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Personality and Gambling Involvement: A Person-Centered Approach

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Individual differences in personality are likely to play an important role in explaining the propensity to gamble. One of the potential roadblocks to elucidating the relation between personality and gambling may be inadequately accounting for the diversity of gambling activities. The goal of the present study was to provide a comprehensive and nuanced portrait of the relation between personality and gambling by taking a multivariate approach to the co-use of multiple gambling activities and employing a broad inventory of potentially relevant personality dimensions. Participants were 4,669 individuals from a national Australian twin registry. Structured interviews including an extensive assessment of gambling behaviors were conducted, and personality questionnaires that included the Multidimensional Personality Questionnaire, the Sensation Seeking Scale, and the Magical Ideation Scale were completed. A latent class analysis of past-year involvement in 10 different gambling activities was performed to classify the participants into 5 groups. Unique personality configurations characterized the 3 more gambling-involved latent classes: (a) low behavioral control in the context of high negative emotionality and magical thinking typified extensive, versatile gamblers at high risk of gambling problems; (b) average behavioral control in the context of high negative emotionality and magical thinking typified those who primarily gambled on non-strategic games of chance; (c) low behavioral control in the context of high positive emotionality and low magical ideation typified those who primarily gambled on strategic games of skill. This study illustrates the value of using a multivariate person-centered approach for characterizing the personality correlates of the multifaceted phenomenon that is gambling.

Keywords: personality, gambling, disordered gambling, latent class analysis, twins

Personality traits represent characteristic ways of thinking, feeling, and behaving and are robust predictors of health-risk behaviors such as unsafe sex and dangerous driving habits (Krueger et al., 2000); important life outcomes like educational attainment, divorce, and longevity (Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007); and mental disorders (Krueger et al., 2000). An extensive literature implicates the role that personality traits play in shaping behavior, including behavioral disorders such as disordered gambling (Slutske, Caspi, Moffitt, & Poulton, 2005). It is therefore surprising that a consensus has not yet been reached about the personality traits that are related to the propensity to gamble. Understanding the role that personality plays in influencing gambling behaviors has the potential to elucidate the individual-level etiology of disordered gambling and may have implications for treatment; for example, an individual whose gambling is motivated by negative affect may require a different treatment approach than one who is driven by impulsivity.

The diversity of gambling activities poses a challenge when trying to understand the relation between personality and gambling. For example, the term "gambling" is used to describe a widely varying array of activities, ranging from purchasing a lottery ticket at the local convenience store to betting on a horse at the Kentucky Derby. Experts have raised concerns about the common practice of lumping together involvement in different activities in studies of the correlates of gambling (Coventry & Brown, 1993; Dickerson, 1993; Zuckerman, 2005) and have suggested that this practice may be contributing to the contradictory findings that are frequently found in the literature (Griffiths, 2013). Considering the variety of available activities that are considered gambling, the diversity of settings in which they take place, and the differences in rewarding and reinforcing properties between activities, there is likely an equally wide array of individual differences in motivations for choosing particular activities. In this regard, personality may play a strong role in shaping an individual's gambling activity preferences and behaviors. Therefore, studying all gamblers without considering activity types may obscure true associations between gambling and personality.

One solution is to examine the correlates of specific gambling activities in isolation. A number of studies have reported the personality correlates of participation in off-course betting (e.g.,

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Coventry & Brown, 1993; McDaniel & Zuckerman, 2003), sports betting (e.g., McDaniel & Zuckerman, 2003; Mowen, Fang, & Scott, 2009), slot machine gambling (e.g., Dickerson, 1993; McDaniel & Zuckerman, 2003), lottery gambling (e.g., Balabanis, 2002; McDaniel & Zuckerman, 2003; Mowen et al., 2009), and online gambling (e.g., Mowen et al., 2009). Even when limiting the focus to individual activities, however, a clear picture of the personality correlates of gambling involvement still does not emerge. For example, off-course betting was inversely related to sensation seeking among men in one study (Coventry & Brown, 1993) and unrelated to sensation seeking among men in another (McDaniel & Zuckerman, 2003). Lottery gambling was associated with the Big Five personality dimensions of high extraversion and low agreeableness in one study (Balabanis, 2002) and with none of the Big Five personality dimensions in another (Mowen et al., 2009). Given that there are at least 11 different types of regulated gambling activities (National Research Council, 1999), studying each in isolation could easily lead to an overwhelming array of findings to synthesize. More importantly, this approach ignores the fact that most people who gamble do not restrict themselves to a single activity (Holtgraves, 2009; LaPlante, Nelson, LaBrie, & Shaffer, 2011).

An alternate approach has been to characterize the *versatility* of gambling involvement, that is, a count of the number of different gambling activities in which an individual has participated (Coventry & Brown, 1993; McDaniel & Zuckerman, 2003; Zuckerman & Kuhlman, 2000). For example, in a sample of 790 participants from the general population, gambling versatility was significantly associated with impulsivity and sensation seeking (McDaniel & Zuckerman, 2003). Although versatility of gambling has proven to be an important correlate of disordered gambling (Welte, Barnes, Wieczorek, Tidwell, & Parker, 2004; LaPlante et al., 2011), it still may not fully capture important individual differences in gambling behavior. For example, two individuals obtaining the same score on a gambling versatility scale may have obtained the score by participating in completely different activities. An ideal approach to characterizing gambling involvement would be one that recognizes that individuals do not always restrict themselves to a single gambling activity and that also takes into account the actual activities in which a gambler has been engaged.

A multivariate statistical technique that can be used to characterize patterns of gambling involvement is latent class analysis (LCA; McCutcheon, 1987; Collins & Lanza, 2010). LCA is used to detect qualitatively distinct classes that underlie the associations between a set of categorical indicators. LCA is a person-centered, rather than a variable-centered, approach to data reduction. In the case of participation in different gambling activities, LCA can be used to empirically sort observations into a smaller number of groups whose members are similar to each other in their patterns of gambling involvement. Several previous studies have used LCA to sort individuals into latent classes based on their gambling activity participation (Boldero, Bell, & Moore, 2010; Faregh & Leth-Steensen, 2011), but to our knowledge, only one has used the results to examine personality correlates of gambling involvement (Goudriaan, Slutske, Krull, & Sher, 2009). However, only one personality trait was measured in this previous study because examining the personality correlates of gambling was not the primary focus.

Goudriaan et al. (2009) conducted a four-wave longitudinal study of gambling in a sample of 3,720 college students. An LCA based on past-year involvement in each of 10 gambling activities found that participants fell into four classes: a large class that was comprised of students who were unlikely to have participated in any of the 10 gambling activities assessed, and three smaller classes that were comprised of (a) students who favored gambling at a casino and playing slot machines, (b) students who were especially likely to play card games for money, and (c) students who were likely to have participated in all 10 of the different gambling activities that were assessed. There were significant mean differences between the four latent classes on scores on the novelty seeking scale from the Tridimensional Personality Questionnaire (Cloninger, Przybeck, & Svrakic, 1991; Sher, Wood, Vandiver, & Crews, 1995). The three classes of gambling-involved students had higher novelty seeking scores than the relatively gambling non-involved students, and across the three more gambling-involved classes, the extensively involved students had higher scores than the primarily card-playing students, who in turn had higher scores than the primarily casino/slot machine gambling students. One obvious caveat is that the study included only college students who, for much of the study, were not legally able to access many regulated forms of gambling. The consequence of this is that many gambling activity patterns could not be observed, and when they were observed they might have been a result of illicit gambling. In other words, the results may not be generalizable to adult samples. Nonetheless, this study nicely illustrates the utility of LCA in aggregating information about involvement in different gambling activities—reducing it down from 10 activities to four meaningful clusters of people.

The purpose of the present study was to conduct a comprehensive examination of the relation between personality and gambling involvement in a large community-based sample of adult Australian twins, in the spirit of what Krueger and colleagues have termed "epidemiological personology" (Krueger, Caspi, & Moffitt, 2000). LCA was used as a data reduction method (Uebersax, 2013) to more parsimoniously characterize the gambling involvement in the sample. There were several innovative aspects to this study: the participants were adults from the general population, the study was conducted in Australia, a heavy gambling milieu (Slutske et al., 2009), and a broad assessment of personality was conducted. The personality assessment included (a) a measure that has been ubiquitously used in gambling research, the Sensation Seeking Scale (Zuckerman, 1971); (b) an omnibus Big Three personality measure, the Multidimensional Personality Questionnaire (Tellegen & Waller, 2008); and (c) a measure to index levels of general superstitious thinking (Joukhador, Blaszczynski, & McCallum, 2004), the Magical Ideation Scale (Eckblad & Chapman, 1983). The goal was to provide a complete and nuanced portrait of the relation between personality and gambling by combining the use of a gambling-enriched sample, a broad inventory of potentially relevant personality dimensions, and a multivariate person-centered approach to the co-use of multiple gambling activities. The research was guided by the following hypotheses:

> *Hypothesis 1:* Different patterns of gambling involvement will be incrementally associated with personality traits, even after taking into account the frequency and versatility of gambling.

Hypothesis 2: A multifaceted profile of personality traits will better distinguish different gambling involvement patterns than will single personality traits considered in isolation.

Method

Participants

Participants for this study were 4,764 members of the Australian Twin Registry Cohort II, a national community-based sample (Slutske et al., 2009). The mean age was 37.7 years (range = 32–43) and 57.2% of the sample was female. The participants represented a relatively broad cross-section of the Australian general population of 32–43-year-olds. For example, the sample included individuals without post-secondary education (38.0%), who were unemployed (2.3%), and who were on public assistance (5.7%). For more information on the recruitment, representativeness, and demographic characteristics of the sample, see Slutske et al. (2009).

Procedure

In 2004–2007, a structured diagnostic interview containing a thorough assessment of gambling behaviors was conducted via telephone with the Australian Twin Registry Cohort II members (individual response rate of 80.4%). Retest telephone interviews were conducted with 166 participants who had completed the baseline interview (retest interval $M = 3.4$ months, $SD = 1.4$ months) in order to establish the test–retest reliability of the interview measures. The participants who completed the telephone interview were mailed a paper-and-pencil personality questionnaire that was returned by 4,355 individuals (91.0%). On average, the personality questionnaire was completed within 20.5 days of the interview; 85.8% were completed within the same 1-month period, and 99.6% were completed within the same 12-month period.

Measures

Gambling involvement. Lifetime and past-year participation in 10 different gambling activities that were included in the 1999 Australian national prevalence survey (Productivity Commission, 1999) were assessed. These activities included electronic gaming (slot) machines (EGMs), betting on horse/dog races, playing scratchcards, playing the lottery, playing keno, playing table games at a casino such as blackjack or roulette, playing bingo for money, betting on sporting events, playing cards or other such games for money outside of a casino, and betting on games of skill such as billiards. Based on endorsements of involvement in the 10 different activities, lifetime and past-year counts of the number of different gambling activities ("gambling versatility") were derived.

Three indicators of past-year gambling involvement based on the amount of time and money spent on gambling were also assessed (Walker et al., 2006). Prior to the questions about time and money spent on gambling, there was an extensive set of questions about involvement in each of the specific gambling activities. Subsequently, participants were instructed that "For the remaining questions, when I refer to 'gambling,' I am talking about any of the different activities that we have been discussing"—therefore, the gambling behavior measures used here were based on all activities which the participant had endorsed. The average amount of time spent on gambling per gambling occasion was based on the response to the question, "In the last 12 months, on a typical day when you gambled, how much time would you spend on gambling?" with open-ended responses in hours or minutes recorded (recoded as minutes). The number of days spent gambling in the past year (gambling frequency) was based on the response to the question, "On how many days in total have you participated in any form of gambling in the last 12 months?" with 14 response options ranging from "never" to "every day," which was recoded as a pseudo-continuous variable indicating number of days per year. The average amount of money spent gambling per occasion was assessed with the item, "In the last 12 months, on a typical day when you gambled, how much money would you spend on gambling? (By money spent on gambling, I mean the total amount that you started out with at the beginning of the day minus the total amount that you ended up with at the end of the day)" with 10 response options ranging from "less than $1" to "$10,001 or more." This variable was also recoded as dollars per day, taking the median for categories with a range of values. The 3-month test–retest reliabilities of the typical number of hours spent gambling ($r = .69$), dollars spent gambling ($r = .63$), and number of days gambled in the past year ($r = .84$) were all acceptable (all $ps < .0001$).

In addition to normative gambling involvement, problematic gambling involvement was assessed to provide a more comprehensive picture of the derived latent classes. This may also indirectly contribute to understanding the patterns of gambling activity that are more or less frequently associated with disordered gambling. Two different disordered gambling inventories were used (see Slutske, Zhu, Meier, & Martin, 2011): the National Opinion Research Center *Diagnostic and Statistical Manual of Mental Disorders–IV* (*DSM–IV*) Screen for Gambling Problems (NODS; Gerstein et al., 1999) and the South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987). The NODS *DSM–IV* and SOGS diagnostic criteria were assessed for all participants who reported that they had ever gambled at least five times within a 12-month period; the majority of participants, 77.5%, surpassed this threshold. The 3-month test–retest reliabilities of disordered gambling as measured by the NODS ($\kappa = 0.67$, Yule's $Y = 0.79$) and the SOGS ($\kappa = 0.78$, Yule's $Y = 0.82$) were acceptable.

Personality. The personality questionnaire contained a modified 177-item version of the Multidimensional Personality Questionnaire (MPQ; Tellegen & Waller, 2008; Slutske, Cho, Piasecki, & Martin, 2013), the 40-item Zuckerman's Sensation Seeking Scale Form V (SSS; Zuckerman, 1971), and a modified 15-item version of the Magical Ideation scale (MIS; Eckblad & Chapman, 1983). The wording of some of the MPQ items was modified for use in Australia, for example, using the word "lift" rather than "elevator."

The MPQ contains items that measure 10 lower-order factors, which in turn comprise three distinct superfactors (the "Big Three"): Positive Emotionality includes Well-Being, Social Potency, Achievement, and Social Closeness; Negative Emotionality includes Stress Reaction, Alienation, and Aggression; and Constraint includes Control, Harm Avoidance, and Traditionalism. An eleventh lower-order factor, Absorption, does not load onto any superfactors. Absorption is related to fantasy and openness to

experience (Tellegen & Atkinson, 1974). See Table A1 in the Appendix for a description of the MPQ scales. The internal consistency reliabilities in the present study of the 11 MPQ lower-order subscales (α = .71 to 0.86, mean α = .81) and for the three superfactors (α = .85 to 0.88, mean α = .87) were acceptable.

The SSS includes four subscales that contribute to an overall sensation seeking score: boredom susceptibility, experience seeking, disinhibition, and thrill and adventure seeking. The internal consistency reliabilities of the SSS subscales (α = .55 to 0.80, mean α = .67), and for the total SSS score (α = .84) were acceptable.

The modified MIS was designed to measure superstitiousness and other types of "beliefs in forms of causation that by conventional standards are invalid" (Eckblad & Chapman, 1983, p. 215), such as horoscopes, good luck charms, or lucky numbers. The items were chosen based on their potential association with the propensity to gamble (e.g., Joukhador et al., 2004) and their suitability for an adult Australian community sample (see Table A2 in the Appendix for a description of the MIS scale and a list of the MIS items used). Magical ideation is typically considered a dimension of abnormal, rather than normal, personality variation; it is included because of its relevance to gambling (e.g., Toneatto, 1999; Wohl & Enzle, 2002) and the absence of similar content in the other personality measures included. The internal consistency reliability of the MIS was acceptable (α = .77).

Data Analysis

Latent class analysis. LCA is a person-centered (as opposed to variable-centered) statistical technique that assigns participants a probabilistic likelihood of membership in a predefined number of classes based on the similarity of their patterns of responses to those of other participants in the sample, highlighting manifest response patterns that may be indicative of underlying latent typologies (for a more thorough description of LCA, refer to McCutcheon, 1987, and Collins & Lanza, 2010). The input for the analysis was the survey question, "In the past year, have you participated in this activity?" for each activity, scored dichotomously as *yes* or *no*. Individuals who reported never having gambled in their lifetime (n = 95, 2.0% of the sample) were not included in the LCA. The LCA was performed in Mplus version 6 (Muthén & Muthén, 2007) using a maximum likelihood estimation method, and was run with two- through eight-class models to find the best-fitting model.

Because past-year gambling may be unrepresentative of gambling habits, a second LCA was conducted using a dichotomous variable for each gambling activity that reflected lifetime participation in each activity on 10 days or fewer, or on more than 10 days. The agreement between latent class memberships obtained from the two LCAs was calculated as a means of establishing the comparability of the two latent class solutions.

Latent class comparisons. The latent class assignments obtained in the past-year LCA were used in subsequent analyses. A multiple imputation approach was used to account for the probabilistic assignment of individuals to each latent class, creating replicate observations so that each individual's data was replicated n times for an n-class solution and one observation was assigned to each latent class. Observations were then weighted according to their conditional probability of membership in each latent class (see Bucholz, Hesselbrock, Heath, Kramer, & Schuckit, 2000, for a more detailed explanation of the multiple imputation method). Participants' scores on the MPQ, SSS, and MIS were standardized and mean differences were compared between classes. Demographic characteristics, gambling behaviors, and disordered gambling indices were also compared.

Mean differences were examined using generalized least squares regression for continuous outcomes and logistic regression for categorical outcomes in SAS (SAS Institute, 2009). The continuous gambling outcomes with non-normal distributions (frequency, versatility, and disordered gambling symptom counts) were square-root-transformed prior to analysis. The non-independence of observations obtained from members of a twin pair was accounted for in the analyses by using SAS survey data analysis procedures, treating the data as clustered with the family unit (the twin pair), delineating the cluster. The analyses employed Taylor series (linearization) variance estimation to obtain correct sampling errors from the clustered data.

Twin concordance. Similarity of twin pairs for membership in the gambling latent classes provided some confirmation of the validity of the empirically derived classes. Comparison of the similarity of monozygotic (MZ) and dizygotic (DZ) twin pairs also provided evidence about whether latent class membership was genetically influenced. Omnibus tests of twin concordance for the most likely latent class membership were evaluated with the kappa coefficient, and the $Q\kappa$ test in SAS was used to test whether these significantly differed in MZ versus DZ twin pairs. MZ and DZ probandwise concordances for each of the latent classes were calculated as [2C/(2C + D)], where C is the number of pairwise concordant and D is the number of discordant twin pairs. The probandwise concordance directly estimates the risk to the cotwin of an index proband (McGue, 1992); in this case, the index proband was a twin assigned to a particular gambling latent class. Relative risks of membership in a particular class given cotwin membership in the same class were calculated by dividing the MZ or DZ concordance by the sample prevalence.

Results

Deriving latent classes based on any past-year gambling involvement. Two latent class analyses were conducted based on (a) any past-year involvement in each of the 10 gambling activities and (b) lifetime participation in each of the 10 gambling activities on more than 10 days. The LCA based on past-year gambling activities was conducted with two- through eight-class models, and the five-class model was chosen as the best fit for the data (see Table 1). The choice between the five- and six-class models was not indisputably clear from a statistical standpoint. Both models had a nonsignificant likelihood ratio chi-square, but the five-class model had the lowest Bayesian information criterion (BIC; Schwarz, 1978), while the six-class model had a lower Akaike's information criterion score (AIC; Akaike, 1987) and sample-size–adjusted BIC score (SSBIC; Sclove, 1987), all of which indicate goodness of fit (see Table 1). Nylund, Asparouhov, and Muthén (2007) found that BIC was consistently the best of the information criteria at predicting the correct number of classes in LCA, and, as Bucholz and colleagues (2000) note, goodness-of-fit tests are not the only criteria on which a model should be selected; also of importance are parsimony, class membership probabilities,

Table 1
Model-Fitting Results of the Latent Class Analysis Based on Past-Year Gambling

Model	Likelihood ratio χ^2	χ^2 *p* value	χ^2 *df*	AIC	BIC	SSBIC
2-Class	1660.03	0.00	996	38538.68	38674.1	38607.37
3-Class	1138.86	<.01	987	38022.64	38022.64	38127.31
4-Class	883.35	0.99	977	37775.82	38053.11	37916.47
5-Class	**659.414**	**1.00**	**966**	**37575.55**	**37923.78**	**37752.19**
6-Class	563.99	1.00	954	37513.35	37932.52	37725.97
7-Class	564.03	1.00	945	37501.86	37991.96	37750.46
8-Class	490.22	1.00	932	37480.33	38041.37	37764.91

Note. AIC = Akaike's information criteria; BIC = Bayesian information criteria; SSBIC = sample-size–adjusted Bayesian information criteria. The five-class solution (bolded) was selected as the best fitting model.

and class-specific endorsement probabilities. The five-class model had the lowest BIC and the largest decrease in SSBIC from the previous model (although the six-class model had a slightly lower SSBIC overall), and the five-class model had a higher average probability of most likely class membership than the six-class model, meaning that individuals in this model had higher average probabilities of belonging to the latent class to which they were assigned. Further, comparing the activity endorsement showed that the six-class model seemed to merely be splitting one small class from the five-class model into two smaller classes whose patterns of gambling activities were overall quite similar, but who differed a moderate amount on the probability of endorsing playing the lottery, scratchcards, and electronic gaming machines. About 90% of individuals in Classes 1, 2, 4, and 5 were assigned to the same class in both the five- and the six-class models, while about 90% of those in Class 3 in the five-class model were assigned to either Class 3 or 6 in the six-class model. For these reasons, the more parsimonious five-class model was selected.

Gambling activities of the five latent classes. The five-class model showed both quantitative and qualitative differences in activity preferences between the latent classes. As Figure 1 illustrates, Class 1 endorsed a large number of different activities (high versatility), and Class 5 participated in few activities. Although Classes 2, 3, and 4 had similarly intermediate levels of versatility, they had unique patterns of gambling participation with each class endorsing different activities.

Class 1 (n = 332), the "Extensive Gambling" class, included 7.1% of the participants and had the highest rates of endorsement in every gambling activity. Class 2 (n = 970), the "Non-Strategic Gambling" class, made up 20.8% of the sample and had the highest participation, besides Class 1, in the lottery, scratchcards, electronic gaming machines (EGMs), keno, and bingo. Class 3 (n = 541), the "Strategic Gambling" class, included 11.6% of participants and had the highest rates of participation (besides Class 1) on horse and dog races, table games, sports betting, cards, and games of skill. Class 4 (n = 1,777), "Lottery/Scratchcard Gambling," was the largest class with 38.1% of participants and had fairly low participation in most activities, but 70% reported using scratchcards, and 90% played the lottery. Class 5 (n = 1,049), the "Low Gambling" class, included 22.5% of participants and was characterized by very low or no participation in each of the activities.

Deriving latent classes based on recurrent lifetime gambling involvement. A similar solution was obtained when the LCA was conducted based on recurrent lifetime participation in each of the 10 gambling activities. Again, the five-class solution was selected as the best fitting model, with the lowest BIC and SSBIC and the highest average probability of most likely class membership. It largely corroborated the five classes found in the past-year LCA. Again, Class 1 (n = 240, 5.1%) had the highest participation in all activities. Class 2 (n = 903, 19.3%) had the highest endorsement after Class 1 of the lottery, scratchcards, EGMs, horse/dog races, keno, and bingo. Class 3 (n =

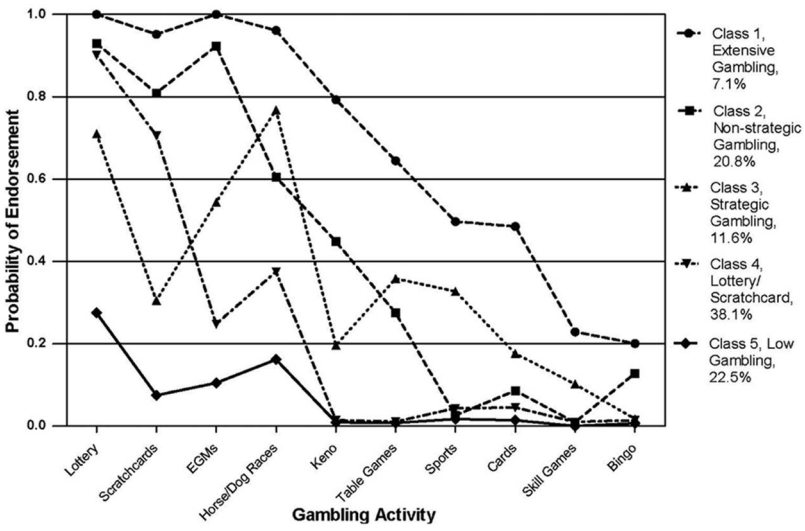

Figure 1. Probability of endorsing gambling activities by latent class membership in a latent class analysis of past year gambling. EGMs = electronic gaming machines (also known as slot machines, fruit machines, video lottery terminals, or pokies).

327, 7.0%) had the highest participation after Class 1 in table games, sports betting, cards, and betting on games of skill. Class 4 (n = 1,767, 37.9%) had almost 90% participation in the lottery and 75% participation in scratchcards, with low participation in all other activities. Class 5 (n = 1,432, 30.7%) had low overall gambling across all of the activities. There was highly significant agreement for most likely class membership between the past-year LCA and the lifetime LCA: $\kappa = .36$, $p < .001$. The one noteworthy difference was that the probability of endorsing playing cards was higher in the lifetime LCA than in the past-year LCA among all classes, suggesting that card-playing may occur more often in adolescence or young adulthood than middle adulthood. Results from the past-year LCA were used in all subsequent analyses.

Twin concordance for latent class membership. Further evidence for the validity of the latent classes comes from the finding that same-sex twin pairs were significantly concordant for their most likely latent class membership (MZ females $\kappa = .250$, $p < .001$; MZ males $\kappa = .247$, $p < .001$; DZ females $\kappa = .129$ $p < .001$; DZ males $\kappa = .068$, $p = .044$, see Table 2). The latent class assignments for the men and women from the unlike-sex DZ pairs were not significantly concordant ($\kappa = .044$, $p = .115$). In addition, MZ twins were significantly more likely to be concordant than DZ twins (MZ: $\kappa = .255$, $p < .001$; DZ: $\kappa = .113$, $p < .001$; test of equal kappas: $Q\kappa = 16.510$, $df = 1$, $p < .0001$), suggesting a genetic influence on individual differences in patterns of gambling activity preferences. Table 2 illustrates the patterns of concordances and discordances across each the five latent classes within MZ and same-sex DZ twin pairs (panel a). The MZ and DZ probandwise concordances along with the overall prevalence in the full sample for the five latent classes are also presented in Table 2 (panel b). The prevalence can be interpreted as the baseline risk for being a member of a particular latent class. The probandwise concordance reflects an individual's risk for being a member of a particular latent class given that their MZ or DZ cotwin is a member of that class. For example, the baseline risk for being a member of the Extensive Gambling class (Class 1) was 7.1%. The risk was increased to 26.2% among the DZ cotwins and to 40.4% among the MZ cotwins of members of the Extensive Gambling class. Relative risks of membership in a particular class given cotwin membership in the same class are also shown in Table 2 (panel b). Across all classes, the relative risk for MZ cotwins was greater than for DZ cotwins, with smaller differences for the Lottery/Scratchcard and Low Gambling classes. Notably, the relative risk for the Extensive Gambling class was quite high for both MZ and DZ cotwins (5.7 and 3.7, respectively), in comparison to all other relative risks, which were 2.1 or less. In contrast, the relative risks for MZ and DZ cotwins of Lottery/Scratchcard class members were 1.3 and 1.1, respectively.

Demographic characteristics of the five latent classes. Table 3 shows that the Extensive (Class 1) and Strategic Gambling (Class 3) classes were mostly male (62–65%), while the other three classes were 59–64% female, compared to 57.2% female in the overall sample. Classes differed significantly on

Table 2
Twin Concordance for Most Likely Latent Class Membership

Panel a: Twin-twin cross tabulations

MZ twin pairs: Twin 2 latent class						Same-sex DZ twin pairs: Twin 2 latent class					
Twin 1 latent class	C1	C2	C3	C4	C5	Twin 1 latent class	C1	C2	C3	C4	C5
C1	**20** **2.4%**	22 2.7%	7 0.8%	5 0.6%	6 0.7%	C1	**11** **1.9%**	20 3.5%	7 1.2%	6 1.0%	8 1.4%
C2	8 1.0%	**77** **9.3%**	16 1.9%	72 8.7%	17 2.0%	C2	1 0.2%	**32** **5.6%**	14 2.4%	42 7.3%	16 2.8%
C3	5 0.6%	14 1.7%	**17** **2.0%**	21 2.5%	11 1.3%	C3	3 0.5%	9 1.6%	**6** **1.0%**	17 3.0%	7 1.2%
C4	4 0.5%	54 6.5%	14 1.7%	**148** **17.8%**	63 7.6%	C4	10 1.7%	43 7.5%	19 3.3%	**89** **15.5%**	58 10.1%
C5	2 0.2%	23 2.8%	16 1.9%	75 9.0%	**113** **13.6%**	C5	7 1.2%	25 4.3%	14 2.4%	52 9.0%	**60** **10.4%**

Panel b: Probandwise concordances (%)

		MZ twin pairs		DZ twin pairs	
Latent gambling class	Sample prevalence %	Concordance	Relative risk	Concordance	Relative risk
Class 1: Extensive	7.1	40.4	5.7	26.2	3.7
Class 2: Non-strategic	20.8	40.5	1.9	27.4	1.3
Class 3: Strategic	11.6	24.6	2.1	11.8	1.0
Class 4: Lottery/Scratchcard	38.1	49.0	1.3	41.9	1.1
Class 5: Low	22.5	51.5	2.3	39.1	1.7

Note. Latent classes correspond to the groups pictured in Figure 1. In Panel a, diagonal cells (bolded) represent twins that were concordant for the most likely latent class. In Panel b, the sample prevalence can be interpreted as the baseline risk for being a member of a particular latent class, the probandwise concordance reflects the risk for being a member of a particular latent class to a monozygotic (MZ) or dizygotic (DZ) cotwin of an individual that belongs to a particular latent class. Relative risk is the concordance divided by the sample prevalence.

Table 3
Demographic Makeup of the Five Latent Classes

Demographic characteristic	Class 1 n = 332 %	Class 2 n = 970 %	Class 3 n = 541 %	Class 4 n = 1,777 %	Class 5 n = 1,049 %	$\chi^2(df)$
Male	64.8	41.1	61.6	35.6	40.5	184.3 (4)**
Marital status						25.9 (16)
Married	56.8	62.6	61.7	65.6	66.2	
Separated	6.6	4.6	3.1	3.4	4.0	
Divorced	7.9	9.0	7.8	7.4	6.7	
Widowed	0.0	0.4	0.2	0.3	0.3	
Never married	28.7	23.4	27.2	23.2	22.8	
Educational attainment						149.5 (16)**
8–10 years	29.9	25.5	18.8	20.6	16.7	
Matriculation	18.0	19.7	17.5	16.8	14.3	
Technical college	32.8	32.2	27.8	29.1	25.1	
Undergraduate	9.3	12.8	18.3	18.6	21.1	
Postgraduate	9.3	9.6	17.3	14.9	22.2	
Primary occupation						126.8 (20)**
Student	1.8	1.5	1.2	2.3	2.0	
Unemployed	1.5	1.3	1.2	1.3	1.3	
Employed part-time	11.4	20.1	14.4	21.9	21.1	
Homemaker	6.6	13.8	8.8	18.1	19.3	
Employed full-time	74.4	61.2	72.4	54.9	53.2	
Retired	2.4	2.0	1.7	1.3	2.2	
	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	$F(df)$
Household income						
(AUD)	80,084 (38,348)	79,900 (39,176)	89,852 (41,274)	81,637 (40,020)	84,788 (42,551)	14.7 (4,2822)***
(USD)	60,063 (28,799)	59,925 (29,382)	67,389 (30,956)	61,228 (30,015)	63,591 (31,913)	

Note. Classes correspond to the groups pictured in Figure 1.
** $p < .001$. *** $p < .0001$.

gender composition, educational attainment, and occupation. The Strategic Gambling and Low Gambling classes (3 and 5) had the highest proportion of individuals with postgraduate education, while the Extensive and Non-Strategic Gambling classes (1 and 2) had the highest proportion of individuals with less than secondary education completed or technical college education. The Extensive and Strategic classes (1 and 3) were most likely to be employed full-time. There were also significant mean differences between the annual household incomes, with the Strategic Gambling class (Class 3) having the largest (M = $89,852 AUD) and the Non-Strategic Gambling class (Class 2) having the smallest (M = $79,900 AUD). Classes did not differ significantly on marital status, although the comparison reached borderline statistical significance ($\chi^2 = 25.9$, $p = .055$). The classes did not significantly differ on age.

Gambling involvement and disordered gambling of the five latent classes. Table 4 illustrates the mean differences in gambling behaviors between the classes. Overall differences between the classes on all of the gambling variables were statistically significant, $F = 37.0–4315.6$, all ps $< .0001$. For all of the gambling behaviors, the Extensive Gambling class (Class 1) fell at the high end of the distribution and the Low Gambling class (Class 5) at the low end, while the middle three classes had intermediate levels without a clear-cut ordinal pattern. The Non-Strategic Gambling class (Class 2) gambled more days in the past year than the Strategic Gambling class (Class 3) but spent less time and money when they gambled. Both of those two classes, however, had essentially the same level of disordered gambling, which was much lower than in the Extensive Gambling class (Class 1) and higher than in the Lottery/Scratchcard and Low Gambling classes (4 and 5). Although the Extensive Gambling class (Class 1) had the highest rates of lifetime *DSM–IV* and SOGS disordered gambling than the other four classes, because of the relative sample sizes, the greatest proportion of individuals in the sample with disordered gambling actually came from the Non-Strategic Gambling class (Class 2). Notably, very few of the participants in any class were experiencing past-year disordered gambling symptoms, despite high rates of gambling overall.

In a linear regression predicting the number of past-year disordered gambling symptoms from past-year gambling frequency, gambling versatility, and latent class assignment, frequency and latent class emerged as significant predictors: frequency: $F(1, 2861) = 55.69$, $p < .0001$; latent class assignment: $F(4, 2861) = 16.94$, $p < .0001$, while versatility was not significant after accounting for these other variables. This showed that while gambling behaviors such as frequency are important predictors of disordered gambling, they do not account for all of the intergroup differences. The patterns of gambling activities accounted for by latent class assignment remained a significant predictor of disordered gambling symptoms over and above differences in gambling behaviors.

Personality characteristics of the five latent classes. There were highly significant differences between the latent classes on almost every measured dimension of personality (see Table 5). All of the differences persisted even after accounting for past-year gambling frequency and versatility (Table 5, column labeled "ad-

Table 4
Gambling Behaviors and Disordered Gambling of the Five Latent Classes

Gambling variable	Class 1 $n = 332$ Mean (*SD*)	Class 2 $n = 970$ Mean (*SD*)	Class 3 $n = 541$ Mean (*SD*)	Class 4 $n = 1,777$ Mean (*SD*)	Class 5 $n = 1,049$ Mean (*SD*)	F[a]
Past year						
Average time spent gambling per occasion (minutes)	76.3 (89.6)	50.2 (66.4)	54.1 (76.5)	20.9 (43.6)	28.7 (61.6)	182.4***
Average money spent gambling per occasion (dollars [AUD])	84.2 (316.8)	48.0 (183.9)	67.5 (229.7)	24.6 (63.8)	23.2 (44.4)	72.9***
Days gambled	93.0 (81.1)	54.3 (63.4)	42.2 (54.3)	32.8 (45.0)	9.3 (25.6)	704.6***
Gambling versatility	6.8 (1.3)	4.2 (1.1)	3.5 (1.4)	2.4 (0.9)	0.7 (0.7)	4315.6***
DSM–IV DG symptoms score	0.5 (1.5)	0.2 (0.8)	0.2 (0.7)	0.0 (0.3)	0.0 (0.2)	37.0***
SOGS DG symptoms score	1.3 (2.1)	0.6 (1.3)	0.4 (1.0)	0.2 (0.6)	0.1 (0.4)	169.1***
Lifetime						
Gambling versatility	7.8 (1.4)	5.9 (1.4)	6.2 (1.8)	4.9 (1.7)	4.0 (1.8)	701.3***
	%	%	%	%	%	Wald χ^2 (*df*)
DSM–IV DG diagnosis	8.2[bc]	3.1[bc]	3.1	1.2[b]	0.8 (ref)	76.9 (4)***
SOGS DG diagnosis	12.8[bc]	5.6[bc]	4.8	1.6[bc]	1.4 (ref)	144.4 (4)***

Note. Classes correspond to the groups pictured in Figure 1. Versatility = the number of different gambling activities endorsed; *DSM–IV* = *Diagnostic and Statistical Manual of Mental Disorders, Version 4*; SOGS = South Oaks Gambling Screen; DG = disordered gambling. Class 5 was used as the reference group for statistical analyses.
[a] Degrees of freedom ranged from 4, 2,690 to 4, 2,865. [b] Differed significantly from class 5, $p < .05$. [c] Differed significantly from class 5 after controlling for sex, $p < .05$.
*** $p < .0001$.

justed"). Gambling frequency and versatility were not sufficient to explain the personality differences between individuals in different latent gambling classes.

The personality profiles of the five latent classes based on MPQ scores are presented in Figure 2, and those based on the SSS and MIS scores are presented in Figure 3. One way to inspect Figures 2 and 3 is to focus on each personality scale individually. When focusing on each personality trait individually the differences for most of the personality traits were modest. There was only one class that scored more than one half standard deviation higher or lower than the sample mean on any of personality measures. There was also not a great deal of spread in the personality scores across the different classes for most of the personality traits. Among the MPQ scales, the largest differences were observed for the lower-order scales of Aggression and Control, and the higher-order dimensions of Negative Emotionality and Constraint, with differences of approximately 0.80, 0.50, 0.40, and 0.40 standard deviations between the lowest and the highest scoring classes, respectively. Among the SSS and MIS scales, the largest differences were for the SSS Disinhibition subscale, the SSS total score, and the MIS, with differences of approximately 0.65, 0.40, and 0.40 standard deviations, respectively. Because the same metric was used in Figures 2 and 3, the results portrayed can be directly compared to each other. Clearly, the two individual personality scales that best distinguished the five latent gambling classes from each other were the MPQ Aggression and the SSS Disinhibition scales.

Another way to inspect Figures 2 and 3 is to focus on the personality scales in combination. When looking at the personality scales in combination, a number of unique patterns emerged. Individuals in the Extensive Gambling class (Class 1) were characterized by a personality profile of relatively high scores on Negative Emotionality, particularly the subscales of Alienation and Aggression, very low Constraint, high Sensation Seeking, and high Magical Ideation. Individuals in the Non-Strategic Gambling class (Class 2) were characterized by a personality profile of somewhat elevated scores on Negative Emotionality, Sensation Seeking, particularly Disinhibition, and Magical Ideation. The Strategic Gambling class (Class 3) had a profile of high Positive Emotionality, particularly the Social Potency subscale, high Aggression (but not other Negative Emotionality subscales), low Constraint, low Magical Ideation, and scores nearly identical to the Extensive Gambling class (Class 1) on all of the Sensation Seeking scales. The Lottery/Scratchcard class (Class 4) had a profile of moderately low Aggression and Sensation Seeking and moderately high Constraint. The Low Gambling class (Class 5) had a profile of low Negative Emotionality, especially Aggression, high Constraint, low Sensation Seeking, especially Disinhibition, and low Magical Ideation.

Discussion

In a large community-based sample of adult Australian twins, latent class analysis was used to aggregate information about involvement in 10 different gambling activities into five meaningful clusters of people. Each of these five latent classes was associated with different personality profiles. Three of the more gambling-involved classes, that we labeled the Extensive, Non-Strategic, and Strategic Gambling classes were of particular interest.

Disordered Gambling and the Extensive and Non-Strategic Gambling Classes

The personality profile of the Extensive Gambling class was very similar to the profile of 21-year-olds with disordered gambling in a previous study (Slutske et al., 2005). In the present study, the Extensive Gambling and Non-Strategic Gambling

Table 5
Differences in Personality Traits for Empirically-Derived Gambling Latent Classes

Personality scale	Unadjusted		Adjusted	
	F value[a]	Group differences (compared to Class 5)[b]	*F* value[a]	Group differences (compared to Class 5)[b]
Multidimensional Personality Questionnaire				
Well-being	2.7*	Class 3	4.3*	Class 1
Social potency	19.5***	Classes 1, 3	14.5***	Classes 2, 3, 4
Achievement	4.6**	Class 3	4.6**	Class 3
Social closeness	2.1	none	2.9*	Class 1
Stress reaction	4.6**	Classes 1, 2	3.4*	Class 3
Alienation	14.6***	Classes 1, 2	6.3***	Classes 1, 3
Aggression	49.3***	Classes 1, 2, 3, 4	12.6***	Classes 1, 2, 3, 4
Control	22.1***	Classes 1, 2, 3	8.2***	Classes 2, 4
Harm avoidance	27.5***	Classes 1, 2, 3	15.1***	Classes 2, 3, 4
Traditionalism	7.8***	Classes 2, 4	7.0***	Classes 2, 4
Absorption	1.2	None	1.8	None
Positive emotionality	9.4***	Class 3	8.4***	Classes 1, 3
Negative emotionality	21.3***	Classes 1, 2, 3, 4	3.0*	Class 1
Constraint	27.7***	Classes 1, 3	16.7***	Classes 2, 4
Sensation Seeking Scale				
Thrill/adventure seeking	19.6***	Classes 1, 3	13.4***	Classes 1, 2, 3, 4
Experience seeking	6.2***	Classes 1, 3	4.7**	Class 2
Disinhibition	70.6***	Classes 1, 2, 3, 4	23.2***	Classes 2, 3
Boredom susceptibility	11.4***	Classes 1, 3	9.4***	Classes 2, 3, 4
Total score	42.2***	Classes 1, 2, 3	23.3***	Classes 2, 3, 4
Magical Ideation Scale	24.3***	Classes 1, 2, 3, 4	9.6***	Classes 2, 4

Note. The adjusted comparisons include past-year gambling frequency and versatility as covariates.
[a] Degrees of freedom ranged from 4, 2,687 to 4, 2,710. [b] Classes listed correspond to the groups pictured in Figure 1 whose scores on the indicated scale differed significantly from the reference class (Class 5) at $p < .05$.
* $p < .05$. ** $p < .001$. *** $p < .0001$.

classes together accounted for the majority of individuals in the sample with a history of disordered gambling, but their personality profiles were markedly different. Members of the Extensive Gambling class had extreme scores on measures of sensation seeking and control/constraint, whereas members of the Non-Strategic Gambling class did not. These results provide some insight into a potential explanation for discrepant findings obtained in studies of the personality correlates of disordered gambling. Two recent studies (Miller et al., 2013; Slutske et al., 2013) have yielded the surprising finding of small (and sometimes nonsignificant) associations between disordered gambling and scores on the MPQ Constraint scale, which is inconsistent with the central role of impulsivity in theories of the development of disordered gambling (Blaszczynski & Nower, 2002; Sharpe, 2002), as well as the designation of disordered gambling as a disorder of impulse control in previous versions of the *DSM*. The results of the present study suggest that an association between disordered gambling and impulsivity-related traits may be dependent upon the relative proportions of individuals similar to those in the Extensive Gambling versus the Non-Strategic Gambling class in the study sample. It is worth noting that a similar Extensive Gambling class was identified in the previous study of Goudriaan et al. (2009); this class was also characterized by a much higher likelihood of a history of disordered gambling than the other classes, and the highest average score on a measure of impulsivity. In the present study, individuals in the Non-Strategic Gambling class far outnumbered individuals in the Extensive Gambling class and therefore accounted for more cases of disordered gambling in the sample. In other words, the issue of "lumping" in studies of the correlates of gambling may also apply to studies of the correlates of disordered gambling. Studies that investigate linkages between personality and disordered gambling may benefit by the "splitting" of individuals with disordered gambling into more homogeneous subclasses by attending to the types of games in which they typically participate (e.g., Petry, 2003).

Positive Emotionality and the Strategic Gambling Class

Members of the Strategic Gambling class evidenced moderate levels of gambling and disordered gambling and, in some ways, had a personality profile that was similar to the Extensive Gambling class. They were characterized by high scores on measures of sensation seeking and aggression, and low scores on measures of constraint. Unlike the Extensive Gambling class, however, they did not have high scores on the measures of negative emotionality. Instead, members of this class were characterized by high scores on measures of positive emotionality (e.g., interpersonal effectiveness and ambitiousness); this was the only latent class that was characterized by relatively high scores on the measure of positive emotionality. Interestingly, the handful of participants who considered themselves "professional gamblers" all came from this latent class.

Non-Strategic Versus Strategic Gambling Classes

The Non-Strategic and Strategic Gambling classes align with descriptions in the literature of individuals that have a prefer-

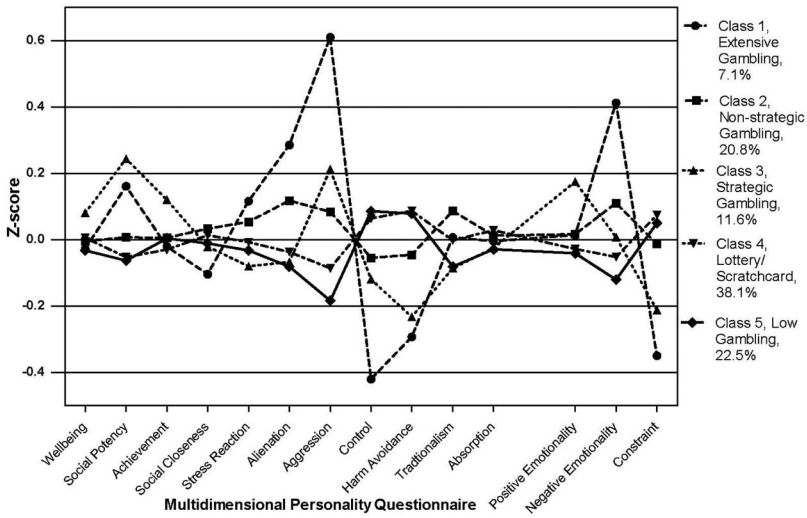

Figure 2. Standardized scores on the Multidimensional Personality Questionnaire as a function of latent class membership. The mean scale scores are displayed as *Z*-scores, making their interpretation relatively straightforward. A score of 0 corresponds to a score that is at the sample mean, a score of 0.50 is one half standard deviation above the sample mean, and a score of −0.50 is one half standard deviation below the sample mean. Because they are on the same metric, the different scales can be directly compared to each other. Approximate effect sizes of differences between any two groups can be deduced by subtracting the *Z*-score of one group from the *Z*-score of the other.

ence for games of chance versus games of skill (e.g., Odlaug, Marsh, Kim, & Grant, 2011; Sharpe, 2002; Young & Stevens, 2009). For example, Non-Strategic Gambling class members were predominantly women, less educated, and had a relatively low income. Strategic Gambling class members were predominantly men, more educated, and had the highest yearly income of all of the latent classes. In terms of personality traits, the two classes differed considerably; the Non-Strategic Gambling class had higher scores on measures of negative emotionality and magical thinking, whereas the Strategic class had higher scores

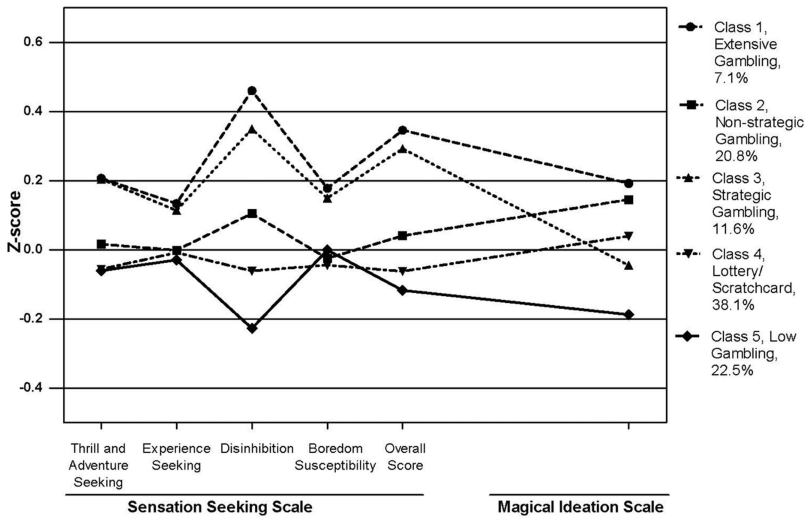

Figure 3. Standardized scores on Sensation Seeking Scales and Magical Ideation Scale as a function of latent class membership. The mean scale scores are displayed as *Z*-scores, making their interpretation relatively straightforward. A score of 0 corresponds to a score that is at the sample mean, a score of 0.50 is one half standard deviation above the sample mean, and a score of −0.50 is one half standard deviation below the sample mean. Because they are on the same metric, the different scales can be directly compared to each other. Approximate effect sizes of differences between any two groups can be deduced by subtracting the *Z*-score of one group from the *Z*-score of the other.

on measures of social potency, achievement, boredom susceptibility, and thrill and adventure seeking. This is consistent with the theory that the gambling of individuals who prefer games of skill is motivated primarily by intolerance of boredom and stimulation seeking, whereas the gambling of individuals who prefer games of chance are motivated primarily by a need to escape from stress or to cope with dysphoric moods (Sharpe, 2002).

Lottery/Scratchcard Class Not Characterized by Personality Extremes

Members of the Lottery/Scratchcard class were characterized by scores that were close to the sample means on every personality trait measured. Previous studies that have demonstrated personality correlates of lottery gambling (e.g., Balabanis, 2002) may have reached erroneous conclusions by failing to account for involvement in other activities. Although almost all of the members of this class played the lottery, over one half of the lottery players in the present study came from classes typified by more diverse gambling involvement and larger personality differences.

Genetic Influences on Latent Gambling Class Membership

Evidence for the validity of the latent class solution came from replicating the latent gambling classes that were based on past-year gambling involvement with an alternate set of recurrent lifetime gambling indicators, and also by demonstrating that latent class assignment was familial. The finding that MZ twin pairs were more concordant than DZ twin pairs for their gambling latent class assignment suggests that genetic influences impact gambling activity preferences. This supports previous findings demonstrating that participation in specific gambling activities is partially genetically influenced (Slutske et al., 2009). Furthermore, the magnitude of the familial influences contributing to latent class membership appeared to differ for the classes. For example, the relative risk of membership in the Extensive Gambling class for both MZ and DZ cotwins was quite high (and higher for MZ than DZ cotwins), suggesting that being a member of the Extensive Gambling class is more strongly influenced by familial/genetic factors than being a member of the other classes. There was evidence for familial influences for the other classes, although they were not as pronounced for the Lottery/scratchcard class, potentially indicating differential effects of the nonshared environment on participating in different types of activities. Low levels of familial influence may indicate that primarily cultural factors play a role in participation in culturally normative groups of activities, such as lotteries and scratchcards here. Although it is beyond the scope of the present paper, an important direction for future research would be to investigate whether the effect of genetic variation on gambling activity profiles is mediated by effects on individual differences in personality profiles.

Generalizability of Findings

The purpose of the LCA used in this study was not to put forth a generalizable scheme for subtyping gamblers, but rather to adopt an improved strategy for examining personality-gambling linkages. The gambling classes obtained in the present study may not be perfectly replicated in other studies, as illustrated by the slightly different LCA results obtained in the previous study conducted among United States college students (Goudriaan et al., 2009). Because there are different patterns of gambling activities in other populations (defined by state, country, college attendance, age, sex, ethnicity, legal restrictions, or other features), different groupings will likely emerge. For example, a primarily card gambling class was uncovered in the previous United States college student but not the present adult Australian study, and a class that primarily participated in strategic forms of gambling was uncovered in the adult Australian, but not the United States college student study. The most replicable gambling groupings appeared to lie at the extremes—no matter what forms of gambling were available, there was a group of those that were extensively involved, and a group of those that were relatively uninvolved. It is the intermediate groupings that participated in a few different types of activities that appeared to be more population specific.

The employment of a relatively gambling-enriched sample from the heavy gambling milieu of Australia is a strength of the present study in that it provided an optimal context for studying linkages between personality and gambling. In other populations where general gambling or specific gambling activities are less customary, certain gambling activity patterns might not be observed due to lack of exposure. This is evidenced by the different proportions of relatively uninvolved gamblers in the United States college students (Goudriaan et al., 2009) versus the current adult Australian sample of 60% and 23%. In other words, the majority of the participants in the United States college sample were uninformative, whereas the majority of the participants in the present study were informative about the correlates of gambling.

Implications

These results have implications for research and intervention. Research that does not take into consideration the constellation of types of gambling in which participants are engaged is likely to continue to lead to nonreplicable and inconsistent findings in the literature, especially when examining linkages between personality and gambling. Likewise, researchers should not limit themselves to one or two personality traits, because it is a combination of traits that best characterizes the individual propensity to become involved in particular patterns of gambling involvement. A comprehensive understanding of gambling will only come by attending to the patterns of gambling involvement and by utilizing broadband personality assessments.

The types of gambling activities in which a gambler is involved can also provide valuable clues to the underlying personality dynamics that may potentially aid in prevention and treatment. For example, our findings support the previously described qualitative distinctions between individuals engaging in games of skill versus games of chance. These may suggest different foci for treatment; thrill-seeking, strategic gamblers who develop gambling problems may benefit from a different treatment strategy than non-strategic gamblers with high negative affect. In some of the classes, the high levels of magical ideation observed may also implicate cognitive treatment that focuses on correcting illogical beliefs about gambling. Members of the Extensive gambling class had the highest rates of disordered gambling; the combination of personality traits

of low behavioral control, high negative emotionality/aggression, and high magical ideation that characterized this class may be useful for identifying individuals who are at the highest risk of developing gambling problems for targeted prevention programs.

Summary and Conclusions

Studies of non-disordered gambling have adopted several approaches for taking into consideration the different games that people play, including lumping together all forms of gambling, individually focusing on a specific activity, or counting the number of different gambling activities. None of these approaches fully capture important individual differences in gambling behavior. In the present study, we used a person-centered, multivariate approach to characterize individuals based on the types of activities that they had been engaged in the past year. Characterizing individuals in this way explained personality differences over and above the overall frequency of any gambling and the versatility of gambling.

Similarly, the personality characteristics associated with gambling were not well captured by focusing on individual scales, but rather by considering the joint influence of multiple personality traits. It is instructive to take stock of the different personality configurations that characterized the three more gambling-involved latent classes of interest. Low behavioral control (i.e., impulsivity, sensation seeking) in the context of high negative emotionality (i.e., antagonism, aggressivity) and magical thinking (superstitiousness and espousing illogical beliefs) typified extensive, versatile gamblers. Average behavioral control in the context of high negative emotionality and magical thinking typified those who primarily gambled on non-strategic games of chance. Low behavioral control in the context of high positive emotionality (i.e., interpersonal effectiveness, ambitiousness) and low magical ideation typified those who primarily gambled on strategic games of skill. Only by taking a person-centered approach and utilizing a comprehensive personality assessment can one uncover the important combinations of personality traits that are related to the heterogeneous, multifaceted phenomenon that is gambling.

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Appendix

Table A1
Multidimensional Personality Questionnaire (MPQ) Scale Descriptions

MPQ scale	Description of a high scorer
Positive Emotionality	Individuals high on the higher-order dimension of positive emotionality have a lower threshold for the experience of positive emotions and for positive engagement in their social and work environments and tend to view life as being essentially a pleasurable experience
Well-Being	Has a happy, cheerful disposition; feels good about self and sees a bright future
Social Potency	Is forceful and decisive; fond of influencing others; fond of leadership roles
Achievement	Works hard; enjoys demanding projects and working long hours
Social Closeness	Is sociable, likes people, and turns to others for comfort
Negative Emotionality	Individuals high on the higher-order dimension of negative emotionality have a low general threshold for the experience of negative emotions such as anxiety and anger, and tend to break down under stress
Stress Reaction	Is nervous, vulnerable, sensitive, prone to worry
Alienation	Feels mistreated, victimized, betrayed, and the target of false rumors
Aggression	Hurts others for own advantage; will frighten and cause discomfort for others
Constraint	Individuals high on the higher-order dimension of constraint tend to endorse conventional social norms, avoid thrills, and act in a cautious and restrained manner
Self-Control	Is reflective, cautious, careful, rational, planful
Harm Avoidance	Avoids excitement and danger; prefers safe activities even if they are tedious
Traditionalism	Desires a conservative social environment; endorses high moral standards
Absorption	Is easily caught up in sensory and imaginative experiences; readily accepts alternate states of awareness

Table A2
Magical Ideation Scale Description and Items

Magical ideation is defined as belief in forms of causation that by conventional standards are invalid, such as a belief in magical influences. Most of the items inquire about the subject's interpretation of his or her own personal experiences including the following: thought transmission, psychokinetic effects, precognition, astrology, spirit influences, reincarnation, good luck charms, the transfer of psychical energies between people, or the presence of secret messages in the behavior of others or in the arrangement of objects. High scorers on the magical ideation scale tend to have illogical beliefs about causality and the nature of reality.

15 items used in the present study:

1. Some people can make me aware of them just by thinking about me
2. I have sometimes been fearful of stepping on sidewalk cracks
3. I think I could learn to read other people's minds if I wanted to
4. Horoscopes are right too often for it to be a coincidence
5. Numbers like 13 and 7 have no special powers (R)
6. The government refuses to tell us the truth about flying saucers
7. I have felt that there were messages for me in the way things were arranged, like in a store window
8. Good luck charms don't work (R)
9. I almost never dream about things before they happen (R)
10. It is not possible to harm others merely by thinking bad thoughts about them (R)
11. If reincarnation were true, it would explain some unusual experiences I have had
12. At times, I perform certain little rituals to ward off negative influences
13. I have felt that I might cause something to happen just by thinking too much about it
14. I have wondered whether the spirits of the dead can influence the living
15. I have sometimes felt that strangers were reading my mind

Note. R = reverse-scored item.

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