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Applying a Behavioral Economic Framework to the Gambling Behavior of College Students

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APPLYING A BEHAVIORAL ECONOMIC FRAMEWORK TO THE GAMBLING BEHAVIOR OF COLLEGE STUDENTS

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Abstract

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Behavioral economic theory conceptualizes human behavior as the result of allocating behavioral resources to engage in preferred activities. This framework has been applied sparingly to gambling behavior. The present study sought to reveal the important behavioral economic construct of relative reinforcing value for the activity of gambling by manipulating the value of an alternative reinforcer as well as constraining it's availability in a sample of college students, a population that consistently shows elevated rates of gambling as well as problematic gambling behaviors. Analyses did not support the hypotheses, as gambling's reinforcing value was not demonstrated by the experimental manipulations. Implications and methodological limitations are discussed.

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An extensive literature comprising animal and human subjects in experimental and applied studies supports a behavioral economic model for alcohol and other drug use behavior (Murphy, MacKillop, Vuchinich, & Tucker 2011; Vuchinich & Tucker, 1988). A small yet expanding body of literature conceptualizes gambling behavior in a behavioral economic framework (Madden, Francisco, Brewer, & Stein, 2011). Those who adopt this approach assert that people place subjective values on reinforcers, and choose to allocate behavioral resources to attain those reinforcers. Behavioral economics is concerned with this valuation process and how people choose the behaviors they engage in (Kahneman, 2003). This focus has proven valuable in the understanding of addictive behavior (Murphy et al., 2011). Considering gambling within a behavioral economic framework should help us to understand why people choose to gamble over other lower risk activities and potentially inform prevention and intervention efforts aimed at lowering reinforcement derived from gambling (Higgins, Heil, & Lussier, 2004). The purpose of the present study was to seek evidence supporting the utility of a behavioral economic view of gambling behavior. Adapting an experimental design taken from Vuchinich and Tucker (1983), we examined whether increasing the value of an alternative reinforcer would decrease gambling's reinforcing value, and if increasing the constraints on an alternative reinforcer would increase the value of gambling.

Borrowing from the field of economics, behavioral economics views individuals as consumers of behavior. In this sense, people choose to allocate time, money, and other resources to a range of possible activities by engaging in a process of weighing the costs and benefits of the available alternatives. As the perceived costs begin to outweigh perceived benefits, preference shifts. As the law of demand predicts, price increases lead to a decrease in consumption or occurrence of a behavior. This decrease in consumption is manifested in the shape of a decelerating curve (Murphy & MacKillop, 2006). Behavioral economics also takes a molar view of behavior in that it does not attempt to predict what choices people make in a specific context, but rather looks at the accrual of behaviors over time. A behavior becomes preferred over a range of alternatives when the behavior is perceived as having higher reinforcing value than the alternatives. This notion of relative reinforcing value (Murphy & MacKillop, 2006) has been an important construct in the addictions literature and has often been operationalized in laboratory studies as the amount of work (e.g, lever presses) reinforcers elicited and the relative amount of the substance consumed compared to the alternative (Higgins et al., 2004).

This relativity of reinforcing behavior is best explicated by Herrnstein's Matching Law (1970). Hernsteinn asserted that the occurrence of a certain behavior compared to its alternatives is equal to the amount of reinforcement or reinforcing value derived from the corresponding behavior and its alternatives. That is, directly relative rates of behavior will match relative rates of reinforcement. In this way, behavioral output is a "zero-sum" game; engaging in one behavior necessarily changes how much one can engage in all other available behaviors.

In behavioral economic theory three key factors impact reinforcing value and the prediction of behavior: 1) the availability of a reinforcer, 2) the availability of alternative reinforcers, and 3) temporal delay to a reinforcer or its alternatives (Vuchinich & Tucker, 1988). Constraints on access to reinforcers influence their relative reinforcing value.

Generally, when a reinforcer is directly constrained, the cost of obtaining it increases, leading to a decrease in resources allocated to obtain it and a lower relative reinforcing value. Alternatively, relieving the constraints on access to a reinforcer will drive up relative reinforcing value because of the lowered cost of reinforcer obtainment. However, individual differences temper this facet of reinforcing value. That is, demand can be relatively elastic, and sensitive to escalating price, or relatively inelastic, and resistant to escalating price. Additionally, when constraints are placed on alternative reinforcers, resources will be less likely to be allocated to them (Vuchinich & Tucker, 1983).

Temporal delays to a reinforcer also impact relative reinforcement value. Generally, as time to the reception of a reinforcer increases, subjective value of that reinforcer decreases. This concept is also referred to as delay discounting (Bickel & Marsh, 2001). A review of delay discounting and gambling studies consistently found that gamblers, compared to controls, preferred smaller, more immediate rewards over larger, later rewards (Madden et al., 2011).

Considerable evidence exists for the influence of alternative, nondrug reinforcers on consumption of drugs. Higgins and colleagues (2004) extensively reviewed laboratory studies with human participants that demonstrate the flexibility of the reinforcing effects of cocaine, nicotine, and alcohol. Across substances, consumption has been shown to be affected by constraints on their availability as well as the availability of alternatives. Specifically, introducing a monetary alternative to cocaine reduced the amount of the drug consumed by human participants (Higgins, Bickel, & Hughes, 1994). Additionally, crack cocaine users given the opportunity to keep money or allocate it to acquire doses of the inhaled drug. As the amount of money increased, less was allocated to the drug (Hatsukami, Thompson, Pentel, Flygare, & Carroll, 1994).

Vuchinich and Tucker (1983) demonstrated the amenability of alcohol use to a behavioral economics model by offering participants the choice, on a button pressing task, to select one of two potential reinforcers with differing temporal delays. On a variable interval schedule participants were either given a choice to work for money in increments of 2 cents or 10 cents or alcohol held constant at increments of 1/20th of a drink. An additional manipulation of temporal delay to the monetary reinforcer was set at immediate receipt of money, a 2-week delay, or an 8-week delay. With the proportion of responses allocated to acquiring alcohol as the dependent variable, the investigators found that as the monetary award increased, responding for alcohol decreased, and as delay to receiving money increased, responding for alcohol increased. These findings demonstrated the explicative value of behavioral economic theory with alcohol choice.

Given that gambling is risking money or something of value on an unknown outcome, choice behavior and weighing risks are necessarily involved. It is ironic then that gambling behavior has not been investigated in this theoretical framework to the extent of other addictive behaviors. The extant literature focuses almost exclusively on the behavioral economic concept of delay discounting (Madden et al., 2011).

Although a common recreational activity that is culturally acceptable (Whelan, Steenbergh, & Meyers, 2007), gambling can be particularly problematic. Pathological gambling is “persistent and recurrent maladaptive gambling behavior that disrupts personal, family, or vocational pursuits” (American Psychiatric Association, 2000). Past year gambling prevalence rates for college students range from 42% (LaBrie, Shaffer, LaPlante, & Wechsler, 2003) to 75% (Barnes, Welte, Hoffman, & Tidwell, 2010). A sample more representative of the US population had a past year gambling prevalence rate of 82% (Welte, Barnes, Wieczorek, & Tidwell, 2004). In a meta-analysis of prevalence studies, Shaffer and Hall (2001) found lifetime pathological gambling rates of 3.4% for adolescents, 1.9% for adults, and 5.6% for college students. More recent meta-analyses suggest rates of pathological gambling in college students range from 3% to 32% with a median of 8.7%, a rate much higher than the adult population (Nowak & Aloe, 2013). Among college students, 18.3% of men and 4.4% of women were found to be problem or pathological gamblers (Engwall, Hunter, & Steinberg, 2004).

College student gamblers are at a high risk for developing other co-occurring behavioral problems. Problem and pathological student gamblers compared to other students reported binge eating and heavier drinking with more negative consequenes (Engwall et al., 2004). Problem gambling among college students also correlates with high-risk behaviors such as alcohol and other drug use and risky sexual behaviors. (Stuldreher, Stuhldreher, & Forres, 2007).

Given the impact of problem gambling, especially among adolescents and young adults, we adapted the Vuchinich and Tucker (1983) methodology to examine college student gambling within the framework of behavioral economics. Based on prior work with alcohol, we expected that preference for gambling would be influenced by the reinforcement value and time delay of alternatives. We hypothesized that as the reinforcing value of a gambling alternative increases, the reinforcing value for gambling will decrease. Secondly, as the temporal delay to the alternative behavior increased, the reinforcing value of gambling would increase.

Methods

Participants

The sample was comprised of 84 participants recruited from a state university undergraduate subject pool who were at least 18 years of age. Of the participants, 62% were female and the average age was 22 years (*SD* = 6.4 years). Approximately 49% of the sample was African American, 37% Caucasian, 7% Asian, 5% Hispanic, and 2% of participants identified as “Other.” Participants’ selection of “Other” was not related to gambling behavior.

Measures

Demographic Questionnaire. A brief demographics questionnaire was administered to assess age, gender, and ethnicity. Other areas of assessment included whether or not the participant found gambling to be an acceptable/permissible behavior, and a measure of gambling activity preference (Dandurand, 1990).

South Oaks Gambling Screen (SOGS). This 20-item self-report questionnaire assesses pathological gambling during the past year (Lesieur & Blume, 1987). Participants who endorsed gambling behavior in the past year were invited to participate in this study. Participants who scored 0 to 4 were classified as non-PG, and participants who scored 5 or higher were classified as pathological gamblers. In other psychometric studies with adult and treatment seeking samples, internal consistency was good to excellent (α = .86-.97), test-retest reliability was adequate (*r* = .71), and convergent validity was demonstrated with clinician-administered interviews (*r* = .86; Lesieur & Blume, 1987).

National Opinion Research Center Diagnosis Screen (NODS). The NODS (Toce-Gerstein, Gestein, & Volberg, 2003) was developed utilizing the diagnostic criteria for Pathological Gambling (American Psychiatric Association, 2000). Designed for population-based surveys rather than clinical samples of problem gamblers, the NODS 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). A score of 0-2 indicates no gambling problems. A score of 3 to 4 indicates subclinical, or at-risk pathological gambling. Five or greater equates to meeting diagnostic criteria for pathological gambling. In a sample of treatment seeking problem gamblers, the NODS had an internal reliability of *alpha*= 0.79 and to have a two to four week test-retest reliability of 0.98. It detects problem gambling in 95% of individuals receiving treatment for problem gambling (Toce-Gerstein, Gerstein & Volberg, 2003).

Delay Discounting Task – Short Form (DDT). The DDT (Amlung & MacKillop, 2011) is a multi-item choice procedure contrasting hypothetical smaller immediate monetary rewards and larger delayed monetary rewards. Preference was measured over 66 items and yields an index of impulsivity, a parameter, *k*. This parameter is part of a hyperbolic discounting function (Mazur, 1987): $V = A / (1 + kD)$. The DDT is considered an index of impulsive decision-making, separate but related to two other broad categories of impulsivity measurements: personality-based indicies and behavioral assays of response inhibition (de Wit, 2009; Perry, Larson, German, Madden, & Carroll, 2005)

Gamblers Belief Questionnaire (GBQ). The GBQ (Steenbergh, Meyers, May, & Whelan, 2002) is a self-report measure designed to assess gambling-related irrational beliefs. The GBQ consists of 21 gambling-related irrational belief statements for which respondents are asked to rate the extent to which they agree or disagree on a 7-point Likert-type scale. The GBQ score is the sum of all items. Scores can range from 20 to 140, with higher scores indicative of higher levels of gambling-related irrational thinking. Both reliability and validity data supported our use of this instrument (Steenbergh et al., 2002).

Measurement of Preference

Participants were randomly assigned to one of six conditions created by manipulations in money amount (two levels) and temporal delay (three levels). The dependent variable was proportion of responses allocated to gambling vs. money. Each participant was given the task of responding on a simple button pressing task to earn either individual spins on a slot machine to be used that day or two small amounts of money. Money was available either in increments of 5 cents or 25 cents and the temporal delay to receive the money was no delay, 2 weeks or 8 weeks. Due to the logistical and ethical barriers of providing all participants with earned money and gambling opportunities, deception was employed. Participants were compensated with snacks provided after the experimental task and debriefing were complete.

The button pressing task was patterned after the task employed by Vuchinich and Tucker (1983). Participants choose either money or gambling and then engaged in a button-pressing task with points delivered on a variable interval (VI) 20-second schedule of reinforcement. Points were accumulated for the selected reinforcer, either money or gambling spins. All technical and visual aspects of Vuchinich and Tucker's operant console were replicated in software designed for this study but the participant performed on a laptop rather than a console. A counter and two labels appeared in each lateral half of the upper third of the console. In the center of the screen is a black button labeled 'Gambling/Money,' and centered in the lower third of the screen is a red button labeled 'Gambling,' or 'Money,' depending on which counter was activated in the initial choice.

One counter registered points earned for spins on a slot machine and the other counter registered points earned for money. Only one counter could be activated at a time, with the label under the activated counter illuminated in green. The red button at the bottom of the screen was labeled with the corresponding activated counter. Participants earned points on the activated counter by clicking on the red button. At any time they could switch to the alternative counter by clicking the black button. The label below each counter explained the relationships: "When the bottom button says, 'Gambling,' (or 'Money') clicking on it will earn points on this counter for spins on a slot machine (or money)." The label next to each counter specified the value of each point. The gambling counter label, which was the same for all subjects read, "Each point on this counter is worth a spin on the slot machine, which can result in wins up to $10, which you receive today." The money counter label was dependent on the participants' treatment condition. It read, "Each point on this counter is worth 5¢ (or 25¢), that you will receive today (or in 2 weeks, or in 8 weeks)." The present study used 5¢ and 25¢ increments to account for inflation since Vuchinich and Tucker (1983) originally conducted their study.

Delivery of the points on either counter was on a VI 20-second schedule of reinforcement. The label below the left counter is illuminated green at the start of the task for all participants. Half of the participants had the gambling counter on the left, while the other half had it on the right. The computer program kept track of the number of red button presses on each counter and the number of switches between counters.

Procedure

Participants were shown slot machines in a room adjacent to the testing room. In the testing room, they were consented and a basic assessment of current alcohol intoxication, tobacco use, and medications was administered followed by questionnaires. Following the consent and assessment processes, participants were seated in front of the laptop with the experimental program (Appendix) and given task instructions. Participants were told they would receive the earned money immediately after the experimental session, in 2 weeks, or 8 weeks, dependent on the condition. The delay conditions of 2 and 8 weeks were explained as a processing requirement of the university. Participants were further instructed that “not every red button press will produce a point on the counter,” but the true nature of the schedule of reinforcement was not divulged. The program was demonstrated by the experimenter and the participants instructed to test out the program in order to familiarize themselves with the procedure. Finally, they were encouraged to press the red and black buttons as often as they wanted during the 20 minute session regardless of the choices they made during the task.

After completion of the experimental task, the experimenter debriefed the participants, informing them of the unfortunate yet necessary deceptive nature of the study. The importance of experimental integrity was emphasized and compensation was awarded.

Results

Gambling Behavior

Past year gambling as measured by the SOGS frequency table indicated 47 participants (56% of the sample) reported past year gambling. Of those participants, 34 (73%) were female. The average SOGS score for the sample was 1.06 (SD = 2.75). Six participants (7%) scored ≥ 5 on the SOGS, indicating probable pathological gambling. The average NODS score for the sample was less than one (M = 0.94, SD = 2.38). Five participants (6%) met DSM-IV criteria for pathological gambling, as measured by ≥ 5 on the NODS. Two participants (3%) were classified as subclinical pathological gamblers (NODS score = 3 – 4).

Preliminary Analyses

ANOVAs revealed no significant differences between proportion of presses for gambling as a function of past year gambling severity. SOGS-classified non-gamblers and non-pathological gamblers (M = .37, SD = .27) did not differ from probable pathological gamblers (M = .54, SD = .33), $F(1,79) = 1.85$, $p = .178$, and NODS-classified pathological gamblers (M = .50, SD = .41) did not differ from at-risk gamblers (M = .37, SD = .16) or non-gamblers (M = .38, SD = .27), $F(2,78) = .45$, $p = .639$.

Participants that reported having gambled in a casino (M = .41, SD = .28) did not have a significantly different proportion of presses for gambling compared to those who either had not gambled in a casino or did not gamble (M = .36, SD = .28), $t(82) = .59$, $p = .56$.

Demographic variables' relations to the proportion of presses for gambling were also assessed. Age did not correlate significantly with proportion of presses for gambling

(r = .02, p = .87), nor was there a correspondence with ethnicity, $F(4,80) = 1.96$, p = .127. Additionally, measures of past-year gambling severity and a measure of gambling-related cognitive distortions did not correlate significantly with the proportion of presses for gambling (SOGS, r = .11, p = .32; NODS, r = .02, p = .83; GBQ, r = .12, p = .26). The SOGS and NODS correlated significantly (r = .42, p < .01), with SOGS scores also being significantly related to the impulsivity index scores yielded by the Delay Discounting Task (DDT) (r = .30, p = .01). DDT impulsivity index scores were not significantly related to the proportion of presses for gambling (r = .02, p = .88).

Preference Analysis

In order to test main hypotheses of the reinforcing value of gambling changing due to manipulations of the relative value of alternatives and temporal delay, respectively, a 2 x 3 (Money x Delay) ANOVA was conducted, with proportion of button presses for gambling as the dependent variable.

The main effect for delay was not statistically significant, $F(2,84) = .317$, p = .73, and the main effect for money's relative value was also not statistically significant $F(1,84) = .565$, p = .46 (see Table 1). The interaction effect of the alternative's relative value and delay was not statistically significant, $F(2,84) = 0.494$, p = .61 (see Table 1). Effect sizes for the interaction, delay, and alternative's relative value were .013, .008, and .007, respectively – indicating small effect sizes (Cohen, 1988).

Because the dependent variable comprised proportions of responses, data was not normally distributed, but rather occurred over a large proportion of the percentage scale. An arcsine transformation was performed on the data prior to a follow-up analysis of variance (Bartlett, 1936). The main effect for delay was not statistically significant,

$F(2,84) = 0.255$, $p = .78$, and the main effect for the alternative's relative value was also not statistically significant $F(1,84) = 0.268$, $p = .61$. The interaction effect of the alternative's relative value and delay was not statistically significant, $F(2,84) = 0.433$, $p = .65$. (See Table 2). Effect sizes for the interaction, delay, and alternative's relative value were .011, .006, and .003, respectively – indicating small effect sizes (Cohen, 1988).

Additional analyses were conducted on the groups by manipulation. An independent-samples t-test was conducted to compare proportion of presses for gambling for 5 cents ($M = .41$, $SD = .30$) and 25 cents ($M = .36$, $SD = .25$; t (82) = .763, $p = .45$, two-tailed) conditions. There was no significant difference in scores for 5 cents and 25 cents. A one-way between-groups analysis of variance was conducted to explore the impact of delay on proportion of presses for gambling. There was no statistical difference for the three groups: F (2, 82) = .323, $p = .73$.

Discussion

The present study sought to demonstrate the behavioral economic properties of gambling in a sample of college students. Several experimental conditions were created by manipulating the relative value of an alternative reinforcer through changing value and temporal delay. The hypothesized differences between groups were not supported by the data. Participants did not prefer gambling to a monetary alternative even when that value increased from 5cents to 25cents nor did they amend their preference as the time to delivery of money increased, thus supporting the null hypothesis.

Given the extant literature on the behavioral economics of gambling, support for the null hypothesis is surprising. Though no published studies have sought to elicit the relative reinforcing value of gambling, evidence of its existence was shown in a recent meta-analysis that found pathological gamblers to consistently discount delayed rewards in similar ways to clinical populations with various addictive diagnoses (MacKillop et al. 2011). Also unexpected were the nonsignificant relationships between proportion of presses for gambling and gambling behavior, a behavioral economic index of impulsivity, and a measure of gambling-related cognitive distortions.

These data are inconsistent with previous work on gambling and behavioral economics, and are inconsistent with the Vuchinich and Tucker (1983) study on the behavioral economics of alcohol. Increasing the value of an alternative to gambling did not decrease the value of gambling. The present findings can be interpreted one of two ways. First, the results may be an anomalous artifact of the extant literature due to methodological issues and/or sample characteristics. The second interpretation holds that gambling is not subject to behavioral economic principles in the ways demonstrated by other addictive behaviors.

Taken in the context of the first interpretation, the study's results question our investigation of gambling and its relation to behavioral economic constructs. In the present study, the reinforcing facets of gambling may not have been represented by spins on a slot machine. Instead, asking participants to press a button to accrue either small amounts of money to be used for gambling or small amounts of money to be received may be a better operationalization of preference for gambling. Additionally, the small amounts of money used as the alternative reinforcer may have rendered the delay to receiving the hypothetical amount inconsequential. Also contributing to this interpretation are sample characteristics. MacKillop et al.'s 2011 meta-analysis of delay reward discounting across addictive diagnoses included ten studies of gambling behavior. Nine of those studies compared clinical samples to healthy controls, with all finding pathological gamblers discounting delayed rewards more steeply than the controls. Not only was the sample non-clinical, but the college student participants gambled at a much lower rate than has been reported for the population (Nowak & Aloe, 2013). Finally, while participants in this study had an average age above 21, some participants may not have had the opportunity to gamble in establishments with slot machines, potentially reducing the reinforcing value of gambling.

A second interpretation of the results is that gambling behavior differs from other addictive behaviors by not complying with behavioral economic principles. This possibility suggests that gambling's reinforcing value is not affected by a monetary alternative changing in value, nor by its temporal delay. Such an interpretation is not convergent with the gambling literature which reveals that gamblers hold these valuations (Madden et al., 2011). Additionally, impulsivity as measured by delay discounting is a hallmark of addictive behavior (de Wit, 2009). Given the state of our understanding of gambling behavior and behavioral economics, study design and operationalizing the target behavior are more likely responsible for these findings than an underlying discrepancy between gambling behavior and behavioral economics.

Limitations of the study include a lack of a manipulation check performed after participants completed the experimental task, leaving open the possibility that experimental groups did not perceive meaningful differences in their conditions. Additionally, the low gambling problem severity of the sample and the relatively high number of females' gambling limits generalizations to more general populations. The study may also have been affected by an insufficient number of participants to detect a true difference between groups. A power analysis performed before data collection revealed a sample size of 82 to be necessary to detect a moderate effect size, though with the present design, additional participants may be necessary for that benchmark. Finally, the increments of 5 and 25 used may have been too small for participants to perceive as a reinforcing alternative to gambling.

A challenge to conducting behavioral economic research on gambling lies in the framework of the empirical literature of other addictive substances. The long history of psychological experimentation on addictive behaviors allowed investigators to model methods and apparatuses after those used with animals that labored for drug administrations and benign alternatives. Researchers have evaluated the behavioral effects of nictotine, alcohol, and opiate by identifying specific units of the relevant substance such as a defined alcoholic drink (Jacobs & Bickel, 1999; Murphy & MacKillop, 2006). Often times the amounts have been accepted quantities (one puff of a cigarette, one alcoholic drink). Does our use of "one spin on a slot machine that can win up to $10" provide the reinforcement for a gambler? Future directions should take into account the challenges of conducting gambling research in such a framework and the special case gambling may present compared to other addictive behaviors.

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Appendix

Table 1

Means and Standard Deviations of Proportion of Presses for Spins on a Slot Machine

	Delay condition			
Money condition	No delay	2 weeks	8 weeks	Average M
5 cents				
M	.41	.33	.36	.36
SD	.34	.19	.20	
25 cents				
M	.42	.46	.35	.41
SD	.27	.34	.31	
Average M	.41	.40	.35	

Table 2

Means and Standard Deviations of Arcsine Transformed Proportion of Presses for Spins on a Slot Machine

	Delay condition			
Money condition	No delay	2 weeks	8 weeks	Average M
5 cents				
M	.71	.60	.62	.64
SD	.1	.1	.1	
25 cents				
M	.68	.74	.63	.68
SD	.1	.1	.1	
Average M	.70	.72	.62	