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A Multidimensional Approach to Measuring How Impulsivity Corresponds to the Gambling of College Students

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A MULTIDIMENSIONAL APPROACH TO MEASURING HOW IMPULSIVITY CORRESPONDS TO THE GAMBLING OF COLLEGE STUDENTS

by

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ABSTRACT

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Impulsivity has been implicated as a contributing factor in the development of gambling problems among college students, but attempts to confirm this relation has been inconsistent. An explanation for incongruous findings is that impulsivity may be multidimensional and differentially predictive of behaviors. Utilizing a diverse sample of college students, a factor analysis of self-report measures of impulsivity revealed a three-factor structure of Behavioral Activation, Preference for Stimulation, and Inhibition Control that was remarkably similar to the structure found by Meda and colleagues (2009). Low risk and symptomatic gamblers scored significantly lower on Behavioral Activation and Inhibition Control than non-gamblers. Conversely low risk and symptomatic gamblers scored significantly higher on Preference for Stimulation. Prevalence of gambling and gambling activity preference for this sample was also assessed.

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CHAPTER 1

INTRODUCTION

College students are primed to behave impulsively and readily exposed to a multitude of opportunities to gamble (Goudriaan, Slutske, Krull, & Sher, 2009). Cortical immaturity in this age group appears to contribute to increased sensation and novelty seeking that translates to increased impulsivity (Chambers & Potenza, 2003; Steinberg et al., 2008). Some suggest that adolescent and young adult impulsivity may be linked to this cohort's higher than expected rate of gambling and problem gambling (Breen & Zuckerman, 1999; Neighbors, Lostutter, Crone, & Larimer, 2002; Villella et al., 2010).

The published research on this question, however, has yielded mixed results. Some have found gamblers, adolescents, and adults, to be more impulsive than controls (Ledgerwood, Alessi, Phoenxi, & Petry, 2009; Loxton, Nguyen, Casey, & Dawe, 2008; Powell, Hardoon, Dervensky, & Gupta, 1999); while others have found gamblers have comparable, or less impulsiveness than controls (Langewisch & Frisch, 1998; Petry, 2001). In a recent paper on impulsivity in at-risk drug and alcohol users, Meda and colleagues (2009) argued that there are multiple dimensions of impulsivity and only some of these dimensions would be associated with specific behavior excess. Inconsistent findings in the gambling literature may be due to variations in the one-dimensional impulsivity facet that is measured. The present investigation used a multidimensional and comprehensive profile of impulsivity measures to consider if the factors of impulsivity found by Meda et al. (2009) replicated in a college student sample and if these factors corresponded to gambling frequency and gambling pathology.

Gambling occurs when something of value, often money, is risked on an outcome that is determined at least partially by chance (Whelan, Steenbergh, & Meyers, 2007). A quantitative review of prevalence studies reported that approximately 87% of college students had gambled at some point in their lives (Shaffer, Hall, & Vander Bilt, 1999) and between 42% (LaBrie, Shaffer, LaPlante, & Wechsler, 2003), and 75% (Barnes, Welte, Hoffman, & Tidwell, 2010) gambled in the past year. When frequency rates are further specified to "having gambled at least once a week" prevalence in those same population based samples varies from 2.6% (LaBrie et al., 2003) to 18% (Barnes et al., 2010).

Pathological gambling is "persistent and recurrent maladaptive gambling behavior that disrupts personal, family, or vocational pursuits" (American Psychiatric Association, 2000). Among college students, about 9% appear at-risk for the development of problem gambling during their lifetime (Shaffer et al., 1999). Another 4.7% are likely to meet diagnostic criteria (Shaffer et al., 1999). Prevalence estimates for college students with pathological gambling behavior are of concern because they are notably higher than the rates found among adults (Shaffer et al., 1999). When compared to their peers, college students who gambled to a diagnosable level performed more poorly in their classes, and engaged in a wider variety of risk taking behaviors including excessive alcohol consumption, drug use, and unprotected sex (Engwall, Hunter, & Steinberg, 2004; LaBrie et al., 2003). Additionally, college students who met criteria for pathological gambling were more likely to experience significant emotional, financial, and social distress due to their gambling (Weinstock, Whelan, & Meyers, 2008).

Impulsivity is a hypothesized risk factor for the development of gambling problems (e.g., Petry, 2001). The empirical literature on the relation between impulsivity and the development of gambling problems has not consistently supported this hypothesis (Allcock & Grace, 1988; Langewisch & Frisch, 1998; Petry, 2000). One explanation for this inconsistency is that such studies typically use a single measure of impulsivity and, therefore, assume that impulsivity is a uni-dimensional construct. It is reasonable that the decision to gamble, the adoption of wagering as a preferred activity, and the resistance to stopping gambling despite losing reflect different types of impulsivity. Therefore, a multidimensional approach to impulsivity measurement might provide a more comprehensive explanation for gambling behavior (e.g., Nower & Blaszczynski, 2006).

A multidimensional approach to impulsivity has received theoretical and empirical support. Reynolds, Ortengren, Richards, and de Wit (2006) defined impulsivity as "a multidimensional concept that includes inability to wait, a tendency to act without forethought, insensitivity to consequences, and an inability to inhibit inappropriate behaviors" (p. 306). As such, using a matrix of measurement tools that correspond to a previously established factor structure (Meda et al., 2009) should serve as a useful tool in specifying the role of impulsivity in frequent or problematic gambling.

Using well-established measures of impulsivity, Meda and colleagues (2009) attempted to clarify those dimensions of impulsivity that were related to addiction. The study included three groups: individuals at risk for addiction, former and current cocaine addicts, and healthy controls. All participants completed the Behavioral Inhibition/Behavioral Activation Scales (Carver & White, 1994), Sensitivity to Punishment and Reward Scale (Torrubia, Ávila, Moltó, & Caseras, 2001), Barratt

Impulsiveness Scale: 11th Version (Patton, Stanford, & Barratt, 1995), Padua Inventory (Sanavio, 1988), Sensation Seeking Scale Form-V (Zuckerman, 1996) as well as a set of laboratory measures of impulsive behavior. This battery was selected because they were common measures in the addiction literature that combined to capture a large number of theoretically unique impulsivity dimensions (Meda et al., 2009).

A factor analysis of the subscales of these measures indicated that individual aspects of impulsivity might relate to specific aspects of substance use. A five-factor model was found to account for approximately 70% of the variance. The first three dimensions were assessed with self-report measures. The Behavioral Inhibition/ Activation Scale (Carver & White, 1994) comprised the first. The Sensitivity to Punishment and Sensitivity to Reward Questionnaire (Torrubia et al., 2001) and the Padua Inventory (Sanavio, 1988) both loaded on the second. The Barratt Impulsiveness Scale: 11th Version (Patton, et al., 1995), and the Sensation Seeking Scale Form-V (Zuckerman, 1996) comprised the third factor. The final two factors were comprised of behavioral tasks that were reported to measure state impulsivity. The findings from Meda et al. (2009) indicated increased impulsivity in the first and third factors were related to higher risk for addiction. Impulsivity research looking at problem gamblers has typically used measures from Meda et al.'s (2009) first three factors. Unlike the substance addiction literature, gambling investigations have not considered how these measures overlap or predict different gambling behaviors (e.g., Breen & Zuckermann, 1999; Langewisch & Frisch, 1998; Ledgerwood et al., 2009; Loxton et al., 2008; Powell et al., 1999).

The aim of this study was to explore relations among the assessment tools completed by a diverse college sample, and to investigate how dimensions of impulsivity correspond to gambling pathology and gambling frequency. It was hypothesized that with a comprehensive and multidimensional measure of impulsivity, specific factors of impulsivity would emerge as strong correlates for gambling pathology and gambling frequency. Given previous findings of relations among substance abuse, pathological gambling, and impulsivity (Petry, 2001) it was hypothesized that the factors revealed by Meda et al. (2009) in a drug abusing, and at-risk for addiction sample may replicate in a sample of college students who gamble.

CHAPTER 2

METHOD

Participants

To increase the diversity of the sample, subjects were recruited at three universities, one southern public university (n = 279) and two institutions in the northeast (n = 97). For inclusion in the study participants needed to be between 18 and 25 years of age (M_{age} = 19.55) as research has shown that individuals show a marked decrease in impulsivity after age 25 years (Steinberg et al., 2008). Participants were 55.6% female (n = 209). The participants placed themselves in ethnic and racial categories, as follows: 54.8% Caucasian, 32.2% African American, 3.2% Hispanic, 2.7% Asian, 0.5% American Indian, 0.3% Native Hawaiian or Other Pacific Islander, and 6.4% Other.

Measures

Demographic Questionnaire. All participants completed a brief demographics questionnaire to assess their age, gender, grade, race, and ethnicity. Questions about family history of gambling, and maximum amounts of money gambled in a single day were also included.

National Opinion Research Center Diagnosis Screen (NODS). The NODS (Toce-Gerstein, Gestein, & Volberg, 2003) represents the diagnostic criteria for Pathological Gambling (American Psychiatric Association, 2000). It was found to be sensitive for identifying pathological gambling in a general respondent sample of individuals aged 18 years and older (Toce-Gerstein et al., 2003). Factor analysis demonstrated a single construct (Toce-Gerstein et al., 2003). A score of 0-2 indicates low risk gamblers. A score of 3 to 4 indicates at-risk pathological gambling. Five or greater equates to meeting diagnostic criteria for pathological gambling. Given the base rate of at-risk and

pathological gamblers, this project considered scores greater than 3 as symptomatic gamblers. In a sample of treatment seeking problem gamblers the NODS has been shown to have an internal reliability of $\alpha = 0.79$ and to have a 2- to 4- week test-retest reliability of 0.98. It detects problem gambling in 95% of individuals receiving treatment for problem gambling (Hodgins, 2004).

Gambling Frequency Measure. The frequency table used in the South Oaks Gambling Screen (Lesieur & Blume, 1987) was modified to assess the frequency of 10 types of gambling activities. Specifically, the original frequency table was expanded to request that for each gambling activity participants indicate whether they gambled," "Not at all," "A few times a year," "About once a month," "About once a week," "A few times per week," and "Almost daily." This modification allowed for a more precise estimate of gambling frequency. Gambling frequencies for each gambling activities and the total gambling frequency were calculated. Participants who do not report an activity frequency data point were scored a 0 for that gambling activity.

Barratt Impulsiveness Scale: 11th version (BIS-11). The BIS-11 (Patton et al., 1995) was developed to assess biological and behavioral correlates of impulsiveness. Respondents rank 30-items on a 4-point Likert scale anchored to responses of "Rarely/Never," "Occasionally," "Often," and "Almost Always." The questionnaire is divided into three second-order factors (Stanford et al., 2009), attentional impulsiveness, motor impulsiveness, and nonplanning impulsiveness. Higher scores on any subscale indicate higher trait impulsivity (Patton et al., 1995). When tested with undergraduates, BIS-11 total score had a Cronbach's alpha of 0.82 (Patton et al., 1995).

Behavioral Inhibition/ Behavioral Activation Scales (BIS/BAS). The BIS/BAS (Carver & White 1994) was theoretically derived to assess the two components of Gray's reinforcement sensitivity theory (Gray, 1970). Participants rate 24 questions on a 4-point scale ("Very true for me to "Very false for me"). BIS assesses the behavior inhibition system, and high BIS predicts feelings of anxiety and withdrawal behavior when placed in a new situation. BAS assesses the behavioral approach system. High BAS predicts greater brain activation to positive events and a strengthened drive to behave in a way that produces desirable stimuli. A factor analysis of the BIS/BAS utilizing a college students yielded three BAS-related subscales: Reward Responsiveness, Drive, and Fun-Seeking, and a fourth subscale measuring BIS which is theoretically opposite and psychometrically independent from the BAS scales (Carver & White, 1994). In an independent parametric analysis with a college students, Cronbach's alpha for BIS was 0.82, for Reward Responsiveness, 0.73, for Drive, 0.65, and for Fun-Seeking, 0.72 (Caseras, Avila, & Torrubia, 2002).

Sensation Seeking Scale: Form V (SSS Form V). This 40-item self-report measure indicates a person's affinity for or against a variety of activities considered risky behaviors or high sensation activities (Zuckerman, Eysneck, & Eysneck, 1978). The SSS Form V yields the total Sensation Seeking Score (Zuckerman et al., 1978).

Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ). The SPSRQ (Torrubia et al., 2001) was also developed from Gray's reinforcement sensitivity theory, but the impulsivity research has proved itself to be a distinct measure from the BIS/BAS (Dawe & Loxton, 2004; Meda et al., 2009). The 48 yes-no questions assess two dimensions. The first, Sensitivity to Punishment (SP), assesses the inability to stop

potential behavior in light of punishment, and the second, Sensitivity to Reward (SR), is the tendency to engage in goal-focused behavior in situations associated with reward (Torrubia et al., 2001). With a sample of college students, the Cronbach's alpha for SP was 0.83 and for SR was 0.76 (Caseras et al., 2003).

Padua Inventory (PI). The PI (Sanavio, 1988) measures obsessionality and compulsivity with community samples. The measure was devised using statements made by individuals meeting criteria for obsessive compulsive disorders and then reduced through factor and item analysis to its present 60 items (Sanavio, 1988). The measure uses a 5-point severity inventory (0 = not at all, 1 = a little, 2 = quite a lot, 3 = a lot, 4 = very much). A score is obtained by summing all responses. The PI has been used with clinical samples with Obsessive Compulsive Disorder and substance use disorders (Blanco et al., 2008). Cronbach's alpha with college students ranged from 0.77 to 0.89 (Sternberger & Burns, 1990).

Procedure

The Institutional Review Boards of each participating university reviewed and approved the protocol. All participants were provided with informed consent materials that emphasized the voluntary nature of participation, a participant's right to withdraw, and the protection of confidentiality. Those providing consent were then administered the assessment packet.

Data collection procedures varied by site. At the southern university, participants were recruited from the undergraduate subject pool. They completed the survey questionnaires online during a single data collection session and were awarded course credit as compensation for their time.

At the two northeastern institutions, participants completed the measures as part of data collection for a large study looking at biomarkers of substance use in a college sample (Brain and Alcohol Research in College Students: BARCS: RO1 AA016599 and RC1 AA019036 to Dr. Godfrey Pearlson). Participants in this larger study completed half of the impulsivity questionnaires in computerized form during an initial visit and then the second half of the impulsivity questions online shortly following their initial visit. A few weeks following the initial sessions, a subset of subjects were randomly chosen for a follow-up appointment. This appointment allowed for a more comprehensive assessment battery that included the gambling assessment measures in paper and pencil form. Participants at the two Northeastern schools were paid $15 per hour for the initial session, $10 for the completion of the online questionnaire, and $20 per hour for the follow-up session.

CHAPTER 3

RESULTS

Analytic Plan

The database was examined to determine if omitted items on impulsivity measures were missing at random (Brown, 2006; Downey & King, 1998). Any missing values were imputed as appropriate. To replicate the efforts of Meda et al. (2009) a Principal Components Analysis with Varimax rotation was used to generate factor scores. The overall fit of the subsequent measurement model was also evaluated.

Once the factor structure was determined, factor scores were calculated and two sets of correlations and regressions were completed, the first assessing impulsivity by gambling frequency, and the second analyzing impulsivity by a continuous variable symptomatology score. A multivariate analysis of variance was also run to compare the effects of impulsivity factor scores on the gambling classifications of non-gambler, low risk gamblers, and symptomatic gamblers.

Missing Data

Unanswered responses were determined to be missing at random. Missing responses for the impulsivity items were uncommon, every item was completed by at least 95.4% of respondents. For any missing items in the impulsivity measures, an individual's item score was imputed using the subscore average from the completed items. Missing data on the frequency measure items and pathology measure (NODS) items were also uncommon (< 1%). Nonresponses on these measures were not added into individual sum scores. The data imputation allowed for 376 subjects to be included in the analyses.

Gambling Behavior

Sixty-three percent (n = 232) reported having gambled at least once in the past year. The largest number of participants indicated that the greatest single bet they had placed in the past year was more than $1 but less than $10 (28.2%, n = 106) or more than $10 but less than $100 (21.5%, n = 81). Only 5% (n = 19) had placed a single bet for more than $100 in the past year. Additionally, 10.2% (n = 38) of the sample indicated that one or both of their parents has had a gambling problem. Men were more likely than women to have gambled during the past year (χ^2 (1, n = 376) = 11.57, $p < .05$), and minorities and Caucasians did not differ in their gambling frequency during the past year (χ^2 (1, n = 376) = 2.54, $p = ns$). On average participants gambled 2.5, times per month (SD = 4.03). Participants engaged in a variety of gambling activities with lottery ticket purchases being the most popular activity (39.6%, n = 149). As shown in Table 1, participants also endorsed gambling in a variety of other ways. Seventy-nine percent of the participants who endorsed having gambled in the past year reported engaging in more than one form of gambling activity.

Table 1.

Frequency of Past Year Gambling Involvement (n =376)

	Not at all		A few times a year		About once a month		About once a week		A few times per week		Almost daily	
Activity	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Cards	282	75.0	81	21.5	9	2.4	1	0.3	0	0	0	0
Animals	350	93.1	17	4.5	7	1.9	2	0.5	0	0	0	0
Sports	283	75.3	70	18.6	13	3.5	7	1.9	2	0.5	1	0.3
Dice	341	90.7	23	6.1	7	1.9	2	0.5	2	0.5	1	0.3
Casino	319	84.8	46	12.2	6	1.6	3	0.8	0	0	0	0
Lottery	227	60.4	102	27.1	27	7.2	15	4.0	4	1.1	1	0.3
Bingo	354	94.1	16	4.3	3	0.8	2	0.5	1	0.3	0	0
Stock Market	349	92.8	19	5.1	3	0.8	3	0.8	1	0.3	0	0
Slots	321	85.4	43	11.4	5	1.3	5	1.3	1	0.3	0	0
Games of Skill	281	74.7	65	17.3	17	4.5	4	1.1	6	1.6	1	0.3
Other	357	94.9	13	3.5	3	0.8	0	0	2	0.5	1	0.3

Note. Participants who failed to indicate the frequency of which they gambled for an activity were excluded from the frequency count by item.

Participants' past year NODS scores classified 36.4% (n = 137) as non-gamblers, 54.5% (n = 205) as low risk gamblers, and 9.1% (n=34) as symptomatic gamblers. Female participants were significantly more likely to be non-problem gamblers than male participants, χ^2 (1, n = 376)=18.54, $p < .05$. Caucasian and minority participants did not differ on their NODS scores, χ^2(1, n = 376)=.90, $p = ns$.

Internal Consistency of Impulsivity Measures

The internal consistency of the subscales scores included in the factor analysis was estimated using coefficient alpha (Cronbach, 1951) with 95% confidence intervals (Iacobucci & Dunacheck, 2003). These values, shown in Table 2, ranged from .54 to .96.

Table 2.

Internal Consistency of Impulsivity Measures with 95% Confidence Intervals

Measure	Subscale	α	95% CI
BIS-11	Attention Impulsiveness	0.72	[0.67, 0.76]
BIS-11	Motor Impulsiveness	0.54	[0.48, 0.61]
BIS-11	Nonplanning Impulsiveness	0.69	[0.65, 0.74]
BIS- BAS	Drive	0.79	[0.76, 0.83]
BIS- BAS	Fun Seeking	0.79	[0.76, 0.83]
BIS- BAS	Reward Responsiveness	0.95	[0.94, 0.96]
BIS- BAS	BIS	0.76	[0.72, 0.79]
SSS	Total	0.84	[0.81, 0.86]
SPSRQ	Sensitivity to Punishment	0.86	[0.84, 0.88]
SPSRQ	Sensitivity to Reward	0.82	[0.79, 0.84]
Padua	Total	0.96	[0.96, 0.97]

Note. CI = confidence interval. Barratt Impulsiveness Scale: 11th version (BIS-11; Patton et al., 1995) Nonplanning Impulsiveness subscale' Behavioral Inhibition/ Behavioral Activation Scales (BIS/BAS; Carver & White, 1994, Sensation Seeking Scale: Form V (SSS Form V; Zuckerman, Eysneck, & Eysenck, 1978), Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ; Torrubia et al., 2001) Padua Inventory (PI; Sanavio, 1988).

Factor Structure of Impulsivity Measures

Principal components analysis with Varimax rotation with Kaiser Normalization was performed to develop aggregate impulsivity factor scores for the proposed multidimensional set of impulsivity measures. The Kaiser-Meyer-Olkin Measure of sampling adequacy (.70) and the Bartlett's Test of Sphericity ($\chi^2 = 1487.63$; df=55,

$p < .05$) indicated that the use of a factor analysis for structure detection was a valid test. The impulsivity domains aligned in a three factor structure when eigenvalues greater than 1.0 were extracted by the analysis. Following Gorsuch's recommendation (1983), a subjective examination of the scree plot supported that three factors be retained in the model. The eigenvalues for these three factors were 3.19, 2.29, and 1.41. These three factors accounted for 62.59% of the total variance in the sample.

Results of the rotated component matrix can be seen in Table 3. The first component was titled Behavioral Activation. This factor was comprised of the BAS Drive subscale, BAS Fun Seeking subscale, and BAS Reward Responsiveness subscale and accounted for 24.48% of the variance. The second component, Preference for Stimulation, was comprised of the Sensation Seeking Scale total score, the SPSRQ Sensitivity to Reward subscale, and the three BIS-11 subscales of Attentional Impulsiveness, Motor Impulsiveness, and Nonplanning Impulsiveness. Preference for Stimulation accounted for 20.12% of the variance. Inhibition Control, the third component, accounted for 18% of the variance. It was comprised of the SPSRQ Sensitivity to Punishment subscale, the Padua total score and the BAS BIS score. The BAS BIS score was reverse scored at this point so it would load in a positive direction on the Inhibition Control factor. The strength of the loading or the location of the loading was not altered by this reverse scoring procedure.

Table 3.

Rotated Component Matrix for the Exploratory Factor Analysis (n =376)

Measure	Subscale	*Mean*	*SD*	Behavioral Activation	Preference for Stimulation	Inhibition Control
BIS-BAS	Drive	9.56	2.69	**.81**	-.06	.03
BIS-BAS	Fun Seeking	9.46	2.97	**.84**	-.02	-.18
BIS-BAS	Reward Responsiveness	10.27	5.04	**.85**	.30	-.19
SSS	Total	17.70	6.86	-.03	**.76**	-.33
SPSRQ	SR	12.01	5.69	-.29	**.51**	.25
BIS-11	Attention Impulsiveness	17.25	3.90	.24	**.56**	.49
BIS-11	Motor Impulsiveness	22.56	3.55	.17	**.75**	.04
BIS-11	Nonplanning Impulsiveness	24.54	4.85	.44	**.50**	.25
SPSRQ	SP	11.51	4.81	.00	-.01	**.82**
Padua	Total	42.75	33.56	-.18	.20	**.65**
BIS-BAS	BIS	18.88	4.26	-.46	-.31	**.58**
Variance explained (%)				28.99	20.83	12.78

Note. Factor loadings are the identical if measure scores are standardized or unstandardized. Highest factor loadings are in boldface. Barratt Impulsiveness Scale: 11th version (BIS-11; Patton et al., 1995) Nonplanning Impulsiveness subscale' Behavioral Inhibition/ Behavioral Activation Scales (BIS/BAS; Carver & White, 1994, Sensation Seeking Scale: Form V (SSS Form V; Zuckerman, Eysneck & Eysenck, 1978), Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ; Torrubia et al., 2001) Padua Inventory (PI; Sanavio, 1988).

To verify the factor structure, the overall fit of the measurement model was evaluated. Because the impulsivity instruments used different measurement scales, subscale scores were standardized to z-values and the factor analysis was repeated. Subscales were determined to load on the rotated component matrix identically both pre and post standardization. The three-factor structure was cross-validated against a standardized model. Variance for the three factors was set to one. Behavioral Activation and Preference for Stimulation were allowed to covary because of their theoretical correlation, but Preference for Stimulation and Inhibition Control were constrained to zero. The model chi-square was rejected indicating that while the model fit was close, there is some variation from the assumed factor structure (χ^2 (32) = 181.59, $p < .05$). Conversely, the factor loading direction and relative magnitude were confirmed for all subscale loadings, all error variances were greater than zero, and the goodness of fit statistic indicated a good model fit (as recommended by Bollen, 1989). These results indicate that while the model chi-square may be significantly different from the ideal standardized model, overall the model fit is good, with the variability of the data largely accounted for by the factor structure.[1]

[1] Given the mixed findings for model fit, and because when model chi-square is calculated with more than three scales loading on one factor a significant amount of error variance is introduced to the model, an exploratory follow up model was run to consider the contributions of unexplained error variances to the model. This model revealed that the commonality for SPSRQ SR was 10%. This suggests that the factor structure left a sizable percent variance unexplained for the SPSRQ SR scale.

Relation between Impulsivity Factors and Gambling Behavior

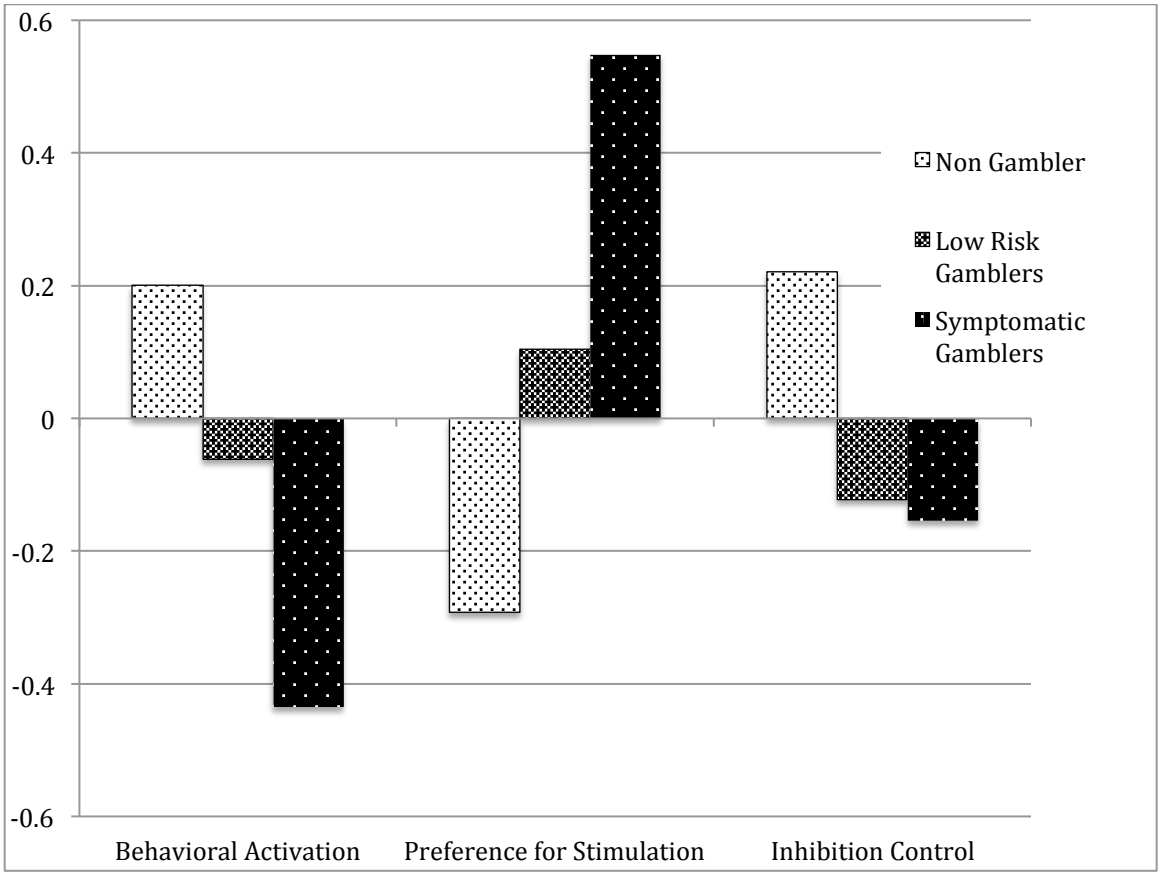
The impulsivity measures used several different rating scales. In order to examine the relation between the three factors and gambling behavior, these scales were all converted to standardized factor scores. A negative correlation was found between gambling frequency and Behavioral Activation, $r = -.17$, $p < .05$ with decreases in Behavioral Activation associated with increases in gambling frequency. A positive correlation was found between Preference for Stimulation and gambling frequency, $r = .26$, $p < .05$ where increases in Preference for Stimulation were associated with increases in gambling frequency.

Regression analyses were then completed. The overall model of the three impulsivity factors significantly predicted gambling frequency, $R^2 = .10$, $F(3,372) = 13.82$, $p < .05$. A closer examination of how the individual factors contributed to the model indicated that Behavioral Activation scores, $b = -.16$, $t(375) = -3.70$, $p < .05$, and Preference for Stimulation scores, $b = .26$, $t(375) = 5.26$, $p < .05$ significantly contributed to the model, but Inhibition Control did not, $b = -.08$, $t(375) = -1.57$, $p = ns$.

A second set of correlations revealed a positive correlation between the NODS score of gambling symptomatology and Preference for Stimulation $r = .10$, $p < .05$. Higher scores on Preference for Stimulation were associated with higher rates of gambling symptomatology. However, when placed in a regression model, none of the impulsivity factors significantly predicted the NODS score, $R^2 = .01$, $F(3,372) = 1.77$, *ns*. A multivariate analysis of variance compared the effect of each impulsivity factor score on gambling classification (non-gamblers, low risk gamblers, symptomatic gamblers). A

non-significant Box's test $F(12, 39132.76) = 1.77$, $p = ns$ suggested the homogeneity of variance-covariance matrix assumption was not violated.

Significant differences were found among the three impulsivity factors and the gambling classification, Wilks' $\lambda = .87$, $F(6,742) = 8.61$, $p < .05$. Follow up univariate analyses of variance showed each impulsivity factor score significantly corresponded to gambling classification; Behavioral Activation, $F(2,373) = 6.55$, $p < .05$, Preference for Stimulation, $F(2,373) = 12.83$, $p < .05$, and Inhibition Control, $F(2,373) = 5.42$, $p < .05$. Post hoc comparisons using the LSD test for Behavioral Activation, showed that non-gamblers ($M = .20$, $SD = .95$) scored significantly higher than low risk gamblers ($M = -.06$, SD=1.02) and symptomatic gamblers ($M = -.43$, $SD = .88$). Additionally, low risk gamblers scored significantly higher than symptomatic gamblers. Comparisons for Preference for Stimulation, revealed that non-gamblers ($M = -.29$, $SD = 1.03$) were significantly lower than low risk gamblers ($M = .10$, $SD = .95$), and symptomatic gamblers ($M = .55$, $SD = .83$). Low risk gamblers were also significantly lower than the symptomatic gamblers. Post hoc comparisons for Inhibition Control revealed that non-gamblers ($M = .22$, $SD = 1.01$) scored significantly higher than low risk gamblers ($M = -.12$, $SD = 1.01$) and symptomatic gamblers ($M = -.15$, $SD = .79$). Low risk gamblers and symptomatic gamblers were not significantly different from each other. See Figure 1.



Note: Non-gamblers are individuals who indicated they had not gambled in the past year. Low risk gamblers wagered in the past year without adverse effects as measured by the National Opinion Research Center Diagnosis Screen (NODS; Toce-Gerstein, Gestein & Volberg, 2003). Symptomatic gamblers were those who reported experiencing at least one adverse effect from their gambling during the past year as measured by the NODS.

Figure 1. Differences between non-gamblers, low risk gamblers and symptomatic gamblers on each Impulsivity Factor.

CHAPTER 4

DISCUSSION

Impulsivity has been shown to correspond with risk factors for developing gambling related problems with varying degrees of certainty (Langewisch & Frisch, 1998; Ledgerwood et al., 2009; Powell et al., 1999; Petry, 2001). One explanation for the inconsistent findings is that impulsivity may be a multidimensional construct (Reynolds et al., 2006) and that different dimensions of impulsivity have different predictive values. Exploring this possibility, the current study had a diverse college student sample complete a set of impulsivity and gambling measures. In addition to closely replicating three impulsivity dimensions revealed by Meda and colleagues (2009), it was found that these factors differentially related to gambling frequency and gambling pathology.

A diverse sample of college students were recruited for the current project. Over half the sample were women and about 45% identified as an ethnic minority. The prevalence of gambling and symptomatic gambling in this cohort was consistent with reports in the literature. The rates of past year gambling and symptomatic gambling were consistent with national surveys of college student gambling (e.g., Barnes et al., 2010; LaBrie et al., 2003; Shaffer et al., 1999). On average participants reported gambling about twice a month and a small number reported daily gambling. As intended the sample was quite different from those participating in Meda et al. (2009). As mentioned, Meda et al. included adult healthy controls, individuals at risk for addiction, and former and current cocaine addicts. Additionally, the Meda et al. (2009) study included proportionally fewer ethnic minorities and a similar percentage of women.

Even with a sample from a distinctly different population, the factor structures and predictive ability of the factors identified in the current study were remarkably consistent with Meda et al. (2009). Also consistent with Meda and colleagues, the Behavioral Activation factor contributed the largest amount of sample variance. This factor was comprised of the three activation subscales of Carver and White's (1994) measure. All three subscales were developed to assess the reward drive system of Gray's theory of reinforcement sensitivity. Behavioral approach corresponds to an internal motivation system that drives cue response and reduces distance between a desired behavior and engagement in behavior. However, the behavioral activation system stops short of creating the initiation for engagement in or prediction of final behavior (Corr, 2002). These measures of the behavioral approach capture aspects of cue response which allow it to be predictive of a variety of health risk behaviors in college students including past month drinking and cigarette smoking involvement (O'Connor, Stewart, & Watt, 2008), as well as risk for alcohol and drug abuse (Franken & Muris; 2006; Franken, Muris, & Georgieva, 2006; Pardo, Aguilar, Molineuvo, & Torrubia, 2007).

Our second factor, Preference for Stimulation, is nearly identical to another of Meda and colleagues factors. It was made up of the Sensation Seeking Scale total score, the SPSRQ Sensitivity to Reward subscale, and the three BIS-11 subscales. This second factor can be conceptualized as a person's perceptions of whether they would actually initiate a specific risk behavior. The Sensation Seeking total score measures a propensity towards new and exciting behaviors (Zuckerman et al., 1978). The Sensitivity to Reward subscale asks questions intended to gain information about specific "situations in which people could do something to obtain rewards" (Torrubia et al., 2001, p. 844). As such,

even from its initial psychometric validation process, Sensitivity to Reward was shown to correlate strongly with sensation seeking. The BIS-11 was designed to capture rash impulsivity, which as opposed to looking at impulsivity as a desire to engage in pleasurable activities, was intended to "relate impulsiveness, along with anxiety, to psychomotor efficiency (Stanford et al., 2009, p. 386)." Throughout the addiction literature, sensation seeking, sensitivity to reward, and rash impulsivity have been individually shown to be predictive of health risk behaviors, particularly alcohol and drug abuse (Jaffe & Archer, 1987, Johnson & Crorsey, 2000).

Our final factor was Inhibition Control. This factor was similar, but not identical, to a third factor found by Meda and colleagues. The Padua Inventory was designed to capture obsessions and compulsions within a population sample (Sanvino, 1981). The behavioral inhibition system (BIS) is "a conflict resolution system; one that moves individuals towards a decision of behavior approach or avoidance by drawing attention to potential dangers of a behavior" (O'Connor et al., 2009, p. 515). The Sensitivity to Punishment scale was specifically designed to assess BIS activity (Torrubia et al., 2001). This subscale is sensitive to feelings of anxiety and worry as well as internal processing of high-risk behavior with uncertain outcome. (Torrubia et al., 2001) Measures of Inhibition Control have been shown to correspond to increased substance use (O'Connor, et al., 2008; Pardo et al., 2007, Simons & Arens, 2007; Sumnall, Wagstaff, & Cole, 2004). Within the substance use disorder literature, it is unclear if it is the anxiety that corresponds with high inhibition control that leads individuals to self-medicate, or if the converse occurs where those with high inhibition control are able to avoid high-risk

behaviors because of their sensitivity to potential poor outcomes (Ball, 2005; Eitle & Traylor, 2010; O'Connor et al., 2009).

Meda et al. (2009) found no significant group differences on Behavioral Activation, but in our sample low risk and symptomatic gamblers scored significantly lower on Behavioral Activation than non-gamblers. Research looking specifically at healthy controls has been able to conclusively show that those scoring higher on behavioral approach took larger risks in an experimental manipulation (Demaree, DeDonno, Burns, & Everhart, 2008). However, the limited findings on gamblers have shown, as in our sample, the inverse conclusion with gamblers scoring lower in behavioral activation than non-gamblers, and low behavioral activation scores corresponding to increased spending when gambling (O'Connor et al., 2008). An explanation is not apparent, further inquiry is needed.

Both in the present study and in Meda et al. (2009), those with higher addictive behavior symptomatology scored higher on Preference for Stimulation. Specific subscales within this factor have individually been shown to predict gambling behavior. In an adult sample, Ledgerwood and colleagues (2009) found specific subscales of rash impulsivity helped identify pathological gamblers. Similarly, Loxton et al. (2008) found adult pathological gamblers to be more impulsive and more sensitive to reward drive when compared to non-pathological gamblers when specifically measuring rash impulsivity and the sensitivity to reward subscale respectively. Conversely, Langewisch and Frisch (1998) looked at male college students and found sensation seeking was related to gambling symptomatology for the non-pathological gambling group, but did not differentiate pathological gamblers from nonpathological gamblers. This suggests

that the addition of rash impulsivity and sensitivity to reward may help further specify gambling risk in a more precise fashion from non-gambler to low risk gambler to symptomatic gambler.

On the factor of Inhibition Control, Meda et al. (2009) found healthy controls were less compulsive and less sensitive to punishment and reward than at risk and addicted individuals. In our sample the reverse was found, with gamblers scoring lower on Inhibition Control than non-gamblers. Other recent literature has found similar surprising results when looking at behavior inhibition and past month gambling behavior (O'Connor et al., 2008). Conversely, research looking at sensitivity to punishment and reward, or specifically at compulsivity in a sample of adult gamblers found that problem gamblers were more sensitive to punishment and more compulsive than non-problem gamblers (Loxton et al., 2008, Skitch & Hodgins, 2004). The differentially predictive value of Inhibition Control for gamblers versus those at risk for or addicted to substances may be explained in at least two ways. First, it may be due to the different subscales loading on this factor than in the original study. Alternatively, these findings could provide further evidence that it is inability to inhibit and insensitivity to punishment (Vitaro, Arseneault, & Tremblay, 1999, Vitaro & Wanner, 2011) that differentiates gamblers from other types of addicts.

While providing interesting exploratory findings on the relation between impulsivity and gambling, our study did have several limitations. First, we did not theoretically approach the question of impulsivity. This was intentional because there continues to be a need to build an empirical foundation for the role of impulsivity in gambling in order to promote more complete theory building. For these empirical efforts,

we chose a selection of impulsivity measures that were commonly used in the addiction literature. However, these measures were not initially created with the intention that they serve as a comprehensive battery of impulsivity assessment. In fact, each measure is based on a different matrix of scale and thus required a transformation to a standard score. Second, despite a substantial sample size, the number of individuals with gambling symptomatology was modest. Replication with a larger sample of pathological gamblers is necessary to further evaluate how these impulsivity factors correspond to high pathology gambling behavior. Finally, it is not clear the NODS was the best tool to assess problem gambling in college students. The NODS was originally designed to sample adults and to date no research fully explains its utility in a college sample.

Given the rates of gambling pathology in college student samples there is a continued need to identify impulsivity-based risk factors within this population. In order to more precisely define the risk, further attention should be paid to the factors' utility in an over-sampling of college students who are gambling with high symptomatology. Additionally, future research efforts should begin to more precisely identify the items within the impulsivity factors that most strongly correspond to increased gambling frequency and increased gambling symptomatology. By further specifying the impulsivity factors that predict gambling pathology we hope to build more precisely a theory of the role of impulsivity in problematic gambling behavior.

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APPENDIX A

FORMS USED IN THE STUDY

Appendix

Page

Appendix A.1. National Opinion Research Center Diagnosis Screen (NODS)**.**

Please mark the selection that best describes your gambling during the **PAST YEAR**.
1. In the table below, please mark with an "X" which of the following types of gambling you have done. For each type, check one answer: "not at all," "a few times a year", "about once a month," "about once a month" or "almost daily."

Types of Gambling (In the PAST YEAR.)	**Not at all**	**A few times a year**	**About once a month**	**About once a week**	**A few times per week**	**Almost daily**
A. Bet on a card game	☐	☐	☐	☐	☐	☐
B. Bet on horses, dogs, or other animals (includes off track betting, or with a bookie)	☐	☐	☐	☐	☐	☐
C. Bet on sports (pro, college, fantasy)	☐	☐	☐	☐	☐	☐
D. Bet on dice games (including craps, over and under, or other dice games)	☐	☐	☐	☐	☐	☐
E. Gambled at a casino	☐	☐	☐	☐	☐	☐
F. Bet on lotteries or played numbers (including scratch tickets and numbers games)	☐	☐	☐	☐	☐	☐
G. Bet on bingo	☐	☐	☐	☐	☐	☐
H. Played the stock and/or commodities market	☐	☐	☐	☐	☐	☐
I. Played slot machines, poker machines, or gambling machines	☐	☐	☐	☐	☐	☐
J. Bet on games of skill (bowling, golf, pool, video games)	☐	☐	☐	☐	☐	☐
K. Gambled on an internet site	☐	☐	☐	☐	☐	☐
L. Other? Please specify. _____	☐	☐	☐	☐	☐	☐

Appendix A.1. (Continued)

2. During a **typical month** in the past year
   when you gambled, how many days did you gamble? _____

3. During the **month** in the past year,
   when you gambled the most, how many days did you gamble? _____

4. What is the largest amount of money you have ever gambled with on any one day?
   - ☐ I've never gambled.
   - ☐ $1 or less
   - ☐ more than $1 but less than $10
   - ☐ more than $10 but less than $100
   - ☐ more than $100 but less than $1,000
   - ☐ more than $1,000 but less than $10,000
   - ☐ more than $10,000

5. Do (or did) your parents have a gambling problem?
   - ☐ Both my father and mother gamble (or gambled) too much
   - ☐ My father gambles (or gambled) too much
   - ☐ My mother gambles (or gambled) too much
   - ☐ Neither gamble (or gambled) too much
   - ☐ I do not know.

6. Do you feel you have ever had a problem with gambling?
   - ☐ No
   - ☐ Yes, in the past, but not now
   - ☐ Yes

Appendix A.1. (Continued)

Remember you are to describe your gambling during the **PAST YEAR**.

Part II.

1. Have there ever been periods lasting 2 weeks or longer when you spent a lot of time thinking about your gambling experiences or planning out future gambling ventures or bets?

   ☐ Yes ☐ No

2. Have there every been periods lasting 2 weeks or longer when you spent a lot of time thinking about ways of getting money to gamble with?

   ☐ Yes ☐ No

3. Have there ever been periods when you needed to gamble with increasing amounts of money or with larger bets than before in order to get the same feeling of excitement?

   ☐ Yes ☐ No

4. Have you ever tried to stop, cut down, or control your gambling?

   ☐ Yes ☐ No

5. On one or more of the times when you tried to stop, cut down or control your gambling were you restless or irritable?

   ☐ Yes ☐ No ☐ Not applicable

6. Have you ever tried but not succeeded in stopping, cutting down, or controlling your gambling?

   ☐ Yes ☐ No

7. If so, has this happened three or more times?

   ☐ Yes ☐ No ☐ Not applicable

8. Have you ever gambled as a way to escape from personal problems?

   ☐ Yes ☐ No

9. Have you ever gambled to relieve uncomfortable feelings such as guilt, anxiety, helplessness, or depression?

   ☐ Yes ☐ No

10. Has there ever been a period when, if you lost money gambling one day, you would return another day to get even?

    ☐ Yes ☐ No

Appendix A.1. (Continued)

11. Have you ever lied to family members, friends, or others about how much you gamble or how much money you lost on gambling?

    ☐ Yes ☐ No

12. If so, has this happened 3 or more times?

    ☐ Yes ☐ No ☐ Not applicable

13. Have you ever written a bad check or taken money that didn't belong to you from family members or anyone else in order to pay for your gambling?

    ☐ Yes ☐ No

14. Has gambling ever caused serious or repeated problems in your relationships with any of your family members or friends?

    ☐ Yes ☐ No

15. Has your gambling cause you any problems in school, such as missing classes or days of school, or your grades dropping?

    ☐ Yes ☐ No

16. Has your gambling ever caused you to lose a job, have trouble with your job, or miss out on an important job or career opportunity?

    ☐ Yes ☐ No

17. Have you ever needed to ask family members or anyone else to loan you money or otherwise bail you out of a desperate money situation that was largely caused by your gambling?

    ☐ Yes ☐ No

Appendix A.2. Barratt Impulsiveness Scale: 11th version (BIS-11).

Directions: People differ in the ways they act and think in different situations. This is a test to measure some of the ways in which you act and think. Read each statement carefully and **CIRCLE THE APPROPRIATE BOX** to the right of the statement. Answer quickly and honestly.

Circle one answer for each	**1 Rarely/Never**	**2 Occasionally**	**3 Often**	**4 Almost Always**
1. I plan tasks carefully.	**1**	**2**	**3**	**4**
2. I do things without thinking.	**1**	**2**	**3**	**4**
3. I make up my mind quickly.	**1**	**2**	**3**	**4**
4. I am happy-go-lucky.	**1**	**2**	**3**	**4**
5. I don't "pay attention."	**1**	**2**	**3**	**4**
6. I have "racing" thoughts.	**1**	**2**	**3**	**4**
7. I plan trips well ahead of time.	**1**	**2**	**3**	**4**
8. I am self-controlled.	**1**	**2**	**3**	**4**
9. I concentrate easily.	**1**	**2**	**3**	**4**
10. I save regularly.	**1**	**2**	**3**	**4**
11. I "squirm" at plays or lectures.	**1**	**2**	**3**	**4**
12. I am a careful thinker.	**1**	**2**	**3**	**4**
13. I plan for job security.	**1**	**2**	**3**	**4**
14. I say things without thinking.	**1**	**2**	**3**	**4**
15. I like to think about complex problems.	**1**	**2**	**3**	**4**

Appendix A.2. (Continued)

16. I change jobs.	**1**	**2**	**3**	**4**
17. I act "on impulse."	**1**	**2**	**3**	**4**
18. I get easily bored when solving thought problems.	**1**	**2**	**3**	**4**
19. I act on the spur of the moment.	**1**	**2**	**3**	**4**
20. I am a steady thinker.	**1**	**2**	**3**	**4**
21. I change where I live.	**1**	**2**	**3**	**4**
22. I buy things on impulse.	**1**	**2**	**3**	**4**
23. I can only think about one problem at a time.	**1**	**2**	**3**	**4**
24. I change hobbies.	**1**	**2**	**3**	**4**
25. I spend or charge more than I earn.	**1**	**2**	**3**	**4**
26. I have outside thoughts when thinking.	**1**	**2**	**3**	**4**
27. I am more interested in the present than the future.	**1**	**2**	**3**	**4**
28. I am restless at lectures or talks.	**1**	**2**	**3**	**4**
29. I like puzzles.	**1**	**2**	**3**	**4**
30. I plan for the future.	**1**	**2**	**3**	**4**

Appendix A.3. Behavioral Inhibition/Behavioral Activation Scales (BIS/BAS).

INSTRUCTIONS: Each item of this questionnaire is a statement that a person may either agree or disagree with. For each item, indicate how much you agree with what the item says by circling a number 1, 2, 3, or 4. Choose only one response for each statement. Please be as accurate and as honest as you can be. Respond to each item as if it were the only item. That is, don't worry about being "consistent" in your responses. Choose from the following four response options.

Circle the number that applies	**Very true for me**	**Somewhat true for me**	**Somewhat false for me**	**Very false for me**
1. A person's family is the most important thing in life	1	2	3	4
2. Even if something bad is about to happen to me, I rarely experience fear or nervousness	1	2	3	4
3. I go out of my way to get things I want	1	2	3	4
4. When I'm doing well at something, I love to keep at it	1	2	3	4
5. I'm always willing to try something new if I think it will be fun	1	2	3	4
6. How I dress is important to me	1	2	3	4
7. When I get something I want, I feel excited and energized	1	2	3	4
8. Criticism or scolding hurts me quite a bit	1	2	3	4
9. When I want something, I usually go all-out to get it	1	2	3	4
10. I will often do things for no other reason than that they might be fun	1	2	3	4
11. It's hard for me to find the time to do things such as get a haircut	1	2	3	4
12. If I see a chance to get something I want I move on it right away	1	2	3	4
13. I feel pretty worried or upset when I think or know somebody is angry at me	1	2	3	4
14. When I seen an opportunity for something I like I get excited right away	1	2	3	4
15. I often act on the spur of the moment	1	2	3	4

Appendix A.3. (Continued)

Circle the number that applies	Very true for me	Somewhat true for me	Somewhat false for me	Very false for me
16. If I think something unpleasant is about to happen I usually get pretty "worked up"	1	2	3	4
17. I often wonder why people act the way they do	1	2	3	4
18. When good things happen to me, it affects me strongly	1	2	3	4
19. I feel worried when I think I have done poorly at something important	1	2	3	4
20. I crave excitement and new sensations	1	2	3	4
21 When I go after something I use a "no holds barred" approach	1	2	3	4
22. I have very few fears compared to my friends	1	2	3	4
23. It would excite me to win a contest	1	2	3	4
24. I worry about making mistakes	1	2	3	4

Appendix A.4. Sensation Seeking Scale: Form V (SSS).

DIRECTIONS: Each of the items below contains two choices A and B. Please indicate which of the choices most describes your likes or the way you feel. In some cases you may find items in which both choices describe your likes or feelings. In some cases you may find items in which you do not like either choice. In these cases mark the choice you dislike least. Do not leave any items blank.

It is important you respond to all the items with only one choice, **A or B**. We are interested only in your likes or feelings, not in how others feel about these things or how one is suppose to feel. There are no right or wrong answers as in other kinds of tests. Be frank and give your best honest appraisal of yourself.

Circle either A or B for each item.

1.	I like "wild" uninhibited parties.	A
	I prefer quiet parties with good conversation.	B
2.	There are some movies I enjoy seeing a second or even third time.	A
	I can't stand watching a movie that I've seen before.	B
3.	I often wish I could be a mountain climber.	A
	I can't understand people who risk their necks climbing mountains.	B
4.	I dislike all body odors.	A
	I like some of the earthy body smells.	B
5.	I get bored seeing the same old faces.	A
	I like the comfortable familiarity of everyday friends.	B
6,	I like to explore a strange city or section of town by myself, even if it means getting lost.	A
	I prefer a guide when I am in a place I don't know very well.	B
7.	I dislike people who do or say things just to shock or upset others.	A
	When you can predict almost everything a person will do and say he or she must be a bore.	B
8.	I usually don't enjoy a movie or play where I can predict what will happen in advance.	A
	I don't mind watching a movie or play where I can predict what will happen in advance.	B

Appendix A.4. (Continued)

9.	I have tried marijuana or would like to.	A
	I would never smoke marijuana.	B
10.	I would not like to try any drug which might produce strange and dangerous effects on me.	A
	I would like to try some of the drugs that produce hallucinations.	B
11.	A sensible person avoids activities that are dangerous.	A
	I sometimes like to do things that are a little frightening.	B
12.	I dislike people who are too easy about sex.	A
	I enjoy the company of people who are free and easy about sex..	B
13.	I find that stimulants make me uncomfortable.	A
	I often like to get high (drinking liquor or smoking marijuana).	B
14.	I like to try new foods that I have never tasted before.	A
	I order the foods with which I am familiar so as to avoid disappointment and unpleasantness.	B
15.	I enjoy looking at home movies, videos or travel slides.	A
	Looking at someone's home movies or travel slides bores me tremendously	B
16.	I would like to take up the sport of water skiing.	A
	I would not like to take up water skiing.	B
17.	I would like to try surf board riding.	A
	I would not like to try surf board riding.	B
18.	I would like to take off on a trip with no preplanned or definite routes or timetable.	A
	When I go on a trip, I like to plan my route and timetable fairly carefully.	B
19.	I prefer the "down to earth" kinds of people as friends.	A
	I would like to make friends in some of the "far out" groups like artists or "punks."	B
20.	I would not like to learn to fly an airplane.	A
	I would like to learn to fly an airplane.	B

Appendix A.4. (Continued)

21.	I prefer the surface of the water to the depths.	A
	I would like to go scuba diving.	B
22.	I would like to meet some persons who are homosexual (men or women).	A
	I say away from anyone I suspect of being gay or lesbian.	B
23.	I would like to try parachute jumping.	A
	I would never want to try jumping out of a plane with or without a parachute.	B
24.	I prefer friends who are excitingly unpredictable.	A
	I prefer friends who are reliable and predictable.	B
25.	I am not interested in experience for its own sake.	A
	I like to have new and exciting experiences and sensations even if they are a little frightening, unconventional, or illegal.	B
26.	The essence of good art is in its clarity, symmetry of form, and harmony of colors.	A
	I often find beauty in the "clashing" colors and irregular forms of modern paintings.	B
27.	I enjoy spending time in the familiar surroundings of home.	A
	I get very restless if I stay around home for any length of time.	B
28	I like to dive off the high board.	A
	I don't like the feeling I get standing on the high board (or I don't go near it at all).	B
29.	I like to date persons who are physically exciting.	A
	I like to date persons who share my values.	B
30.	Heavy drinking usually ruins a party because some people get loud and boisterous.	A
	Keeping the drinks full is the key to a good party.	B
31.	The worst social sin is to be rude.	A
	The worst social sin is to be a bore.	B
32.	A person should have considerable sexual experience before marriage.	A
	It's better if two married people begin their sexual experience with each other.	B

Appendix A.4. (Continued)

33.	Even if I had the money, I would not care to associate with flighty rich persons who travel around the world in pursuit of pleasures and new experiences.	A
	If I had lots of money, I would spend much of my time traveling around the world in pursuit of pleasures and new experiences.	B
34.	I like people who are sharp and witty even if they sometimes insult others.	A
	I dislike people who have their fun at the expense of hurting the feelings of others.	B
35.	There is altogether too much portrayal of sex in movies.	A
	I enjoy watching many of the "sexy" scenes in movies.	B
36.	I feel best after taking a couple of drinks.	A
	Something is wrong with people who need liquor to feel good.	B
37.	People should dress according to some standard of taste, neatness and style.	A
	People should dress in individual ways even if the effects are sometimes strange.	B
38.	Sailing long distances in small sailing crafts is foolhardy.	A
	I would like to sail a long distance in a small but seaworthy sailing craft.	B
39.	I have no patience with dull or boring persons.	A
	I find something interesting in almost every person I talk to.	B
40.	Skiing down a high mountain slope is a good way to end up on crutches.	A
	I think I would enjoy the sensations of skiing very fast down a high mountain slope.	B

Appendix A.5. Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ).

Please circle the answer (NO or YES) that best describes you. Please answer every question.

1. Do you often refrain from doing something because you are afraid of it being illegal?	NO	YES
2. Does the good prospect of obtaining money motivate you strongly to do some things?	NO	YES
3. Do you prefer not to ask for something when you are not sure you will obtain it?	NO	YES
4. Are you frequently encouraged to act by the possibility of being valued in your work, in your studies, with your friends, or with your family?	NO	YES
5. Are you often afraid of new or unexpected situations?	NO	YES
6. Do you often meet people that you find physically attractive?	NO	YES
7. Is it difficult for you to telephone someone you do not know?	NO	YES
8. Do you like to take drugs because of the please you get form them?	NO	YES
9. Do you often renounce your rights when you know you can avoid a quarrel with a person or an organization?	NO	YES
10. Do you often do things to be praised?	NO	YES
11. As a child were you troubled by punishments at home or in school?	NO	YES
12. Do you like being the center of attention at a party or a social meeting?	NO	YES
13. In tasks that you are not prepared for, do you attach great importance to the possibility of failure?	NO	YES
14. Do you spend a lot of your time on obtaining a good image?	NO	YES
15. Are you easily discouraged in difficult situations?	NO	YES
16. Do you need people to show their affection for you all the time?	NO	YES
17. Are you a shy person?	NO	YES
18. When you are in a group, do you try to make your opinions the most intelligent or the funniest?	NO	YES
19. Whenever possible, do you avoid demonstrating your skills for fear of being embarrassed?	NO	YES
20. Do you often take the opportunity to pick up people you find attractive?	NO	YES
21. When you are with a group do you have difficulties selecting a good topic to talk about?	NO	YES
22. As a child, did you do a lot of things to get people's approval?	NO	YES
23. Is it often difficult for you to fall asleep when you think about things you have done or must do?	NO	YES
24. Does the possibility of social advancement move you to action, even if this involves not playing fair?	NO	YES

Appendix A.5. (Continued)

25. Do you think a lot before complaining in a restaurant if your meal is not well prepared?	NO	YES
26. Do you generally give preference to those activities that imply an immediate gain?	NO	YES
27. Would you be bothered if you had to return to a store when you noticed you were given the wrong change?	NO	YES
28. Do you often have trouble resisting the temptation of doing forbidden things?	NO	YES
29. Whenever you can, do you avoid going to unknown places?	NO	YES
30. Do you like to compete and do everything you can to win?	NO	YES
31. Are you often worried by things you said or did?	NO	YES
32. Is it easy for you to associate tastes and smells to very pleasant events?	NO	YES
33. Would it be difficult for you to ask your boss for a raise (salary increase)?	NO	YES
34. Are there a large number of objects or sensations that remind you of pleasant events?	NO	YES
35. Do you generally try to avoid speaking publically?	NO	YES
36. When you start to play with a slot machine, is it often difficult for you to stop?	NO	YES
37. Do you, on a regular basis, think that you could do more things if it was not for your insecurity or fear?	NO	YES
38. Do you sometimes do things for quick gains?	NO	YES
39. Comparing yourself to people you know, are you afraid of many things?	NO	YES
40. Does your attention easily stray form your work in the presence of an attractive stranger?	NO	YES
41. Do you often find yourself worrying about things to the extent that performance of intellectual abilities is impaired?	NO	YES
42. Are you interested in money to the point of being able to do risky jobs?	NO	YES
43. Do you often refrain from doing something you like in order not to be rejected or disapproved of by others?	NO	YES
44. Do you like to put competitive ingredients in all of your activities?	NO	YES
45. Generally do you pay more attention to threats than to pleasant events?	NO	YES
46. Would you like to be a socially powerful person?	NO	YES
47. Do you often refrain from doing something because of your fear of being embarrassed?	NO	YES
48. Do you like displaying your physical abilities even though this may involve danger?	NO	YES

Appendix A.6. Padua Inventory (PI).

Instructions: The following statements refer to thoughts and behaviors which may occur to everyone in everyday life. For each statement, choose the reply which best seems to fit you and the degree of disturbance which such thoughts or behaviors may create. Rate your replies as follows:

0- not at all
1- a little
2- quite a lot
3- a lot
4- very much

1. I feel my hands are dirty when I touch money.	0	1	2	3	4
2. I think even slight contact with bodily secretions (perspiration, saliva, urine etc.) may contaminate my clothes or somehow harm me.	0	1	2	3	4
3. I find it difficult to touch an object when I know it has been touched by strangers or by certain people.	0	1	2	3	4
4. I find it difficult to touch an object when I know it has been touched by strangers or by certain people.	0	1	2	3	4
5. I avoid using public toilets because I am afraid of disease and contamination.	0	1	2	3	4
6. I avoid using public telephones because I am afraid of contagion and disease.	0	1	2	3	4
7. I wash my hands more often and longer than necessary.	0	1	2	3	4
8. I sometimes have to wash or clean myself simply because I think I may be dirty or 'contaminated'.	0	1	2	3	4
9. If I touch something I think is 'contaminated' I immediately have to wash or clean myself.	0	1	2	3	4
10. If an animal touches me, I feel dirty and immediately have to wash myself or change my clothing.	0	1	2	3	4
11. When doubts and worries come to mind, I cannot rest until I have talked them over with a reassuring person.	0	1	2	3	4
12. When I talk I tend to repeat the same things and the same sentences several times.	0	1	2	3	4
13. I tend to ask people to repeat the same things to me several times consecutively, even though I did understand what they said the first time.	0	1	2	3	4
14. I feel obliged to follow a particular order in dressing, undressing and washing myself.	0	1	2	3	4
15. Before I go to sleep I have to do certain things in a certain order.	0	1	2	3	4
16. Before going to bed I have to hang up or fold my clothes in a special way.	0	1	2	3	4
17. I feel I have to repeat certain numbers for no reason.	0	1	2	3	4
18. I have to do things several times before I think they are properly done.	0	1	2	3	4
19. I tend to keep checking on things more often than necessary.	0	1	2	3	4
20. I check and recheck gas and water taps and light switches after turning them off.	0	1	2	3	4

Appendix A.6. (Continued)

21. I return home to check doors, windows, drawers, etc., to make sure they are properly shut.	0	1	2	3	4
22. I keep checking forms, documents, checks etc. in detail, to make sure I have filled them out correctly.	0	1	2	3	4
23. I keep on going back to see that matches, cigarettes etc. are properly extinguished.	0	1	2	3	4
24. When I handle money I count and recount it several times.	0	1	2	3	4
25. I check letters many times before posting them.	0	1	2	3	4
26. I find it difficult to make decisions, even about unimportant matters.	0	1	2	3	4
27. Sometimes I am not sure I have done things which in fact I know I have done.	0	1	2	3	4
28. I have the impression that I will never be able to explain things clearly, especially when talking about important matters that involve me.	0	1	2	3	4
29. After doing something carefully, I still have the impression I have either done it badly or not finished it.	0	1	2	3	4
30. I am sometimes late because I keep on doing certain things more often than necessary.	0	1	2	3	4
31. I invent doubts and problems about most of the things I do.	0	1	2	3	4
32. When I start thinking of certain things, I become obsessed with them.	0	1	2	3	4
33. Unpleasant thoughts come into my mind against my will and I cannot get rid of them.	0	1	2	3	4
34. Obscene or dirty words come into my mind and I cannot get rid of them.	0	1	2	3	4
35. My brain constantly goes its own way and I find it difficult to attend to what is happening around me.	0	1	2	3	4
36. I imagine catastrophic consequences as a result of absent-mindedness or minor errors which I make.	0	1	2	3	4
37. I think or worry at length about having hurt someone without knowing it.	0	1	2	3	4
38. When I hear about a disaster, I think it is somehow my fault.	0	1	2	3	4
39. I sometimes worry at length for no reason that I have hurt myself or have some disease.	0	1	2	3	4
40. I sometimes start counting objects for no reason.	0	1	2	3	4
41. I feel I have to remember completely unimportant numbers.	0	1	2	3	4
42. When I read I have the impression I have missed something important and must go back and reread the passage at least two or three times.	0	1	2	3	4
43. I worry about remembering completely unimportant things and make an effort not to forget them.	0	1	2	3	4
44. When a thought or doubt comes into my mind, I have to examine it from all points of view and cannot stop until I have done so.	0	1	2	3	4
45. In certain situations I am afraid of losing my self-control and doing embarrassing things.	0	1	2	3	4

Appendix A.6. (Continued)

46. When I look down form a bridge or a very high window, I feel an impulse to throw myself into space.	0	1	2	3	4
47. When I see a train approaching I sometimes think I could throw myself under its wheels.	0	1	2	3	4
48. At certain moments I am tempted to tear off my clothes in public.	0	1	2	3	4
49. When driving I sometimes feel an impulse to drive the car into someone or something.	0	1	2	3	4
50. Seeing weapons excites me and make me think violent thoughts.	0	1	2	3	4
51. I get upset and worried at the sight of knives, daggers and other pointed objects.	0	1	2	3	4
52. I sometimes feel something inside me which make me do things which are really senseless and which I do not want to do.	0	1	2	3	4
53. I sometimes feel the need to break or damage things for no reason.	0	1	2	3	4
54. I sometimes feel an impulse to steal other people's belongings, even if they are of no use to me.	0	1	2	3	4
55. I am sometimes almost irresistibly tempted to steal from the supermarket.	0	1	2	3	4
56. I sometimes have an impulse to hurt defenseless children or animals.	0	1	2	3	4
57. I feel I have to make special gestures or walk in a certain way.	0	1	2	3	4
58. In certain situations I feel an impulse to eat too much, even if I am then ill.	0	1	2	3	4
59. When I hear about a suicide or a crime, I am upset for a long time and find it difficult to stop thinking about it.	0	1	2	3	4
60. I invent useless worries about germs and disease.	0	1	2	3	4

Appendix A.7.

THE UNIVERSITY OF MEMPHIS

Institutional Review Board

To:	Meredith Ginley and James Whelan Psychology
From:	Chair, Institutional Review Board For the Protection of Human Subjects irb@memphis.edu
Subject:	The Substance Use and Gambling Project: Assessing Gambling Behaviors and Impulsivity in College Students (120710-227)
Approval Date:	December 8, 2010

This is to notify you of the board approval of the above referenced protocol. This project was reviewed in accordance with all applicable statuses and regulations as well as ethical principles.

Approval of this project is given with the following obligations:

1. At the end of one year from the approval date, an approved renewal must be in effect to continue the project. If approval is not obtained, the human consent form is no longer valid and accrual of new subjects must stop.
2. When the project is finished or terminated, the attached form must be completed and sent to the board.
3. No change may be made in the approved protocol without board approval, except where necessary to eliminate apparent immediate hazards or threats to subjects. Such changes must be reported promptly to the board to obtain approval.
4. The stamped, approved human subjects consent form must be used. Photocopies of the form may be made.

This approval expires one year from the date above, and must be renewed prior to that date if the study is ongoing.

_____

Chair, Institutional Review Board
The University of Memphis

Cc: Dr. James Whelan

THE UNIVERSITY OF MEMPHIS.
Dreamers. Thinkers. Doers.

Institutional Review Board

315 Administration Bldg.
Memphis, TN 38152-3370
Office: 901.678.3074
Fax: 901.678.2199

Internet Informed Consent Form

Substance Use and Gambling Project

Investigators Meredith K. Ginley and James P. Whelan, Ph.D.
Department of Psychology
The University of Memphis, TN 38152

Purpose of the Project

You are being asked to take part in a University of Memphis research project conducted by Meredith Ginley under the supervision of Dr. James Whelan. You must be at least 18 years of age to participate. The purpose of this project is to learn more about behaviors of college students.
If you have any questions or comments regarding this project prior to or after participating, you are encouraged to contact us through e-mail: Meredith Ginley (mkginley@memphis.edu).

Explanation of Procedures

You will be asked to complete several online questionnaires related to your experiences with gambling, alcohol and drug use, things you like or dislike, and the ways you think or act in different situations. These online questionnaires will take approximately 60 minutes.
We understand that for some questions you may feel the response choices are limited, or that you fall somewhere in between two answers. However, we ask that you pick the answer that you feel is closest to what best describes you. We appreciate your patience and honesty in participating in this project.

Risks or Discomforts

The risks in this study are considered minimal. These questionnaires are commonly used in research. It may be difficult or upsetting for you to answer questions about your experiences. You may discontinue the questionnaires at any time.

Benefits

We cannot guarantee that you will receive any direct benefits from this study. Your participation is completely voluntary. You will receive one research credit for participation. Additionally, you will contribute to the field of gambling addiction research.

Confidentiality

You will not be asked to provide your name or any other identifying information during your participation in this project. Therefore your responses are anonymous, and they will be kept on a password-protected computer at the University of Memphis. The overall findings of this project may be published in a scientific journal. You can request a copy of these findings by sending an e-mail to mkginley@memphis.edu.

Decision to participate and right to quit at any time

Participation is completely voluntary, and you may quit at any time.
Questions about the study should be directed to Meredith Ginley and Dr. James Whelan by e-mail (jwhelan@memphis.edu). For questions regarding your rights as a research participant contact the Chair of the Institutional Review Board for the Protection of Human Subjects in Tennessee at 901-678-2533.

CONSENT TO PARTICIPATE

_____ I AM AT LEAST 18 YEARS OF AGE.

_____ I HAVE READ THE CONSENT FORM AND FULLY UNDERSTAND IT.

IRB ID#: 120710-227
Expiration Date: December 8, 2011

THE UNIVERSITY OF MEMPHIS

Institutional Review Board

To: Meredith Ginley
Psychology

From: Chair, Institutional Review Board
For the Protection of Human Subjects
irb@memphis.edu

Subject: The Substance Use and Gambling Project: Assessing Gambling Behaviors and Impulsivity in College Students (120710-227-CR01)

Approval Date: December 7, 2011

This is to notify you of the board approval of the above referenced protocol. This project was reviewed in accordance with all applicable statuses and regulations as well as ethical principles.

Approval of this project is given with the following obligations:

1. At the end of one year from the approval date, an approved renewal must be in effect to continue the project. If approval is not obtained, the human consent form is no longer valid and accrual of new subjects must stop.
2. When the project is finished or terminated, the attached form must be completed and sent to the board.
3. No change may be made in the approved protocol without board approval, except where necessary to eliminate apparent immediate hazards or threats to subjects. Such changes must be reported promptly to the board to obtain approval.
4. The stamped, approved human subjects consent form must be used. Photocopies of the form may be made.

This approval expires one year from the date above, and must be renewed prior to that date if the study is ongoing.

_____
Chair, Institutional Review Board
The University of Memphis

Cc: Dr. James Whelan