 (377)	315 (915)	1.04 [0.99–1.10]	1599 (4835)	1436 (3376)	1.00 [0.99–1.00]
Ratio money gambled per month/income	0.1 (0.1)	0.1 (0.3)	9.97* [0.92–107.5]	0.5 (0.7)	0.5 (0.5)	1.07 [0.79–1.45]
Familial antecedent of problem gambling	17.2%	20.0%	1.10 [0.50–2.43]	31.7%	28.1%	0.84 [0.52–1.37]
Age of initiation	21.9 (10.7)	19.8 (8.1)	0.98 [0.94–1.01]	22.5 (10.3)	18.1 (6.9)	0.94*** [0.91–0.97]
Subjective feeling of having a gambling problem	–	–	–	83.2%	91.2%	2.11* [1.04–4.29]
Distorted cognitions						
Global score (/100)	31.8 (17.9)	34.1 (18.3)	1.01 [0.99–1.02]	49.8 (16.9)	49.6 (15.9)	1.00 [0.99–1.01]
Attitudes (/100)	46.3 (25.0)	49.3 (25.3)	1.00 [0.99–1.02]	60.5 (21.2)	59.9 (18.7)	1.00 [0.99–1.01]
Strategies (/100)	31.6 (26.0)	37.4 (25.8)	1.01 [1.00–1.02]	44.1 (25.7)	46.7 (22.8)	1.00 [0.99–1.01]
Luck (/100)	34.1 (23.6)	34.2 (24.4)	1.00 [0.99–1.01]	42.7 (24.8)	41.2 (26.5)	1.00 [0.99–1.01]
Chasing (/100)	23.8 (21.5)	25.5 (20.3)	1.00 [0.99–1.02]	51.6 (25.0)	52.5 (21.2)	1.00 [0.99–1.01]
Emotions (/100)	23.1 (21.4)	24.3 (22.4)	1.00 [0.99–1.02]	50.1 (23.0)	47.8 (20.8)	1.00 [0.99–1.01]
Personality profile						
Novelty Seeking (/100)	44.1 (16.3)	42.6 (18.2)	0.99 [0.98–1.01]	55.6 (16.7)	60.2 (15.7)	1.02* [1.00–1.03]
Harm avoidance (/100)	41.3 (21.2)	43.7 (24.3)	1.01 [0.99–1.02]	48.7 (24.4)	43.7 (23.9)	0.99 [0.98–1.00]
Reward dependence (/100)	62.4 (17.8)	60.7 (19.5)	0.99 [0.98–1.01]	59.8 (15.8)	57.0 (18.1)	0.99 [0.98–1.00]
Persistence (/100)	56.7 (27.8)	48.8 (28.6)	0.99*** [0.98–1.00]	59.5 (26.8)	49.0 (29.6)	0.99*** [0.98–0.99]

(continued)

Table 2. Continued

	Non-problem gamblers N = 219			Problem gamblers N = 318		
	Bank games of pure chance N = 169 N (%) or M (SD)	Bank games of chance and skill N = 50	Univariate OR [95% CI]	Bank games of pure chance N = 183 N (%) or M (SD)	Bank games of chance and skill N = 135	Univariate OR [95% CI]
Self-directedness (/100)	77.7 (17.5)	76.5 (18.5)	1.00 [0.98–1.01]	60.7 (19.9)	62.0 (18.1)	1.00 [0.99–1.01]
Cooperativeness (/100)	77.2 (14.4)	75.6 (15.3)	0.99 [0.97–1.01]	72.4 (15.2)	71.8 (15.2)	1.00 [0.98–1.01]
Self-transcendence (/100)	29.1 (21.4)	33.3 (23.8)	1.01 [0.99–1.02]	38.2 (24.5)	28.1 (20.2)	**0.98***** [0.97–0.99]
Psychiatric comorbidities						
Mood disorders	40.8%	44.0%	1.11 [0.59–2.09]	56.3%	48.1%	0.69 [0.45–1.08]
Anxiety disorders	36.1%	36.0%	0.96 [0.50–1.86]	45.9%	40.0%	0.80 [0.51–1.25]
Addictive disorders	23.1%	32.0%	1.54 [0.77–3.08]	33.9%	45.9%	**1.67*** [1.07–2.63]
Antisocial personality disorder	0.0%	4.0%	– [–]	6.0%	5.2%	0.85 [0.32–2.24]
Suicidal risk	15.4%	16.0%	1.02 [0.43–2.40]	36.1%	25.9%	0.62 [0.38–1.01]
ADHD in childhood	7.7%	18.0%	2.40 [0.97–5.93]	26.8%	23.7%	0.87 [0.52–1.46]

OR are Odds Ratios obtained at the first step of the analysis (univariate logistic regression). They are given in reference to the group of bank games of chance and skill – i.e. if the OR is greater than 1, it means that the characteristic is found more in the group of gamblers of bank games of chance and skill, and conversely.

Significant differences (i.e. p value < 0.05) are indicated in bold.

*p value < 0.05
**p value < 0.01
***p value < 0.001.

Variables selected to be introduced in the multivariate analyses (p < 0.25) are highlighted in light grey.

the least significant variable (backward procedure), in order to select only the variables which provided significant information in the model. Odds Ratios (OR) and associated 95% Confidence Intervals (95% CI) were estimated for each final model, in order to quantify the strength of the association between the predictive factors selected and the two structural characteristics of interest. Each regression was performed twice, once in the NPG sample and once in the PG sample. Each regression was controlled for type and place of recruitment.

Ethical considerations

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

Results

General description of the cohort

The sample consisted of 256 NPG and 372 PG. The participants were mainly men (66.6%) and the mean age of whole sample was 43.4 years (SD = 12.9). The majority of the sample was employed (63.5%), with a regular income, higher than the French minimum wages (approximately 1100€) (70.1%). The major characteristics of the JEU Cohort at baseline are freely available online in the study protocol: (Challet-Bouju et al., 2014b).

Types of gambling

The name of the preferred gambling activity given by the participant was recoded within nine types of gambling, and then in the four categories used for theoretical classification of gambling games. Thirteen participants (5 NPG and 8 PG) were excluded from the analysis because they could not be classified within one of the nine types, as their answer was not sufficiently precise. As can be seen in Table 1, the category of social pure chance games was not represented in the cohort. The gambling activities mostly played in our sample were Electronic Gaming Machines (EGM) (26.7%) and horse race betting (21.8%). The ranking of game preference was different in the two sub-samples (NPG and PG), but EGM remained the most frequent game of choice for each. The differences in the ranking between the two groups could be explained by the type and place of recruitment, confirming the importance of controlling the analyses for these parameters.

Table 3. Multivariate logistic regression analysis (final model) showing factors associated with a preference for games with an element of skill.

		Multivariate OR	95% Confidence Intervals	p Value	Adjusted R^2
NPG	Gender (*male*)	9.64	3.91–23.77	<0.001	0.237
	ADHD in childhood	4.38	1.43–13.38	0.010	
	Age	1.04	1.01–1.07	0.020	
	Maximum frequency of gambling (*more than once a week*)	0.05	0.01–0.41	0.005	
PG	Gender (*male*)	17.78	6.74–46.91	<0.001	0.297
	Illegal acts related to gambling	2.28	1.12–4.64	0.023	
	Maximum frequency of gambling (*once a week*)	0.28	0.09–0.88	0.030	
	Suicidal risk	0.45	0.24–0.84	0.013	
	TCI-persistence score	0.99	0.89–1.00	0.015	

Profiles of gamblers according to the presence of skill in their favourite game

Non-problem gamblers

Table 2 shows the results of the univariate comparisons between gamblers of bank games of pure chance ($n = 169$) and gamblers of bank games of chance and skill ($n = 50$) within the NPG sample. This analysis is given in a purely descriptive purpose, because it is just a preliminary step to the final logistic regression, in order to select the variables to be included in the multivariate analysis. However, we can note that the two groups seem to differ mainly based on gambling problems and gambling habits. From the 46 starting variables, 20 were introduced in the multivariate analyses ($p < 0.25$). The final model obtained with the multivariate logistic regression is provided in Table 3. The odd of being gamblers of bank games of chance and skill rather than gamblers of bank games of pure chance is higher for males (OR = 9.64), older gamblers (OR = 1.04) and those with a history of ADHD in childhood (OR = 4.38), and is lower for higher gambling frequencies (OR = 0.05).

The model accounted for 23.7% of variance in the presence of skill in NPG.

Problem gamblers

Table 2 shows the results of the univariate comparisons between gamblers of bank games of pure chance ($n = 183$) and gamblers of bank games of chance and skill ($n = 135$) within the PG sample. Univariate results indicated that except for cognitive distortions, the two groups differ on all the categories of variables included (sociodemographics, gambling problems, gambling habits, personality profile and psychiatric comorbidities). When talking about problem gamblers, the distinction between games depending on the presence of skill thus seems to have a different impact compared to non-problem gamblers, especially on personality profile, psychiatric comorbidities and gambling habits. From the 46 starting variables, 25

were introduced in the multivariate analyses ($p < 0.25$). The final model obtained with the multivariate logistic regression is provided in Table 3. The odd of being gamblers of bank games of chance and skill rather than gamblers of bank games of pure chance is higher for males (OR = 17.78), those who had experimented with illegal acts (OR = 2.28) and those with a low TCI-persistence score (OR = 0.99), and is lower for high gambling frequencies (OR = 0.28) and those who presented a suicidal risk (OR = 0.45). The model accounted for 29.7% of variance in the presence of skill in NPG.

Profiles of gamblers according to the expected value of their favourite game

Non-problem gamblers

Table 4 shows the results of the univariate comparisons between gamblers of social games of chance and skill ($n = 32$) and gamblers of bank games of chance and skill ($n = 50$) within the NPG sample. Univariate results indicated that the two groups differ on all the categories of variables included, but mainly on sociodemographics, gambling habits and personality profile. From the 46 starting variables, 19 were introduced in the multivariate analyses ($p < 0.25$). The final model obtained with the multivariate logistic regression is provided in Table 5. The odd of being gamblers of social games of chance and skill rather than gamblers of bank games of chance and skill chance is higher for younger gamblers (OR = 0.87), those who gambled a higher maximum amount of money in a single day (OR = 1.12), those with a high GABS-attitude score (OR = 1.06) and those with a high TCI-cooperation score (OR = 1.07), and is lower for those with the highest severity of gambling problems (OR = 0.19). The model accounted for 52.2% of variance in the expected value in NPG.

Problem gamblers

Table 4 shows the results of the univariate comparisons between gamblers of social games of chance and skill

Table 4. Univariate comparisons based on the expected value: Gamblers' profiles compared between bank games of chance and skill and social games of chance and skill.

	Non-problem gamblers N = 82			Problem gamblers N = 181		
	Bank games of chance and skill N = 50 N (%) or M (SD)	Social games of chance and skill N = 32	Univariate OR [95% CI]	Bank games of chance and skill N = 135 N (%) or M (SD)	Social games of chance and skill N = 46	Univariate OR [95% CI]
Sociodemographics						
Gender (Male)	82.0%	78.1%	0.78 [0.26–2.37]	96.3%	93.5%	0.54 [0.12–2.35]
Age	47.3 (12.6)	33.3 (12.6)	0.92*** [0.88–0.96]	41.4 (11.4)	35.6 (11.7)	0.95** [0.92–0.99]
Marital status (single)	52.0%	71.9%	2.36 [0.91–6.10]	40.0%	52.2%	1.63 [0.83–3.18]
Educational level (≥ high school graduation)	54.0%	68.8%	1.87 [0.74–4.76]	43.0%	63.0%	2.43* [1.21–4.87]
Professional activity (working)	54.0%	65.6%	1.63 [0.65–4.07]	64.4%	73.9%	1.51 [0.72–3.18]
Level of income (regular & > 1100 €)	74.0%	56.3%	0.45 [0.18–1.16]	68.1%	80.4%	1.92 [0.85–4.33]
Severity of gambling problems						
Number of positive DSM criteria	1.2 (1.7)	0.8 (1.1)	0.75 [0.48–1.17]	6.2 (2.0)	6.0 (2.0)	0.96 [0.81–1.13]
• Preoccupation	16.0%	9.4%	0.54 [0.13–2.22]	77.8%	65.2%	0.54 [0.26–1.12]
• Increasing amounts of money	8.0%	6.3%	0.77 [0.13–4.45]	65.2%	63.0%	0.91 [0.45–1.82]
• Inability to reduce or stop gambling	14.0%	9.4%	0.64 [0.15–2.66]	68.9%	73.9%	1.24 [0.58–2.63]
• Withdrawal symptoms	6.0%	6.3%	1.04 [0.16–6.62]	46.7%	52.2%	1.23 [0.63–2.39]
• Escapism	16.0%	12.5%	0.75 [0.21–2.73]	65.9%	56.5%	0.65 [0.33–1.29]
• Chasing	32.0%	9.4%	0.22* [0.06–0.83]	83.0%	87.0%	1.33 [0.51–3.51]
• Lies	16.0%	12.5%	0.75 [0.21–2.73]	85.2%	84.8%	1.00 [0.39–2.53]
• Illegal acts	6.0%	0.0%	– [–]	29.6%	21.7%	0.66 [0.30–1.45]
• Jeopardising relations or job	4.0%	6.3%	1.60 [0.21–11.97]	48.1%	54.3%	1.30 [0.66–2.54]
• Borrowing to gamble	2.0%	3.1%	1.58 [0.95–26.20]	47.4%	43.5%	0.86 [0.44–1.69]
Gambling habits						
Gamble preferentially on the Internet	10.0%	6.3%	0.69 [0.12–3.81]	14.8%	45.7%	5.77*** [2.60–12.76]
Maximum frequency of gambling						
Less than once a month	2.0%	21.9%	0.41 [0.16–1.03]	0.0%	0.0%	0.53 [0.20–1.44]
Less than once a week	18.0%	25.0%	0.73 [0.24–2.19]	3.7%	6.5%	1.78 [0.50–6.39]
Once a week	24.0%	18.8%	1.52 [0.52–4.46]	5.2%	8.7%	1.86 [0.43–8.09]
More than once a week	56.0%	34.4%	13.7** [1.60–117.8]	91.1%	84.8%	– [–]
Money gambled per month (€)	192 (448)	170 (237)	0.98 [0.87–1.11]	712 (745)	1219 (2278)	1.02 [1.00–1.05]
Higher money gambled in one day (€)	315 (915)	718 (1788)	1.03 [0.98–1.07]	1436 (3376)	2462 (5457)	1.00 [1.00–1.01]
Ratio of money gambled per month/income	0.1 (0.3)	0.1 (0.2)	0.90 [0.12–6.98]	0.5 (0.5)	0.6 (0.8)	1.18 [0.78–1.80]
Familial antecedent of problem gambling	20.0%	9.4%	0.43 [0.11–1.70]	28.1%	21.7%	0.69 [0.31–1.54]
Age of initiation	19.8 (8.1)	16.8 (4.8)	0.93* [0.85–1.00]	18.1 (6.9)	16.8 (6.2)	0.97 [0.92–1.02]
Subjective feeling of having a gambling problem	–	–	–	91.2%	83.0%	0.45 [0.17–1.19]
Distorted cognitions						
Global score (/100)	34.1 (18.3)	38.6 (15.6)	1.02 [0.99–1.04]	49.6 (15.9)	55.0 (13.1)	1.02* [1.00–1.05]
Attitudes (/100)	49.3 (25.3)	61.5 (25.5)	1.02* [1.00–1.04]	59.9 (18.7)	71.5 (17.0)	1.04*** [1.01–1.06]
Strategies (/100)	37.4 (25.8)	45.2 (22.5)	1.01 [0.99–1.03]	46.7 (22.8)	54.9 (21.5)	1.02* [1.00–1.03]
Luck (/100)	34.2 (24.4)	34.9 (23.7)	1.00 [0.98–1.02]	41.2 (26.5)	39.8 (23.5)	1.00 [0.98–1.01]
Chasing (/100)	25.5 (20.3)	26.3 (21.8)	1.00 [0.98–1.02]	52.5 (21.2)	51.7 (17.7)	1.00 [0.98–1.02]
Emotions (/100)	24.3 (22.4)	25.4 (18.1)	1.00 [0.98–1.02]	47.8 (20.8)	57.1 (20.9)	1.02* [1.00–1.04]
Personality profile						
Novelty Seeking (/100)	42.6 (18.2)	56.5 (18.2)	1.04** [1.01–1.07]	60.2 (15.7)	60.0 (17.2)	1.00 [0.98–1.02]
Harm avoidance (/100)	43.7 (24.3)	36.5 (20.7)	0.99 [0.97–1.01]	43.7 (23.9)	43.4 (24.7)	1.00 [0.99–1.01]
Reward dependence (/100)	60.7 (19.5)	67.3 (16.2)	1.02 [0.99–1.05]	57.0 (18.1)	58.4 (19.0)	1.00 [0.98–1.02]
Persistence (/100)	48.8 (28.6)	60.0 (30.1)	1.01 [1.00–1.03]	49.0 (29.6)	52.3 (28.7)	1.00 [0.99–1.02]
Self-directedness (/100)	76.5 (18.5)	73.7 (16.3)	0.99 [0.97–1.02]	62.0 (18.1)	60.0 (19.4)	0.99 [0.98–1.01]
Cooperativeness (/100)	75.6 (15.3)	80.4 (11.4)	1.03 [0.99–1.06]	71.8 (15.2)	66.9 (15.5)	0.98 [0.96–1.00]

(continued)

Table 4. Continued

	Non-problem gamblers N = 82			Problem gamblers N = 181		
	Bank games of chance and skill N = 50 N (%) or M (SD)	Social games of chance and skill N = 32	Univariate OR [95% CI]	Bank games of chance and skill N = 135 N (%) or M (SD)	Social games of chance and skill N = 46	Univariate OR [95% CI]
Self-transcendence (/100)	33.3 (23.8)	29.6 (19.5)	0.99 [0.97–1.01]	28.1 (20.2)	22.5 (15.4)	0.98 [0.96–1.00]
Psychiatric comorbidities						
Mood disorders	44.0%	43.8%	0.99 [0.40–2.42]	48.1%	45.7%	0.94 [0.48–1.84]
Anxiety disorders	36.0%	15.6%	0.33* [0.11–1.00]	40.0%	28.3%	0.59 [0.29–1.23]
Addictive disorders	32.0%	43.8%	1.65 [0.66–4.13]	45.9%	47.8%	1.06 [0.54–2.07]
Antisocial personality disorder	4.0%	3.1%	0.77 [0.07–8.91]	5.2%	6.5%	1.31 [0.32–5.27]
Suicidal risk	16.0%	9.4%	0.54 [0.13–2.22]	25.9%	17.4%	0.60 [0.25–1.40]
ADHD in childhood	18.0%	9.4%	0.49 [0.12–1.96]	23.7%	26.1%	1.05 [0.48–2.26]

OR are Odds Ratios obtained at the first step of the analysis (univariate logistic regression). They are given in reference to the group of social games of chance and skill – i.e. if the OR is greater than 1, it means that the characteristic is found more in the group of gamblers of social games of chance and skill, and conversely.
Significant differences (i.e. p value < 0.05) are indicated in bold.
*p value < 0.05
**p value < 0.01
***p value < 0.001
Variables selected to be introduced in the multivariate analyses ($p < 0.25$) are highlighted in light grey.

($n = 46$) and gamblers of bank games of chance and skill ($n = 135$) within the PG sample. Univariate results indicated that the distinction between games depending on the expected value for problem gamblers is relatively close to that for non-problem gamblers. The main differences related to gambling severity, cognitive distortions and personality profile. From the 46 starting variables, 20 were introduced in the multivariate analyses ($p < 0.25$). The final model obtained with the multivariate logistic regression is provided in Table 5. The odd of being gamblers of social games of chance and skill rather than gamblers of bank games of chance and skill chance is higher for those who have a higher income (OR = 3.16), those who live alone (OR = 2.94), those who gambled preferentially on the Internet (OR = 10.96) and those with a high GABS-attitude score (OR = 1.04), and is lower for lower gambling frequencies (OR = 0.05). The model accounted for 26.3% of variance in the expected value in NPG.

Discussion

The objective of this study was to provide a new understanding of the link between preferred gambling activity and gamblers' profiles and gambling practices by distinguishing the specificities of types of gambling on a recreational or problematic level of gambling. Figure 2 is an attempt to summarise the findings of this study and shows the gamblers' profiles in relation to their preferred gambling activity.

If we consider the choice of the preferred gambling activity in NPG, it seems that older men prefer games with an element of skill. Pure chance games are more likely to be chosen for a possibly higher frequency of gambling. In addition, social games are found to be associated with greater cooperativeness (the essence of social games) and opportunities for higher stakes. The conviction in gambling attitudes thought to increase the probability of winning (assessed through the GABS-A score) is likely to be more important in social games. However, this result should be taken with caution, because the important component of skill could totally invalidate the concept of erroneous attitudes in poker. Indeed, some attitudes which are considered to be erroneous for pure chance games (keep calm even if you are not, feel confident, etc.) could be considered normal in the context of poker. As a consequence, a high GABS-attitude score in poker gamblers would not necessarily mean that they have a higher level of distorted cognitions, because it depends on the context of the game (Bouju, Grall-Bronnec, Quistrebert-Davanne, Hardouin, & Vénisse, 2013).

Table 5. Multivariate logistic regression analysis (final model) showing factors associated with a preference for social games.

		Multivariate OR	95% Confidence Intervals	p Value	Adjusted R^2
NPG	Age	0.87	0.81–0.93	<0.001	0.522
	Number of positive DSM-IV criteria	0.19	0.05–0.74	0.017	
	Higher money gambled in one day	1.12	1.03–1.21	0.007	
	GABS-attitude score	1.06	1.02–1.11	0.002	
	TCI-cooperation score	1.07	1.00–1.14	0.037	
PG	Level of income	3.16	1.03–9.75	0.045	0.263
	Marital status (single)	2.94	1.09–7.92	0.033	
	Internet as the preferred gambling medium	10.96	4.03–29.83	<0.001	
	Maximum frequency of gambling (Less than once a month)	0.20	0.05–0.74	0.016	
	GABS-attitude score	1.04	1.01–1.07	0.004	
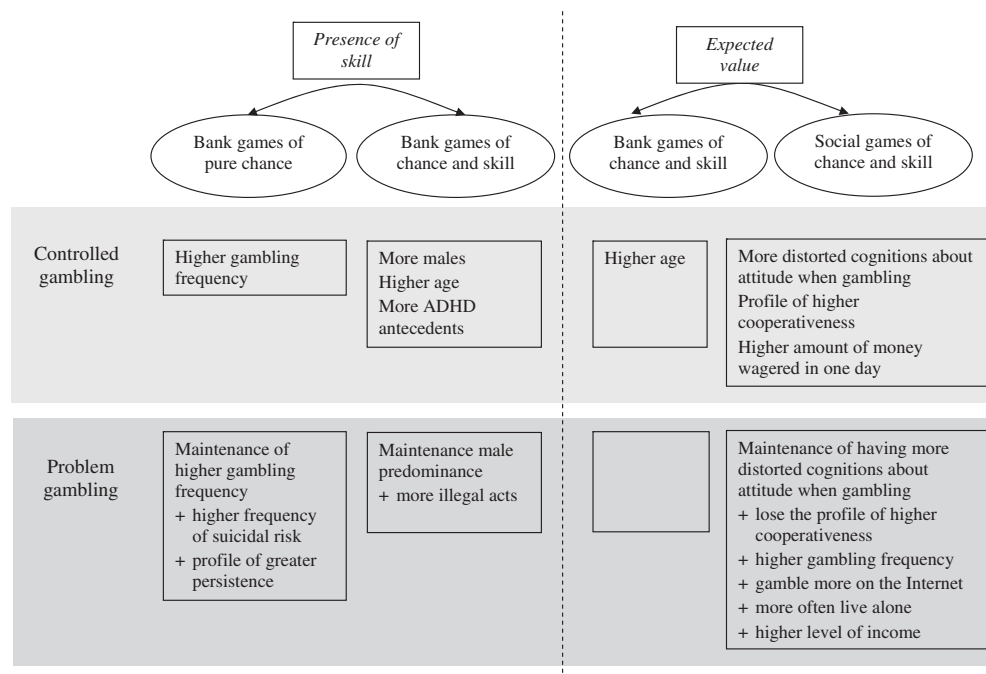
Figure 2. Gamblers' profiles in relation to their preferred gambling activity.
Note: This figure shows the features characterizing the types of gambling that appeared in PG compared to NPG. It should be read as an attempt to visually summarize the results of the multivariate analyzes (Tables 3 and 5) and was established to highlight the main and more clinically significant findings. The "plus" (+) indicate clinically relevant changes between NPG and PG. The number of positive DSM criteria in NPG was not represented because it was not considered relevant for NPG.
For example, non-problem gamblers of bank games of pure chance gambled more often than non-problem gamblers of bank games of chance and skill. When talking about problem gamblers, gamblers of bank games of pure chance still gambled more often, but had also higher frequency of suicidal risk and a profile of greater persistence.

Now, if we are interested in what changes in PG compared with NPG, we can see that the profiles do not differ in the same elements. If we compare the results of NPG with those of PG for each comparison made, we can see some additional features appearing in PG.

Firstly, concerning comparison based on the presence of skill in the game, a suicidal profile and higher persistence are emerging for bank games of pure chance at a problematic level of gambling. The relationship between high persistence and a possibly higher frequency of gambling could explain this result. The opportunity to gamble at high frequencies would accentuate persistence

with the game. Indeed, a high level of persistence is considered to be a maladaptive behaviour when rewards are intermittent with rapidly changing contingencies (Cloninger, Zohar, Hirschmann, & Dahan, 2012; Department of Psychiatry - Center for Well-being, 2014), which is especially true for games of pure chance. Conversely, bank games with an element of skill seem to be particularly associated with illegal acts at a problematic level of gambling.

Secondly, concerning the comparison of expected value of the game, several features appear for social games at a problematic level of gambling: higher

frequency of gambling, preference for Internet gambling, more likely to be living alone, with a higher level of income and loss of cooperativeness. The Internet is widely known to be an important risk factor for excessive gambling (Bouju et al., 2011; Griffiths, Wardle, Orford, Sproston, & Erens, 2009; Parke & Griffiths, 2007; Petry, 2006), particularly because of its easy accessibility. Here, it seems that the Internet reinforces addictive behaviour only in the case of social games. This would involve both the Internet's ability to increase the potential frequency of gambling, thus reinforcing gambling behaviour and the ease of Internet gambling when it becomes more complicated with the family. The opportunity for higher stakes may also increase the danger of social games, and high incomes would be particularly at risk of addictive drift. An important result is the loss of a highly cooperative profile at a problematic level of gambling, although that is the essence of social games.

Finally, contrary to what might have been expected and to what literature suggested (Lund, 2011), we did not obtain any significant results for gambling-related cognitions based on the chosen game. We particularly expected to find significant differences in gambling-related cognitions in the comparisons based on the presence of skill. The only result obtained concerned attitudes among social game gamblers, but this could not, itself, be considered to be a distortion, as we have explained above. Thus, gambling-related cognitions are not likely to differ according to preferred gambling activity. However, this does not mean that the work on gambling-related cognitions is not important in PG treatment programs, as it has demonstrated its effectiveness in the past (Gooding & Tarrier, 2009; Ladouceur et al., 2001, 2003; Petry et al., 2006), but rather that the distinction between the types of gambling would not necessarily be relevant in this context.

Limitations

Even if we tried to cover the whole range of gambling activities, it is certain that other types of gambling exist in addition to the nine mentioned. Moreover, the sample size for each type of gambling is very unbalanced. However, this overall sample size is rarely achieved for studies with semi-structured interviews. Another limitation is that the four regression models accounted for only 23.7–52.2% of variance in the presence of skill or expected value. This means that the profiles of gamblers based on the presence of skill or expected value are poorly explained by the models and that other variables are at play in addition to those tested (for example, locus of control, impulsivity, gambling motivations). Another

weakness of the study is that the diagnosis of a gambling problem was made based on the 10 criteria from the DSM-IV, because the DSM-5 was not published at the time of recruitment and baseline assessment (2009–2011). DSM-5 changes include: reclassification (from Impulse Control Disorder to Addiction), renaming (from Pathological Gambling to Gambling Disorder) and changes in diagnostic criteria and lowering of threshold for a diagnosis (removing of illegal acts criterion, reformulation of 3 criteria and threshold of 4 instead of 5) (Reilly & Smith, 2013). All these changes could have led to underestimate the prevalence of addiction compared to the DSM-IV. However, a recent study of the impact of DSM-5-related changes on prevalence rates and classification accuracy concluded that the new criteria yielded equivalent or slightly better classification accuracy in all comparisons and across all samples (Petry, Blanco, Stinchfield, & Volberg, 2013). Finally, we forced our participants to choose one preferred gambling activity out of all of those they had tried during their life. Consequently, gamblers with a multi-game profile were restricted to defining a single preferred gambling activity, and their particular profile was not considered separately.

Conclusions

The preference for one particular gambling activity may concern different profiles of gamblers, who might be receptive to very different kinds of care or preventive actions. For example, behavioural therapy focusing on the reduction of high levels of persistence would provide a great opportunity to reduce gambling problems in gamblers of bank games of pure chance. For gamblers of bank games with an element on skill, protective measures like guardianship could be particularly interesting in the therapeutic arsenal to avoid illegal behaviours and related harm. Working on cooperativeness with gamblers of social games, like poker, could also represent an interesting line of treatment: return to a controlled practice could be promoted by emphasising the game as a means of socialisation.

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