



Gambling as a form of risk-taking: Individual differences in personality, risk-accepting attitudes, and behavioral preferences for risk

Sandeep Mishra*, Martin L. Lalumière, Robert J. Williams

University of Lethbridge, Canada T1K4W1

ARTICLE INFO

Article history:

Received 19 March 2010

Received in revised form 12 May 2010

Accepted 27 May 2010

Available online 6 July 2010

Keywords:

Gambling
Risk-taking
Problem gambling
Attitudes
Impulsivity
Sensation-seeking
Self-control
Behavioral measures

ABSTRACT

Substantial evidence suggests that various forms of risk-taking co-occur within individuals. We examined whether indicators of risk-propensity, including self-reported personality traits, laboratory-based behavioral measures of risk, and self-reported attitudes toward risk in various domains were associated with general gambling involvement and problem gambling behavior in a sample of university students, using an extreme-groups design. Personality traits and attitudes toward risk were correlated with both problem gambling and general gambling involvement. Behavioral measures were positively correlated with general gambling involvement. Confirmatory factor analyses indicated that both problem gambling and general gambling involvement loaded on single factors with other measures of risk, suggesting that gambling represents one expression of a general propensity for risk-taking. Future study of the causes of gambling behavior may benefit from integration within a more general framework of risk-taking.

© 2010 Elsevier Ltd. All rights reserved.

1. Introduction

Gambling involves an element of risk, typically a high probability of loss against a smaller probability of large gain. More generally, risky endeavors are those involving variable outcomes. Gamblers engage in such endeavors, exposing money not only to negative expected outcomes, but also to uncertain or variable outcomes. Some gamblers also subject other aspects of their lives to risky outcomes, sometimes jeopardizing their jobs or families to maintain a habit with negative returns. It is unclear whether gamblers have a general affinity for risky outcomes or whether their risk-preference is specific only to the gambling domain.

1.1. The generality of risk

Various forms of risky behavior, including substance use, dangerous driving, promiscuous sex, and delinquency, co-occur within individuals (reviewed in Mishra & Lalumière, 2009). Gambling may be part of this general pattern of risk-acceptance. Gambling has been associated with various forms of risky behavior (e.g., Martins, Tavares, da Silva Lobo, Galetti, & Gentil, 2004; Powell, Hardoon, Derevensky, & Gupta, 1999; reviewed in Van Brunshot, 2009),

and shares instigative factors associated with general risky behavior (reviewed in Stinchfield, 2004). If gambling is part of a broader constellation of risk-accepting behaviors, then various aspects of personality, decision-making tendencies, and attitudes associated with risky behavior should also be associated with gambling tendencies.

1.2. Personality and risk-taking

Such personality traits as sensation-seeking, impulsivity, and low self-control have been associated with risky behavior in various domains (reviewed in Zuckerman, 2007). Sensation-seeking describes a preference for varied, stimulating experiences and a willingness to engage in risk-taking in order to obtain such experiences (Zuckerman, 1994). Impulsivity refers to a tendency to prefer short-term rewards, without planning or forethought, with the potential for immediate or future costs (Eysenck, Pearson, Easting, & Allsopp, 1985). Self-control, like impulsivity, is associated with a tendency to focus on temptations of the moment, ignoring long-term consequences (Marcus, 2003).

Impulsivity has been consistently associated with problem and pathological gambling (Blaszczynski, Steel, & McConaghy, 1997; Clarke, 2004; Franken, van Strien, Nijs, & Muris, 2008; Langewisch & Frisch, 1998; Myrseth, Pallesen, Molde, Johnsen, & Lorvik, 2009; Vitaro, Arseneault, & Tremblay, 1999). Sensation-seeking has been less consistently associated with gambling, with some studies

* Corresponding author. Address: University of Lethbridge, Department of Psychology, 4401 University Dr W, Lethbridge, AB, Canada T1K4W1. Tel.: +1 403 359 1544.

E-mail address: mishrs@gmail.com (S. Mishra).

suggesting problem gamblers exhibit higher levels of sensation-seeking (e.g., Cloninger, 1987), and others suggesting the opposite (e.g., Powell et al., 1999; reviewed in Hammelstein, 2004). The relationship of low self-control and gambling has not received much attention so far; one study found that a self-control scale differentiated problem and non-problem gamblers, with problem gamblers exhibiting lower self-control (Corless & Dickerson, 1989). Factors implicated in temporary reduction of self-control have also been associated with increases in gambling and risk-taking behavior (Baron & Dickerson, 1999; Corless & Dickerson, 1989; Freeman & Muraven, 2010).

1.3. Behavioral preferences for risk

Several laboratory tasks have been developed as behavioral measures of risk-taking, including the Choice Task (Mishra & Lalumière, 2010), the Balloon Analogue Risk Task (Lejuez et al., 2002), and the Variance Preference Task (Rode, Cosmides, Hell, & Tooby, 1999). In these tasks, scenarios are presented such that people's decisions reflect individual differences in risk-preference. Risk-preference as measured in laboratory settings has been associated with real-world risky behaviors, including addictive, health, and safety risk behaviors, risky sexual behaviors, substance use, and general delinquency (e.g., Lejuez, Aclin, Zvolensky, & Pedulla, 2003; Lejuez et al., 2002). These studies demonstrated that behavioral measures of risk explain additional variance in risk-taking above and beyond that accounted for by self-report personality traits such as impulsivity and sensation-seeking.

1.4. Attitudes toward risk

Attitudes toward risk may also play an important role in explaining gambling behavior. Risk-accepting attitudes have been correlated with such personality traits as sensation-seeking, impulsivity, and low self-control, and have been associated with self-reports of real-world risk-taking (Weber, Blais, & Betz, 2002). Instruments such as the Domain-Specific Risk Taking Scale (Weber et al., 2002) measure risk-accepting attitudes in various domains (e.g., financial, health, ethical, social, and recreational risk). Possessing risk-accepting attitudes in various domains may be associated with elevated gambling tendencies.

1.5. Overview

Personality traits associated with risk-acceptance, laboratory-based behavioral measures of risk, and attitudes toward risk have been correlated with various forms of real-world risky behavior. If gambling is a form of risk-taking, various measures of risk-propensity should be correlated with gambling behavior. We examined the relationship between gambling tendencies and personality traits associated with risk, behavioral measures of risk, and attitudes toward risk. We predicted that gambling tendencies would be significantly correlated with individual differences associated with non-gambling forms of risk-taking. Furthermore, we predicted that a one-factor solution should account for variance in gambling tendencies and individual differences associated with risk-taking.

2. Method

2.1. Participants

This study was comprised of two phases. In phase one, 240 participants (120 men), age 18–25 ($M = 20.3$, $SD = 1.9$) were recruited from undergraduate psychology classes and completed measures

of personality associated with risk-taking (sensation-seeking, impulsivity, and self-control). The same participants were used in Mishra and Lalumière (2010). Undergraduate students have been shown to exhibit relatively high levels of gambling behavior (e.g., Engwall, Hunter, & Steinberg, 2004; Winters, Bengston, Door, & Stinchfield, 1998), thus representing an appropriate population in which to investigate the relationship between gambling and risk-taking.

We conducted a principal components analysis (PCA) without rotation on measures of personality associated with risk-taking (sensation-seeking, impulsivity, and self-control). A single component, *risky personality*, explained 66.4% of the variance ($KMO = .69$). All measures on this factor loaded highly (all $>.70$) and positively. Scatterplots were used to examine homoscedasticity and linearity for all PCAs, with no obvious deviations observed. Rotation was not used because of high intercorrelation among the three variables, increasing the likelihood of maximal variance being extracted without rotation. Similar results were obtained using an oblique rotation.

The risky personality component was used to select participants for the second phase of the experiment. Those phase one participants scoring highest (20 males, 19 females), lowest (19 males, 23 females), and in the middle (19 males, 15 females) of the sex-specific distribution of risky personality participated in phase two of the experiment, following a within-sex extreme-groups design. Phase two participants were 58 men and 57 women (age: $M = 20.0$, $SD = 2.0$). Participants comprised 65 non-problem gamblers (60.2%), 27 low-risk gamblers (25.0%), 15 problem gamblers (13.9%), and one pathological gambler (.9%), as measured by the PGSI (described below).

2.2. Measures

2.2.1. Personality

2.2.1.1. *Zuckerman's Sensation Seeking Scale (SSS-V)*. The Sensation Seeking Scale, Version 5 (Zuckerman, 1994), consists of 40 choices between pairs of antithetical statements about preferences for varied, stimulating experiences and disinhibited behavior. A total score was obtained by summing the number of high sensation-seeking choices.

2.2.1.2. *Eysenck's Impulsivity Scale (EIS)*. The EIS (Eysenck et al., 1985) consists of 19 yes/no statements about impulsive behaviors. A total score was obtained by summing the number of "yes" answers.

2.2.1.3. *Retrospective Behavioral Self-control Scale (RBS)*. The RBS (Marcus, 2003) measures behaviors across the lifespan associated with low self-control. It consists of 67 items, measuring the frequency of behaviors associated with low self-control in childhood, adolescence, and adulthood. Behaviors were rated on a scale from 1 (*never*) to 7 (*always*). A total score was obtained by summing ratings of frequency of engagement in risky behavior. Higher scores indicated lower self-control.

2.2.2. Risk-attitudes

2.2.2.1. *Domain-Specific Risk Taking Scale (DOSPERT)*. The DOSPERT (Weber et al., 2002) is a self-report measure of likelihood of engagement in 60 risky behaviors in five content domains: (financial, health/safety, recreational, ethical, and social). Behaviors were rated on a scale from 1 (*extremely unlikely*) to 5 (*extremely likely*). A total score was obtained by summing all of the items.

2.2.3. Behavioral measures of risk

2.2.3.1. *Choice task (CT)*. Participants made six decisions, each between two monetary options (Mishra & Lalumière, 2010). Both options had equal mean expected values, but differed in payoff

variance (e.g., “Would you rather choose (A) \$3 guaranteed, or (B) a 30% chance of earning \$10?”). At the end of the task, participants rolled a die and received the value of one of the six choices they made corresponding with the number on the die. A total score of number of risky choices was computed (0–6).

2.2.3.2. Variance Preference Task (VPT). Participants chose one of two options (Rode et al., 1999): (1) “Choose one of two cups, one with 100 black beads (Cup A), and one with 100 white beads (Cup B). You are allowed to pick either Cup A or Cup B (without knowing what each contains), and draw 10 beads from that single chosen cup; or (2) “A single cup that contains a random combination of white and black beads totaling 100. You are allowed to draw 10 beads from this cup, replacing each bead after drawing it.” Participants earned \$1 for each black bead drawn. Option 1 is a riskier option (all-or-nothing) than Option 2. A binary score of risky/not-risky was computed.

2.2.3.3. Balloon Analogue Risk Task (BART). Participants saw a computer screen with a deflated balloon and a “PUMP” button (Lejuez et al., 2002). For each pump of the balloon, participants earned one cent and increased the balloon in size. The balloon was set to pop randomly, with an average of 65 pumps required before popping. If the balloon popped, participants lost all money gained for that trial. Participants could end the trial at any time by clicking on a “COLLECT” button. Thirty trials were presented; the first five were excluded from analysis as training. The average number of pumps for all trials where the balloon did not pop was computed (Lejuez et al., 2002).

2.2.4. Gambling

2.2.4.1. Problem Gambling Severity Index (PGSI). The PGSI (Ferris & Wynne, 2001) is a nine-item self-report measure of problem and pathological gambling behavior, based on behavior in the last 12 months. Engagement in various gambling behaviors were rated on a scale from 0 (*never*) to 3 (*almost always*). The PGSI categorizes an individual's gambling tendencies into one of four types: non-problem gambling, low-risk gambling, moderate problem gambling, and severe problem (pathological) gambling. For analysis, we used a continuous total score of 0–27.

2.2.4.2. Gambling involvement. Self-reports of (1) total number of different gambling activities engaged in, and (2) monthly frequency of gambling (both over the past year) were obtained (Williams & Connolly, 2006).

2.3. Procedure

Phase one participants completed paper questionnaires consisting of the personality measures in small groups. Phase two participants were tested individually at computer stations, and completed the behavioral measures and the gambling measures. After each task, participants called the experimenter to make any relevant draws and collect earnings, denoted with poker chips (making earnings tangible). Earnings were exchanged at the end of the session for a cheque. All questionnaires and tasks were presented in random order. Average earnings were \$44.38 (*SD*: \$22.54, *Range*: \$10.75–\$106.50).

3. Results

3.1. Data preparation and reduction

All data were normally distributed, except for the BART, two DOSPERT subscales (social, gambling), PGSI, and days per month

spent gambling. All data were normalized using logarithmic transformations, except for DOSPERT gambling and days per month spent gambling, which could only be normalized using inverse transformations. There were seven missing PGSI values. These participants were excluded from all relevant analyses. Other missing values ($n = 1$ for RBS, EIS, SSS-V, DOSPERT; $n = 2$ for SSS-V) were imputed with the series mean. Three outliers were detected for days per month spent gambling; these values were winsorized. Scatterplots were used to examine homoscedasticity and linearity for all PCAs; no violations were observed. To simplify subsequent analyses involving gambling tendencies, a composite variable, *general gambling involvement* (GGI), was computed by summing z -scores of the two gambling involvement behaviors.

3.2. Gambling and risk-acceptance

Descriptive statistics are provided in Table 1. Correlations between measures of gambling, personality traits, and behavioral measures of risk are shown in Table 2. Impulsivity, sensation-seeking, and low self-control were significantly associated with both problem gambling (PG) and GGI. Behavioral measures of risk were less strongly associated with gambling behavior. Correlations between measures of gambling and attitudes toward risk are shown

Table 1
Descriptive statistics for gambling measures, personality traits associated with risk, and behavioral measures of risk-preference ($N = 115$).

	Mean (Std. Dev.)	Alpha
<i>Gambling measures</i>		
PGSI	.94 (1.5)	.63
GGI	.00 (1.9)	–
<i>Personality traits</i>		
EIS	.39 (.21)	.78
SSS-V	.52 (.16)	.84
RBS	145.8 (50.9)	.95
<i>Risk-attitudes</i>		
D-I	12.5 (3.3)	.70
D-G	6.1 (3.5)	.90
D-H	21.2 (5.5)	.66
D-R	26.1 (7.2)	.83
D-S	28.8 (4.5)	.58
D-E	16.8 (6.1)	.82
D-T	111.4 (20.7)	–
<i>Behavioral measures</i>		
VPT	.00 (1.0)	–
CT	2.1 (1.6)	–
BART	33.0 (15.0)	–

Notes: All means reported reflect untransformed, raw scores. Attitudes toward investment (D-I), gambling (D-G), health (D-H), recreational (D-R), social (D-S), and ethical (D-E) risk are abbreviated. D-T = total risk-accepting attitude score; PGSI = problem gambling; GGI = general gambling involvement; EIS = impulsivity, SSS-V = sensation-seeking, RBS = low self-control, VPT = variance preference, BART = balloon analogue risk-taking, CT = choice task.

Table 2
Correlations between gambling measures, personality traits associated with risk, and behavioral measures of risk-preference ($N = 115$).

	GGI	EIS	SSS-V	RBS	VPT	BART	CT
PGSI	.433**	.207*	.240*	.393**	.032	.053	.106
GGI		.320**	.298**	.238*	.206*	–.001	.128
EIS			.459**	.541**	.052	.103	.156*
SSS-V				.491**	.055	.158*	.119
RBS					–.016	.052	.120
VPT						.142	.000
BART							.202*

Notes: See note for Table 1 for abbreviations. All tests are one-tailed (** = significant with Bonferroni correction; * = significant without Bonferroni correction; $\alpha = .05$).

Table 3
Correlations between gambling measures and risk-attitudes ($N = 115$).

	D-I	D-G	D-H	D-R	D-S	D-E	D-T
PGSI	.204*	.413**	.312**	.139	.017	.371**	.359**
GGI	.196*	.368**	.318**	.179*	.093	.403**	.373**
D-I		.277**	.222*	.248*	.361**	.381**	.538**
D-G			.386**	.306**	.090	.495**	.573**
D-H				.516**	.321**	.619**	.801**
D-R					.290**	.346**	.738**
D-S						.290**	.549**
D-E							.783**

Notes: See note for Table 1 for abbreviations. All tests are one-tailed (** = significant with Bonferroni correction; * = significant without Bonferroni correction; $\alpha = .05$).

Table 4
Results of PCAs on (A) problem gambling and risk measures, and (B) general gambling involvement and risk measures ($N = 115$).

Measure	Loading
(A)	
SSS-V	.782
EIS	.727
RBS	.800
D-T	.832
VPT	.084
CT	.261
BART	.195
PGSI	.531
(B)	
SSS-V	.800
EIS	.743
RBS	.744
D-T	.831
VPT	.164
CT	.268
BART	.240
GGI	.546

Notes: See Table 1 for abbreviations.

in Table 3. PG was associated with risk-accepting attitudes in all domains except recreational and social risk. GGI was associated with risk-accepting attitudes in all domains except for social risk.

Men scored significantly higher than women on all raw and composite measures in this study, with the exception of the CT and the investment and social scales of the DOSPERT. Fisher's Z -tests indicated that correlation magnitudes significantly differed ($ps < .05$) between men and women for seven of 64 comparisons. After Bonferroni correction for multiple comparisons, however, no significant differences remained. Consequently, data from men and women were combined for all subsequent analyses.

3.3. The structure of risk and gambling measures

If gambling represents a manifestation of general risk-acceptance, a single factor should underlie all measures of risk and gambling. Two confirmatory factor analyses were conducted to examine whether PG and GGI loaded on single factors along with other measures of risk. Separate analyses were conducted for PG and GGI because they appear to comprise distinct patterns of gambling behavior (Williams, West, & Simpson, 2008).

3.3.1. Problem gambling

A goodness-of-fit test using the maximum likelihood procedure indicated that a one-factor model adequately accounted for the underlying variance in risk measures and PGSI, $\chi^2(20) = 18.06$,

$p = .58$ (KMO = .78). PCA indicated that one factor explained 35.8% of the variance in measures of risk and PG (Table 4A).

3.3.2. General gambling involvement

A goodness-of-fit test using the maximum likelihood procedure indicated that a one-factor model adequately accounted for the underlying variance in risk measures and GGI, $\chi^2(20) = 25.30$, $p = .19$ (KMO = .76). PCA indicated that one factor explained 36.1% of the variance in measures of risk and GGI (Table 4B).

A goodness-of-fit test including both PG and GGI indicated that a one-factor model still adequately accounted for underlying variance in all measures, $\chi^2(27) = 38.89$, $p = .07$ (KMO = .75). PCA indicated that one factor explained 34.5% of variance in measures of risk and gambling.

3.4. Predicting problem gambling and general gambling involvement

PGSI and GGI scores were regressed on three blocks of variables (in order): personality traits associated with risk (SSS-V, EIS, RBS), behavioral measures of risk (CT, VPT, BART), and risk-accepting attitudes (DOSPERT subscales: investment, health, recreational, social, ethical, and gambling). The order of blocks was chosen such that established correlates of gambling tendencies, such as impulsivity and sensation-seeking, would be allowed to account for as much variance as possible in PG and GGI before other measures were allowed to do so. This hierarchical method allowed for quantification of the degree to which behavioral measures of risk and attitudes toward risk explained variance above and beyond established personality correlates of gambling.

3.4.1. Problem gambling

Personality traits associated with risk significantly predicted PG as measured by the PGSI, adjusted $R^2 = .13$, $p < .001$. The only significant individual predictor was low self-control, $\beta = .375$, $p = .001$. Behavioral measures of risk did not significantly add to variance explained in PG, R^2 change = .005, $p = .90$. Risk-accepting attitudes significantly added to the variance explained in PG, R^2 change = .13, $p = .01$, with attitudes toward gambling as the only significant predictor, $\beta = .342$, $p = .004$.

3.4.2. General gambling involvement

Personality traits associated with risk significantly predicted GGI (adjusted $R^2 = .11$, $p = .001$). The only significant individual predictor was impulsivity, $\beta = .220$, $p = .05$. Behavioral measures of risk marginally added to variance explained, above and beyond personality traits associated with risk, R^2 change = .05, $p = .10$. VPT was the only significant individual predictor, $\beta = .213$, $p = .02$. Risk-accepting attitudes also marginally added to variance explained in GGI, R^2 change = .09, $p = .06$, with no significant individual predictors.

4. Discussion

The results indicate that individual differences in personality traits associated with risk, behavioral preferences for risk, and attitudes toward risk are associated with gambling behavior. A single factor accounted for variance among all measures of risk and gambling tendencies. Regression analyses indicated that attitudes toward risk and behavioral preferences for risk explain variance in gambling behavior above and beyond personality traits toward risk. Together, the results provide support for the hypothesis that gambling is a form of more general risk-taking.

4.1. Personality and gambling

Both PG and GGI were predicted by personality traits associated with risk. Sensation-seeking and impulsivity were not significant individual predictors of PG when self-control was included in a regression model. Impulsivity has been shown to be a robust predictor of problem PG (e.g., Blaszczynski et al., 1997; Clarke, 2004; Langewisch & Frisch, 1998). In the present study, however, impulsivity was not a significant predictor of PG when included in a regression with other measures of personality traits associated with risk. Rather, self-control was the best predictor of PG. Because impulsivity and self-control are similar constructs, it is possible that the relationship between PG and impulsivity may be a byproduct of a stronger relationship between PG and low self-control. A partial correlation between PG and impulsivity controlling for low self-control was not significant, $r = -.011$, $p = .91$, whereas a partial correlation between PG and low self-control controlling for impulsivity remained significant, $r = .340$, $p < .001$, suggesting that low self-control is an important, but understudied, personality trait associated with PG. Unlike PG, GGI was better predicted by sensation-seeking and impulsivity than self-control. A lack of self-control may lead to PG, whereas a more general preference for varied, stimulating experiences may lead to gambling behavior more generally (e.g., Langewisch & Frisch, 1998). Further research is required to better understand associations between impulsivity, self-control, and gambling behavior.

4.2. Attitudes toward risk

Beyond personality traits, additional variance in PG and GGI was explained by positive attitudes toward risk, especially specific attitudes toward gambling. Attitudes toward risk may therefore represent an important component of gambling behavior. Risk-accepting attitudes toward gambling were highly and significantly associated with risk-accepting attitudes in most other domains of risk, lending support to the notion that gambling-related attitudes are a component of more general risk-accepting attitudes. Attitudes toward risk have been largely unstudied in the context of gambling, and as such, future research should integrate attitude measures to better understand motivational mechanisms that may facilitate gambling behavior.

4.3. Behavioral measures of risk

A behavioral preference for risky outcomes was marginally associated with GGI, but not PG. Behavioral measures of risk tap into interest for variable outcomes, suggesting that non-problem gamblers may be attracted to the variability inherent in gambling outcomes. That a behavioral preference for risky outcomes was not associated with PG is puzzling, although it is somewhat consistent with previous findings (Vigil-Colet, 2007). Problem gamblers may be initially attracted to gambling due to the appeal of variable outcomes with high reward potential, but may maintain the behavior for other reasons, such as low self-control leading to an inability to resist further engagement in a self-defeating behavior. Increased arousal to positive outcomes, comorbid psychiatric disorders, gambling-related irrational beliefs, or other social or situational factors may also contribute to the maintenance of PG (reviewed in Williams et al., 2008).

4.4. Limitations

Two confirmatory factor analyses demonstrated that one-factor solutions effectively explained common variance in both forms of gambling and other measures associated with risk-propensity. The loadings on these factors were highest for personality traits

associated with risk, risk-accepting attitudes, and the two gambling measures. A behavioral preference for risk did not load as highly on these two factors. Shared method variance may play a role in explaining these findings: In this study, all measures of risk-propensity, with the exception of behavioral measures of risk, were presented in questionnaire form.

Our sample was comprised of university students, a population that has been shown to exhibit high levels of gambling behavior (e.g., Engwall et al., 2004; Winters et al., 1998). We maximized variance on personality traits of interest by utilizing an extreme-groups approach, which demonstrably increases statistical power in situations with constrained variability in measures of interest (Preacher, Rucker, MacCallum, & Nicewander, 2005). Nevertheless, further study of individual differences and gambling behavior should utilize more diverse and representative populations of gamblers.

Other individual differences in personality have been implicated in the production of gambling behavior, including perfectionism, positive urgency, and the Big Five personality traits (e.g., Bagby et al., 2007; Brand & Altstotter-Gleich, 2008; Cyders & Smith, 2008). Future studies examining the association between individual differences in personality and gambling behavior should integrate a wider array of personality measures.

5. Conclusions

Both GGI and PG share common variance with various measures of risk-propensity. This finding, in addition to the positive correlations between personality traits associated with risk, risk-attitudes, and gambling, adds to a growing literature suggesting there are common determinants for gambling and risk-taking. Future research should integrate the measurement of individual differences in general risk-propensity with other established determinants of gambling (e.g., presence of an early win, parental gambling, ethnicity, proximity to gambling opportunities; Williams et al., 2008) in order to gain a better understanding of the various causal mechanisms underlying gambling behavior.

Acknowledgements

Funding for this study was provided by an Alberta Gaming Research Institute grant to S.M., M.L.L. and R.J.W., and a Social Sciences and Humanities Research Council CGS Fellowship to S.M.

References

- Bagby, R. M., Vachon, D. D., Bulmash, E. L., Toneatto, T., Quilty, L. C., & Costa, P. T. (2007). Pathological gambling and the five-factor model of personality. *Personality and Individual Differences*, 43, 873–880.
- Baron, E., & Dickerson, M. (1999). Alcohol consumption and self-control of gambling behaviour. *Journal of Gambling Studies*, 15, 3–15.
- Blaszczynski, A., Steel, Z., & McConaghy, N. (1997). Impulsivity in pathological gambling: The antisocial impulsivist. *Addiction*, 92, 75–87.
- Brand, M., & Altstotter-Gleich, C. (2008). Personality and decision-making in laboratory gambling tasks – Evidence for a relationship between deciding advantageously under risk conditions and perfectionism. *Personality and Individual Differences*, 45, 226–331.
- Clarke, D. (2004). Impulsivity, locus of control, motivation, and problem gambling. *Journal of Gambling Studies*, 4, 319–345.
- Cloninger, C. R. (1987). A systematic method for clinical description and classification of personality variants. *Archives of General Psychiatry*, 44, 573–588.
- Corless, T., & Dickerson, M. (1989). Gamblers' self-perceptions of the determinants of impaired control. *British Journal of Addiction*, 84, 1527–1537.
- Cyders, M. A., & Smith, G. T. (2008). Clarifying the role of personality dispositions in risk for increased gambling behavior. *Personality and Individual Differences*, 45, 503–508.
- Engwall, D., Hunter, R., & Steinberg, M. (2004). Gambling and other risk behaviors on university campuses. *Journal of American College Health*, 52, 245–256.
- Eysenck, S. B. G., Pearson, P. R., Easting, G., & Allsopp, J. F. (1985). Age norms for impulsiveness, venturesomeness and empathy in adults. *Personality and Individual Differences*, 6, 613–619.

- Ferris, J., & Wynne, H. (2001). *The Canadian problem gambling index: Final report* (Submitted to the Canadian Centre on Substance Abuse). Ottawa, Ontario: Canadian Centre on Substance Abuse.
- Franken, I. H. A., van Strien, J. W., Nijs, I., & Muris, P. (2008). Impulsivity is associated with behavioral decision-making deficits. *Psychiatry Research*, *158*, 155–163.
- Freeman, N., & Muraven, M. (2010). Self-control depletion leads to increased risk taking. *Social Psychological and Personality Science*, *1*, 175–181.
- Hammelstein, P. (2004). Faites vos jeux! Another look at sensation seeking and pathological gambling. *Personality and Individual Differences*, *37*, 917–931.
- Langewisch, M. W. J., & Frisch, G. R. (1998). Gambling behaviour and pathology in relation to impulsivity, sensation seeking, and risky behaviour in male college students. *Journal of Gambling Studies*, *14*, 245–262.
- Lejuez, C. W., Aklin, W. M., Zvolensky, M. J., & Pedulla, C. M. (2003). Evaluation of the Balloon Analogue Risk Task (BART) as a predictor of adolescent real-world risk-taking behaviors. *Journal of Adolescence*, *26*, 475–479.
- Lejuez, C. W., Read, J. P., Wahler, C. W., Richards, J. B., Ramsey, S. E., Stuart, G. L., et al. (2002). Evaluation of a behavioral measure of risk-taking: The Balloon Analogue Risk Task (BART). *Journal of Experimental Psychology: Applied*, *8*, 75–84.
- Marcus, B. (2003). An empirical examination of the construct validity of two alternative self-control measures. *Educational and Psychological Measurement*, *63*, 674–706.
- Martins, S. S., Tavares, H., da Silva Lobo, D. S., Galetti, A. M., & Gentil, V. (2004). Pathological gambling, gender, and risk-taking behaviors. *Addictive Behaviors*, *29*, 1231–1235.
- Mishra, S., & Lalumière, M. L. (2009). Is the crime drop of the 1990s in Canada and the USA associated with a general decline in risky and health-related behaviors? *Social Science and Medicine*, *68*, 39–48.
- Mishra, S., & Lalumière, M. L. (2010). You can't always get what you want: The motivational effect of need on risk-sensitive decision-making. *Journal of Experimental Social Psychology*, *46*, 605–611.
- Myrseth, H., Pallesen, S., Molde, H., Johnsen, B. H., & Lorvik, I. M. (2009). Personality factors as predictors of pathological gambling. *Personality and Individual Differences*, *47*, 933–937.
- Powell, J., Hardoon, K., Derevensky, J. L., & Gupta, R. (1999). Gambling and risk-taking behavior among university students. *Substance Use & Misuse*, *34*, 1167–1184.
- Preacher, K. J., Rucker, D. D., MacCallum, R. C., & Nicewander, W. A. (2005). Use of the extreme groups approach: A critical reexamination and new recommendations. *Psychological Methods*, *10*, 178–192.
- Rode, C., Cosmides, L., Hell, W., & Tooby, J. (1999). When and why do people avoid unknown probabilities in decisions under uncertainty? Testing some predictions from optimal foraging theory. *Cognition*, *72*, 269–304.
- Stinchfield, R. (2004). Demographic, psychosocial, and behavioural factors associated with youth gambling and problem gambling. In J. L. Derevensky & R. Gupta (Eds.), *Gambling problems in youth: Theoretical and applied perspectives*. New York: Kluwer.
- Van Brunschot, E. G. (2009). Gambling and risk behaviour: A literature review. *Report prepared for the Alberta Gaming Research Institute*.
- Vigil-Colet, A. (2007). Impulsivity and decision making in the balloon analogue risk-taking task. *Personality and Individual Differences*, *43*, 37–45.
- Vitaro, F., Arseneault, L., & Tremblay, R. E. (1999). Impulsivity predicts problem gambling in low SES adolescent males. *Addiction*, *94*, 565–575.
- Weber, E. U., Blais, A. R., & Betz, N. E. (2002). A domain-specific risk-attitude scale: Measuring risk perceptions and risk behaviors. *Journal of Behavioral Decision Making*, *15*, 263–290.
- Williams, R. J., & Connolly, D. (2006). Does learning about the mathematics of gambling change gambling behavior? *Psychology of Addictive Behaviors*, *20*, 62–68.
- Williams, R. J., West, B. L., & Simpson, R. I. (2008). Prevention of problem and pathological gambling: A comprehensive review of the evidence. *Report prepared for the Ontario Problem Gambling Research Centre*.
- Winters, K. C., Bengston, P., Door, D., & Stinchfield, R. (1998). Prevalence and risk factors of problem gambling among college students. *Psychology of Addictive Behaviors*, *12*, 127–135.
- Zuckerman, M. (1994). *Behavioural expressions and biosocial bases of sensation seeking*. Cambridge: Cambridge University Press.
- Zuckerman, M. (2007). *Sensation seeking and risky behavior*. Washington, DC: American Psychological Association.