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PROBABILITY DISCOUNTING IN A SAMPLE OF AMERICAN INDIANS: GAMBLING AS AN ESCAPE PREDICTS DISCOUNTING OF MONETARY, BUT NOT NON-MONETARY, OUTCOMES

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The present study investigated the relationship between measures of gambling and the process of probability discounting in a sample of participants from a population that has historically shown high rates of gambling problems. Thirty nine American Indian university students complete the South Oaks Gambling Screen, the Gambling Functional Assessment – Revised, and a probability-discounting task involving two monetary and two non-monetary outcomes. Consistent with results from previous research focusing on majority-population participants, severity of gambling problems was more strongly associated with endorsing gambling as an escape than with gambling for positive reinforcement. Endorsing gambling as an escape, but not for positive reinforcement, was also a significant predictor of discounting the monetary outcomes. Specifically, greater endorsement of escape predicted greater tendencies toward risk taking. Neither subscale predicted discounting of the non-monetary outcomes. The results potentially inform researchers about the relationship between measures of gambling behavior and the process of discounting, as well as factors that influence the gambling behavior of American Indians.

Keywords: Gambling, Escape, Probability Discounting, American Indians

Although estimating the prevalence of pathological gambling among the general population is a less-than-exact science, many researchers agree that the prevalence rate is likely between 1 – 2% (Petry, 2005). That prevalence rate, however, is not equal across all segments of the population. For instance, Petry (2005) lists race or ethnicity as one of the six major risk factors for pathological gambling. Among American Indians, researchers have suggested that the prevalence rate of pathological gambling occurs at up to 15 times that found in the general population (Wardman, el-Guebaly, & Hodgins, 2001). However, little empirical research has been conducted on gambling in this population compared to the majority population in the United States.

Because pathological gambling is a major societal problem, a considerable amount of research has been conducted investigating what factors contribute to and/or maintain the disorder. Within behavioral psychology, one of the major areas of focus has been the potential contribution of the process of discounting (e.g., Madden, Francisco, Brewer, & Stein, 2011). Discounting occurs when the subjective value of an outcome is altered because its delivery is either delayed or uncertain (see Madden & Bickel, 2010, for a review). Although the research literature is not entirely consistent on the issue, a general finding is that pathological gamblers discount delayed rewards more than non-gamblers, which is indicative of a tendency toward preferring smaller, but sooner, reinforcing out-

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comes over larger, but later reinforcing outcomes (see Petry & Madden, 2010). Alternatively, pathological gamblers discount probabilistic rewards to a lesser extent than non-gamblers, which is indicative of a tendency toward risk proneness versus risk aversion (see Petry & Madden, 2010).

A second behavioral factor that has attracted research attention is gambling as an escape. Escape is the only contingency that appears as an official symptom of pathological gambling (American Psychiatric Association, 2000). Endorsing gambling as an escape has been shown to be a strong predictor of who qualifies as a potential pathological gambler (Miller, Dixon, Parker, Kulland, & Weatherly, 2010). Likewise, endorsing gambling as an escape has also been shown to be predictive of how people play video poker in a laboratory environment (Martner, Montes, & Weatherly, 2012; Weatherly, Montes, & Christopher, 2010).

Because both discounting and the contingencies maintaining gambling behavior have been associated with the disorder of pathological gambling, some researchers have investigated the relationship between discounting and these contingencies. For instance, Shead, Callan, and Hodgins (2008) studied 59 participants who gambled on a regular basis. Participants' severity of gambling problems was not a significant predictor of how they discounted probabilistic outcomes. However, Shead et al. (2008) did report that gambling for positive affect was predictive of discounting. That is, participants reporting that they expected to gain a positive affective state by gambling also displayed a greater proneness towards risk taking in the probability-discounting task. Weatherly and Derenne (2010), using a large university sample, reported that students' severity of gambling problems was predictive of how they discounted delayed hypothetical monetary gains, but not how they discounted non-monetary gains. In a follow-up study, Weatherly (2011a) demonstrated that participants' endorsement of gambling for either positive reinforcement or escape was predictive of more or less discounting, respectively, of how participants discounted a hypothetical delayed loss of $1,000. However, neither was predictive of discounting of a larger delayed loss or either of two magnitudes of a delayed gain.

Perhaps surprisingly, little research has been conducted on either discounting or the contingencies maintaining gambling behavior in ethnic minorities. Du, Green, and Myerson (2002) found that their 28 American and 28 Chinese participants displayed steeper rates of delay discounting of hypothetical gains than did their 23 Japanese participants. On the other hand, Chinese participants displayed the least discounting of probabilistic gains. In terms of American Indians, only one study has been conducted on the topic of discounting. In that study, Weatherly and McDonald (2011) compared the rates of delay discounting of 26 American Indian university students to a matched control group of 26 Caucasian university students. These authors reported different rates of discounting by the two ethnicities, with the direction of the difference varying depending on the outcome that was being discounted. Importantly, as steep rates of delay discounting have been correlated with pathological gambling, steeper rates of discounting were not always observed in the American-Indian participants relative to the non-Indian participants.

Likewise, only one study has examined the contingencies that may be maintaining the gambling behavior of American Indians. Weatherly (2011b) had 29 American Indian university students, and a matched sample of Caucasian university students, complete the South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987), which is a widely used diagnostic screening tool for the potential presence of pathological gambling, and the Gambling Functional Assessment – Revised (GFA-R; Weatherly, Miller, & Terrell, 2011), which is a self-report functional assessment tool designed to measure whether the respondent's gambling behavior is maintained by positive reinforcement and/or escape. Perhaps surprisingly, the American-Indian participants tended to display both lower rates of gambling severity and lower scores on gambling for either positive reinforcement or escape than the non-Indian participants. Weatherly (2011b) argued these results were consistent with the notion that the high rate of pathological gambling observed in the American-Indian population was perhaps not the outcome of racial differences *per se*, but rather environmental and/or experiential factors.

The present study was designed as an extension of these previous studies. Specifically, it was an attempt to study discounting rates and the contingencies maintaining gambling in an American-Indian sample. American Indian university students were recruited to complete the SOGS, the GFA-R, and a discounting task involving four probabilistic outcomes. Three particular questions were of specific interest. First, would the severity of gambling problems, as measured by the SOGS, be more highly related to gambling as an escape than to gambling for positive reinforcement, both of which are measured by the GFA-R, as previous research has demonstrated with primarily Caucasian samples? Second, would participants' rates of probability discounting be predicted by the contingencies that maintain their gambling behavior? Third, would measures of participants' gambling be predictive of how they discount hypothetical monetary outcomes, but not how they discount hypothetical non-monetary outcomes that might be experienced by others besides themselves?

METHOD

Participants

The participants were 39 (29 females; 10 males) self-identified American Indian students enrolled in psychology classes at the University of North Dakota. Recruitment for the study advertised that participation was for American-Indian participants only. Twenty of the participants self-identified as Chippewa, 9 as Sioux, with the remaining 10 identifying another tribal affiliation or declining to identify. The mean age of the participants was 24.4 years (SD = 8.4 years) and their self-reported grade point average was 3.0 out of 4.0 (SD = 0.8). Participants received (extra) course credit in return for their participation.

Materials and Procedure

Participants completed the study online using an experiment management system (SONA Systems, Ltd, Version 2.72; Tallinn, Estonia). This system ensured participants could only complete the study once regardless of in how many psychology courses they were enrolled.

The first item presented to the participant was a description of the study as approved by the Institutional Review Board at the University of North Dakota. If the participant continued in the study beyond this point, that continuation constituted the granting of informed consent.

The next item presented to the participant was a demographic questionnaire, which asked about the information presented in the participants section. Then participants were given the SOGS (Lesieur & Blume, 1987). The SOGS is a 20-item, self-report questionnaire that asks respondents about their history gambling. On the SOGS, a score of 3 or 4 is indicative of the potential presence of problem gambling (see Petry, 2005). A score of 5 or more is indicative of the probable presence of pathological gambling. Early research (Lesieur & Blume, 1987) has indicated that the SOGS has high internal consistency (α = 0.97), with subsequent research reporting fair (α = 0.69; Stinchfield, 2002) to good (α = 0.81; Stinchfield, 2003) internal consistency. Test-retest reliability of the SOGS has been shown to be good (r = 0.89 at four weeks and

r = 0.67 at 12 weeks; Weatherly, Miller, Montes, & Rost, 2012).

Next, participants completed the GFA-R (Weatherly et al., 2011). The GFA-R is a 16-item, self-report questionnaire that assesses whether the respondent's gambling behavior is maintained by positive reinforcement and/or escape. The respondent endorses each item on a scale of 0 ("Never") to 6 ("Always"). Eight of the items are associated with each contingency. No items are reverse coded. Research indicates that the internal consistency of the GFA-R is high for the overall score (α = 0.91), as well as for the positive reinforcement (α = 0.94) and escape subscales (α = 0.91; Weatherly et al., 2012). Likewise, its test-retest reliability has also been shown to be good (r = 0.80 at four weeks and r = 0.81 at 12 weeks; Weatherly et al., 2012).

The final item completed by the participant was a probability-discounting task that involved four different outcomes. The four outcomes were hypothetically potentially winning $1,000, winning $100,000, passing federal education legislation, and passing tribal council resolutions on education on the participant's reservation. These questions were chosen because a hypothetical monetary sum is the standard outcome tested in discounting research with humans (see Madden & Bickel, 2010). The different education related questions were chosen because they were non-monetary outcomes and represented outcomes that would hypothetically be experienced by others besides the respondent. The exact wording of each outcome can be found in the Appendix. Five questions were asked pertaining to each particular outcome, which differed in terms of the probability of the outcome (1, 10, 50, 90, or 99%). The order in which the four different outcomes were presented varied randomly across participants. The order that the five different probabilities were presented for each outcome also varied randomly across participants.

The method employed for collecting participants' response was a variation of the multiple-choice (MC) method (Beck & Triplett, 2009). That is, when participants answered each discounting question, they did so by choosing their response from a list of 51 possible response options that ranged from zero to the full amount of the outcome in 2% increments. This method of data collection was used because it requires far fewer questions than does the binary-choice method (see Madden & Bickel, 2010). Research on the MC method indicates that it produces reliable rates of discounting (Beck & Triplett, 2009) that are typically statistically similar to rates of discounting (Weatherly & Derenne, 2011) produced by other methods of measuring discounting (e.g., the fill-in-the-blank method; Chapman, 1996).

Data Analysis

Rates of discounting were determined by calculating the area under the discounting curve (AUC; Myerson, Green, & Warusawitharana, 2001) using Equation 1:

$$\sum_{i=1} (x_{i+1} - x_i) \times (y_i + y_{i+1})/2 \quad \text{(Equation 1)}$$

Using Equation 1, AUC is calculated by summing the areas of the successive trapezoids that are created by the participant's response at the five different probabilities. In the present case, x was calculated in terms of odds against the outcome. AUC values can vary between 0.0 and 1.0, with their values varying inversely with the level of discounting. That is, low AUC values indicate steep decreases in the subjective value of the outcome as it becomes increasingly uncertain. High AUC values indicate little decrease in the subjective value of the outcome as it becomes increasingly uncertain. Equation 1 was chosen as the method of analysis because AUC does not presuppose the form that the data should follow across the different probabilities. Also, AUC values are typically normally distributed and thus do not require transformation before parametric statistics can be employed. Although other methods could be employed to calculate an AUC value, Equation 1 is a widely used measure (see Madden & Bickel, 2010).

RESULTS AND DISCUSSION

Participants' mean score on the SOGS was 1.2 (*SD* = 2.0). The scores ranged from 0 to 9, with four participants (10.3%) scoring 3 – 4 (potential problem gambling) and two participants (5.1%) scoring 5 or more (probable pathological gambling). The mean score on the GFA-R was 14.9 (*SD* = 16.8), with total scores ranging from 0 to 74. The mean score for the positive reinforcement subscale was 11.1 (*SD* = 11.0). The mean score for the escape subscale was 3.8 (*SD* = 8.8). In terms of correlations, SOGS scores did significantly correlate with GFA-R positive reinforcement subscale scores ($r = .30$, $p = .032$ one-tailed).[1] However, SOGS scores were more strongly correlated with GFA-R escape subscale scores ($r = .64$, $p < .001$ one-tailed). Thus, as previously reported with majority-population samples (e.g., Weatherly, 2011a), severity of gambling problems among American Indians, at least with the present sample, appeared to be more closely correlated with endorsing gambling as an escape than with endorsing gambling for positive reinforcement.

To determine whether participants' GFA-R scores were predictive of how they discounted the four different outcomes, a series of simultaneous linear regressions were conducted. In each analysis, the AUC values for that particular outcome served as the dependent measure and the participants' scores on the GFA-R subscales served as the predictor variables. Simultaneous regressions were conducted because they identify the amount of variance accounted for by each predictor variable independent of the other variable. SOGS scores were excluded from these analyses because they were so strongly correlated to GFA-R escape scores. Also, because the GFA-R escape scores were positively skewed, these scores were converted into categorical variables so as to estimate a linear relationship. The categories were informed by Miller et al. (2010), with escape scores of 1 – 5 being coded as 1 and scores of 6 or more being coded as 2. Scores of 0 remained coded as 0.

The first analysis was conducted on the outcome of potentially winning $1,000 (Mean AUC = 0.36, *SD* = 0.28). In this analysis, the model was significant, $F(2, 36) = 4.19$, $p = .023$, $R^2 = 0.22$. The positive reinforcement subscale scores were not significant predictors of discounting ($\beta = -0.058$, $p = .954$), but escape subscale scores were ($\beta = 0.439$, $p = .013$). This latter result indicates that AUC values increased as participants' escape scores increased. Phrased differently, participants' preference for risk increased as their GFA-R escape scores increased.

The second analysis was conducted on the outcome of potentially winning $100,000 (Mean AUC = 0.33, *SD* = 0.29)[2]. As was the case when the outcome involved $1,000, the model was significant, $F(2, 36) = 4.37$, $p = .020$, $R^2 = 0.34$. Likewise, the positive reinforcement subscale scores again were not significant predictors of discounting ($\beta = -0.180$, $p = .286$), but escape subscale scores were ($\beta = 0.491$, $p = .006$). Thus, for probability discounting of the two hypothetical monetary outcomes, endorsing gambling as an escape was predictive of less discounting (i.e., a tendency toward preference for risk). However,

[1] For this analysis and all that follow, statistical significance was met at $p \leq .05$.

[2] Note that the mean AUC value for winning $100,000 was below that observed for winning $1,000. Such a result would be expected given the magnitude effect (e.g., Thaler, 1981). That is, with probability discounting, respondents typically become more risk averse (i.e., lower AUC values) as the magnitude of the outcome increases.

endorsing gambling for positive reinforcement was not predictive of discounting.

The third analysis was conducted on the outcome of federal education legislation (Mean AUC = 0.72, *SD* = 0.23). This model was not statistically significant, $F(2, 36) = 0.00$, $p = .999$, $R^2 = 0.01$, with neither the positive reinforcement (β = -0.004, $p = .983$) nor the escape subscale scores (β = 0.008, $p = .967$) being significant predictors of discounting.

The final analysis was conducted on the outcome of the tribal resolutions on education (Mean AUC = 0.69, *SD* = 0.25). This model was also not statistically significant, $F(2, 36) = 0.05$, $p = .948$, $R^2 = 0.06$, and again, neither the positive reinforcement (β = -0.059, $p = .751$) nor the escape subscale scores (β = 0.014, $p = .942$) were significant predictors of discounting. Thus, although endorsing gambling as an escape was predictive of rates of probability discounting for the hypothetical monetary amounts, neither subscale of the GFA-R was predictive of rates of probability discounting of the two hypothetical non-monetary education outcomes tested.

Before overemphasizing these results, several limitations of the present study should be noted. For one, the sample of American Indians mostly consisted of Indians from the Northern Plains area. Thus, the results may not generalize to different American-Indian populations across the United States. Next, all of the participants were enrolled at the University of North Dakota. Thus, the results may not generalize to American Indians who live on reservations and/or who attend tribal colleges. It could also be argued that the overall sample size was not large. However, one could counter that argument by pointing out that the sample of American Indians in the present study was larger than that in previous research relating to the present issues (i.e., discounting as a function of race; contingencies maintaining gambling behavior among American Indians).

In terms of methodology, the present study employed a version of the MC method (Beck & Triplett, 2009) of collecting the discounting data. Although this method has been employed in numerous studies on discounting (e.g., Weatherly, Plumm, & Derenne, 2011; Weatherly & Derenne, 2010), research has demonstrated that different methods of collecting discounting data can lead to somewhat different conclusions (e.g., Smith & Hantula, 2008). Thus, one cannot guarantee that the present results could be reproduced with another data-collection procedure.

In addition, no attempt was made to ascertain the students' level of bicultural competence, which has been identified by some (McDonald & Chaney, 2003) as a behavioral mediator. Likewise, the present sample did not contain a large absolute number of problem and pathological gamblers, at least as measured by the SOGS. Different relationships might have been identified has more of these individuals been involved in the study. Lastly, the present study only looked at discounting of two non-monetary outcomes. One cannot therefore assume that measures of gambling will never be predictive of discounting of all non-monetary outcomes. Such relationships may have emerged had a greater number of outcomes been tested.

With that said, the present results are highly consistent with past results. The results showed that a measure of problem/pathological gambling (i.e., SOGS scores) was more closely related to endorsing gambling as an escape than endorsing gambling for positive reinforcement, a finding that has previously been reported in studies that have sampled the majority population (e.g., Miller et al., 2010; Weatherly, 2011a). Finding a similar relationship in a non-majority sample as in majority samples is consistent with the notion that the connection between problem/pathological gambling and gambling as an escape is a potentially general and strong one.

Previous results using majority-population samples have also demonstrated that measures of gambling are predictive of rates of delay discounting of hypothetical monetary, but not non-monetary, outcomes (Weatherly & Derenne, 2010). The present results would appear to extend this finding not only to a non-majority population, but also to probability discounting. One reason researchers have been interested in discounting as it relates to substance abuse and gambling problems is because it has been theorized that differences in discounting rates observed within these populations represent a general decision-making tendency (e.g., Yi, Mitchell, & Bickel, 2010). However, repeatedly finding that certain measures related to problem behavior, such as endorsing gambling as an escape, are related to rates of discounting of certain outcomes, but not others, would appear to question this assumption.

The rates of problem and pathological gambling in the present study, at least as measured by the SOGS (Lesieur & Blume, 1987), also deserve noting. With 10.3% of the sample qualifying as potential problem gamblers and 5.1% qualifying as potential pathological gamblers, these percentages are above what is reported in the general population (see Petry, 2005) and also above that reported by Weatherly (2011b). They are not, however, inordinately higher as might be expected given the literature on pathological gambling among American Indians (e.g., Wardman et al., 2001). One could legitimately contend that these percentages might be the outcome of, and should be interpreted with caution given, the size of the participant sample. Likewise, it is possible that higher prevalence rates would have been observed if a non-university sample of American Indians had been employed.

With that said, however, the present data are consistent with the idea that the heightened rates of pathological gambling that have been previously observed in American-Indian samples were not necessarily the outcome of race or ethnicity *per se*. Rather, they may be the outcome of, or at least influenced by, environmental or experiential factors such as economic and social hardships experienced by American Indians. Future research might be well served by determining how these factors, some of which are risk factors for pathological gambling (see Petry, 2005) might account for the rate of pathological gambling researchers find in samples of the American Indian population and, in line with the present study, how those factors might be related to endorsing gambling as an escape.

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Appendix

Five different probabilities were asked for each question (1, 10, 50, 90, & 99%).

Winning $1,000

You are a finalist in a national sweepstakes. You have a __% chance of winning $1,000. If your number is not called, however, you do not receive anything. The organization running the sweepstakes is willing to guarantee to pay you a certain amount of money if you agree to remove your name from the sweepstakes. What is the smallest amount of money would you be willing to accept rather than having a ___% chance of winning $1,000?

Winning $100,000

You are a finalist in a national sweepstakes. You have a ____% chance of winning $100,000. If your number is not called, however, you do not receive anything. The organization running the sweepstakes is willing to guarantee to pay you a certain amount of money if you agree to remove your name from the sweepstakes. What is the smallest amount of money would you be willing to accept rather than having a % chance of winning $100,000?

Federal Education Legislation

One bill will be forwarded in this year's federal legislative session. Your senators are considering two possible bills. The first bill is perfect in that it will address all of the issues that need reforming, but the chance of it passing is ___%. The second bill will not address all of the issues that need reforming, but it is guaranteed to pass. What percentage of perfect (i.e., 100%) would the second bill need to be before you would advise your senators to vote for it rather than having ___% chance that the perfect policy passes?

Tribal Education Resolutions

The tribal council of your tribe is considering two resolutions concerning the school system on your reservation. The council members indicate that the first resolution will address all of the issues that need addressing, but the chance of it passing before the next tribal election is ___%. The second resolution will not address all of the issues that need addressing, but it is guaranteed to be approved. What percentage of perfect (i.e., 100%) would the resolution need to be before you would advise the council members to vote for it rather than having ___% chance that the perfect resolution passes?