

THE EFFECT OF NEAR-MISS RATE AND CARD CONTROL WHEN AMERICAN INDIANS AND NON-INDIANS GAMBLE IN A LABORATORY SITUATION: THE INFLUENCE OF ALCOHOL

Melissa Whitton, M.A. and Jeffrey N. Weatherly, Ph.D.

Abstract: Twelve American Indian (AI) and 12 non-AI participants gambled on a slot-machine simulation and on video poker. Prior to the gambling sessions, half of the participants consumed alcohol while the other half consumed a placebo beverage. They then played the slot-machine simulation three times, with the percentage of programmed “near misses” varying across sessions. They also played video poker three times, with the control the players had over holding and discarding cards varying across sessions. Results showed that AI participants played significantly fewer poker hands than did non-AIs and that participants played most when they had the least control over what cards were played. No significant effect of alcohol consumption was observed. Likewise, results failed to show a significant effect of the percentage of near misses when participants played the slot-machine simulation. The present results lend support for the idea that the differences in gambling problems between AI and non-AI reported in the literature are not a function of ethnicity per se. They may also suggest that providing video poker players with accurate information may have the unintended effect of increasing the rate at which they gamble.

Over the past several decades there has been a large expansion of gambling in the United States, at least partially driven by the Indian Gaming Regulatory Act (Wardman, el-Guebaly, & Hodgins, 2001). With this expansion has come increased concern about problem gambling and the factors that lead to it. “Pathological gambling” became an official impulse-control disorder in 1980 (American Psychiatric Association, 1980). Although prevalence rates are difficult to accurately determine, Petry (2005) estimated that 1-3% of the population suffers from pathological gambling.

Importantly, the prevalence of pathological gambling is not equal across different populations. Pertinent to the current investigation, research indicates that American Indians (AIs) suffer from pathological gambling at a much higher frequency than non-AIs. Raylu and Oei (2002), for instance, reviewed numerous studies on the relationship between ethnicity and/or Indigenous cultures and gambling. They reported that results consistently demonstrate a higher rate of pathological gambling among Indigenous populations than in the majority culture. This conclusion was consistent with the findings of Volberg and Abbott (1997), who interviewed a random sample of AI and Caucasian residents of North Dakota about gambling behavior. AIs reported gambling more frequently than Caucasians and also reported spending more money on certain forms of gambling. Wardman et al. (2001) reported that rates of pathological gambling in Indigenous populations were 2.2 to 15.69 times higher than in non-Indigenous populations.

There are many potential reasons why AIs may display heightened rates of pathological gambling. One possibility is that ethnicity (e.g., genetics) is directly related to the disorder. A second possibility is that cultural factors, such as differences in beliefs and norms, may contribute to gambling problems by influencing individuals' gambling patterns (see Raylu & Oei, 2004). Another possibility is that mediating factors (e.g., socioeconomic status, drug use) related to both ethnic minority status and pathological gambling account for the increased prevalence (see Petry, 2005).

Recent results from our laboratory would appear to be consistent with the last of these possibilities. McDougall, McDonald, and Weatherly (2008) had non-pathological AI and non-AI participants play a slot-machine simulation in the presence or absence of an AI or non-AI confederate. No significant differences were observed in the gambling behavior of the AI and non-AI participants, nor were there significant differences in how they were influenced by the presence or actions of the confederate. Likewise, Gillis, McDonald, and Weatherly (2008) studied the gambling behavior of AI and non-AI participants who were high or low sensation seekers. Participants played a slot-machine simulation in three different sessions, across which the simulation paid out at three different rates. Again, no differences in gambling behavior were observed between AI and non-AI participants. It is important to note, however, that the findings of both of these studies represent null results and therefore cannot conclusively eliminate the possibility that ethnicity and/or cultural factors influence gambling behavior.

It is certainly possible to identify potential mediators that may be responsible for the heightened rates of pathological gambling in the AI population. One possibility is drug use. According to Petry (2005), drug use is largest risk factor for pathological gambling. Specifically, results from LaBrie, Shaffer, LaPlante, and Wechsler (2003) suggest that alcohol use is strongly tied to problem gambling. Similarly, Welte, Barnes, Wieczorek, Tidwell, and Parker (2001) determined

that drinkers who consumed an average of two ounces or more of alcohol daily were five times as likely as abstainers to be problem or pathological gamblers. This factor is relevant because research indicates that AIs display heightened rates of substance abuse relative to the majority population (e.g., see McDonald & Chaney, 2003).

AI and non-AI cultures may also differ in how individual members interpret environmental events and/or view themselves in relationship to the environment (e.g., see Raylu & Oei, 2004). These differences may be important because research on gambling has indicated that aspects of games of chance and/or the player-game interaction can influence how people gamble. For example, persistence of play on a slot machine has been shown to differ as a function of the frequency of near misses (i.e., winning symbols in all but one of the necessary positions and just above or below the remaining one). Kassinove and Schare (2001) showed that participants who experienced near misses on 30% of the trials persisted longer in playing than those who experienced near misses on 15% or 45% of trials. The authors suggested that 30% was apparently the “optimal range.”

Others have found that dispositional factors, such as the illusion of control (Langer, 1975), can influence gambling behavior. The illusion of control occurs when active participation enhances one’s sense of having control over the outcome when, in fact, such participation has no influence over the result. Dixon, Hayes, and Ebbs (1998), for instance, found that participants were willing to purchase the opportunity to place their own bets when playing roulette rather than have the researcher choose the bet for free. Similarly, Dixon (2000) found that participants wagered more chips when they had control over the numbers bet than when the experimenter controlled bet placement. However, when studying video-poker play, Dannewitz and Weatherly (2007) found that participants played more hands and bet more credits when the game chose the cards that would be “held” versus when the player chose the cards.

Thus, it is possible that the differences in gambling behavior between AIs and non-AIs reported in literature (e.g., Wardman et al., 2001) represent ethnic differences. However, the differences may be related to other factors such as alcohol use, how individuals persist in the face of situations such as near misses, or how they display the illusion of control. The present study was an initial attempt to assess these possibilities. AI and non-AI participants were recruited to participate. Half of the participants consumed alcohol whereas the other half consumed a placebo beverage. All participants then played a slot-machine simulation three different times, with the simulation differing across periods in terms of the percentage of near misses that were programmed. They also played video poker three different times, with the game differing across periods in how much control players had over which cards were played.

Given that previous experimental research from our laboratory (e.g., Gillis et al., 2008; McDougall et al., 2008) failed to demonstrate differences in the gambling of AI and non-AI participants, we were not optimistic that a main effect of ethnicity would be observed in the present study. Rather, because the literature suggests that alcohol use is related to heightened levels of gambling (e.g., LaBrie et al., 2003), we predicted that participants who consumed alcohol would display heightened levels of gambling relative to participants who did not consume alcohol. Consistent with Kassinove and Schare (2001), we predicted that participants would gamble most on the slot-machine simulation when 33% of the outcomes were near misses (vs. 0 or 67%). Consistent with Dannewitz and Weatherly (2007), we predicted that participants would gamble most on the video-poker game when the game, rather than the player, chose which cards would be held or discarded.

METHOD

Participants

Twenty-four participants were recruited through the Psychology Department participant pool and advertisements on a local public-access television channel. All participants were males¹ 21 years of age or older. Twelve were of AI descent and 12 were of non-AI descent, both determined by self report. Participants were non-pathological gamblers, as determined by scores on the South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987). They also did not abuse alcohol, as determined by scores on the Khavari Alcohol Test (KAT; Khavari & Farber, 1978) and the Michigan Alcoholism Screening Test (MAST; Selzer, 1971). Participants were in good health when the experimental sessions were conducted, as determined by scores on a medical questionnaire.

Materials

Participants were asked to complete a series of paper-and-pencil measures. The first of these was the SOGS (Lesieur & Blume, 1987). The SOGS is a 20-item questionnaire that asks respondents about their gambling history. It is the most widely used screening measure for gambling problems (see Petry, 2005), with a score of 5 or more indicating the potential presence of pathology. Research indicates that the SOGS has adequate internal consistency (Stinchfield, 2003) and good reliability (Lesieur & Blume, 1987).

The second measure was the KAT (Khavari & Farber, 1978). The KAT consists of three different sets of three items. The first set addresses the frequency of drinking beer, wine, and liquor. The second set addresses the average number of drinks of beer, wine, and liquor the person has at

one sitting. The third set addresses the maximum number of beers, glasses of wine, or drinks with liquor consumed at one time. The cutoffs for these values were set according to diagnostic criteria for alcohol abuse (Khavari & Farber, 1978).

The third measure was the MAST (Selzer, 1971), which consists of 25 yes/no statements that address the participant's drinking habits and history. Item responses are weighted with a specific point value. A combined score of 16 or greater is indicative of an alcohol abuse problem. The MAST has been shown to identify individuals with a history of drunk and disorderly conduct as well as driving under the influence of alcohol (Selzer, 1971).

The fourth measure was a brief medical questionnaire created for the present study. The questionnaire was employed to rule out current illness. It asked if the participant had been diagnosed with any chronic medical conditions, such as heart disease or diabetes, as well as whether he was taking any prescription or over-the-counter medication at the time. In addition to ruling out illness, the medical questionnaire asked if the participant had ever undergone treatment for addiction, had received a DUI within the past two years, or had consumed any illicit drugs during the past month. These questions were used to rule out participants who may have had a history of substance abuse. The researcher reviewed the sheet to ensure no prescription medicines and no over-the-counter cold medicines were currently being taken.

Apparatus

Experimental sessions were conducted in a windowless room that measured approximately 1.5 m by 1.5 m. The room contained two small desks, each equipped with an IBM-compatible computer. One computer was used to collect data with the slot-machine simulation customized from MacLin, Dixon, and Hayes (1999). The simulation differed from the original in that the outcomes of the individual trials could be predetermined by the researcher. The other computer was used to collect data with the video-poker game, which was a 5-card-draw poker game by Zamzow (2003). The software allowed a variety of games to be played. The present study used only Jacks-or-Better poker. The software allowed the researcher to program whether the game indicated to the player which cards should be held or discarded each hand.

Blood alcohol levels (BAL) were determined by using a breathalyzer (Alcomonitor CC Series 02.XX; Intoximeters Inc., St. Louis, MO). The breathalyzer was located in a room directly adjacent to the one housing the computers. This adjacent room was approximately 5 m by 5 m and had two windows and several tables. Participants completed the paper-and-pencil tasks and consumed the alcoholic or placebo beverages in this room before going to the other room for the gambling session.

Procedure

All the procedures were reviewed and approved by the Institutional Review Board at the University of North Dakota. Participants were run individually. When the participant entered the room, the researcher checked his identification to ensure he was at least 21 years of age. The researcher then initiated the process of receiving informed consent. The participant granted informed consent and completed the paper-and-pencil measures. Once the participant had completed the SOGS, KAT, MAST, and medical questionnaire, the researcher scored these measures to determine whether the participant qualified to continue. One participant was dismissed due to an elevated SOGS score of 5. He was replaced by an additional participant.

The researcher then read the participant a prepared script informing him about the procedure of the study. The researcher then weighed the participant and subsequently mixed the beverage the participant would consume. The drink was a mixture of 0.66 ml/kg dose of either 95% ethanol or water mixed with soda in a 1:5 dose/soda ratio. This mixture was divided equally into three separate cups; the participant was required to consume the contents of one cup every 5 min. Breathalyzer readings were taken every 5 min following the final consumption period until the participant exhibited a second consecutive drop in BAL. Those participants who did not receive alcohol were yoked with other participants who did receive alcohol regarding the time interval between drink consumption and the start of the gambling sessions. The dose of alcohol administered to participants was chosen because research (e.g., Davidson, Carnara, & Swift, 1997) suggests that a dose of at least 40 ml/kg is necessary for participants to discriminate receiving alcohol and to report positive subjective effects of its administration.

Before the start of the gambling sessions, the researcher read the participants the following instructions:

You will be given the opportunity to play two different computer simulations. One simulation will be a computer-simulated slot machine. This slot machine is programmed identical to those found in actual gaming establishments. Each possible winning outcome is scheduled at a constant probability and each individual play is independent of the previous play. Before you begin this session, you will be given instructions on how the program works and the payoff table. The other simulation will be a 5-card-draw video poker game. This game is also programmed identical to those found in actual gaming establishments. Each possible winning outcome is scheduled at a constant probability and each individual play is independent of the previous play.

Each of these 15-minute sessions will be divided into three 5-minute periods. For each period, you will be staked with 100 credits. Each credit is worth \$0.05. This means that after you receive instructions on how to play the game, you will be given 5 minutes to play. When those 5 minutes are up, or you reach 0 credits, the researcher will reset the game with 100 credits and you are able to play again for another 5 minutes with those 100 credits.

The participant then completed a total of six 5-min gambling sessions. In three of the six sessions, participants played the customized version of the MacLin et al. (1999) slot-machine simulation. These sessions were identical with the exception of the rate at which near misses occurred during losses (0, 33, or 67%). Near misses were defined as winning symbols falling on the first two positions on the win line but not in the third position. Prior to the first slot-machine session, the researcher read the participant the following directions:

You are able to control the amount bet by clicking on either the “Bet 1 Credit” button or by clicking the “Bet Max Credits” button. The maximum number of credits that can be wagered on one spin is 5 credits. After selecting a wager amount, click the “Spin” button. The payout table is located directly to your right.

In the remaining three sessions the participants played video poker (Zamzow, 2003). Participants played Jacks-or-Better 5-card draw in each session. In one, the participant was not provided information on which cards to hold or discard. In another session, the “autohold” feature was enabled, which indicated to the participant which cards should be held to maximize his chances of winning (or minimize his chances of losing). However, the participant was not required to follow the supplied advice. In the third session, the autohold feature was enabled and the participants were required to play as instructed by the software. Prior to the first video-poker session, the researcher read the participants the following instructions:

You are able to control the amount bet by clicking on either the “Bet 1 Credit” button or by clicking the “Bet Max Credits” button. The maximum number of credits that can be wagered on one hand is 5 credits. When you are satisfied with the wager amount, click the “Deal/Draw” button. Depending on the condition, you may be able to choose which cards are held. You can do this by clicking on the cards you would like to hold or clicking the hold button directly beneath the card. Do you have any questions?

The order participants experienced these six 5-min sessions was counterbalanced. At the end of the gambling sessions, all participants were debriefed, paid cash for the number of credits they had accumulated in the gambling sessions, and given extra credit for their psychology course

(if applicable). Participants who consumed the placebo beverage were then dismissed. Those who had consumed alcohol remained under supervision until their BAL had reached 0.02, at which time they were dismissed.

Dependent Measures

There were two main dependent measures for the slot-machine sessions. The first was the total number of trials played, which can be taken as a measure of rate and persistence. The second was the total amount bet, which can be taken as a measure of risk. Ideally, the same two measures would be analyzed for the video-poker session. However, due to a recording error, the total number of credits bet per session was not recorded for enough participants to allow analyses to be conducted on this measure. Analyses were therefore conducted on the total number of credits remaining each session, which is an indirect, but imperfect, measure of how much participants risked during the session. Due to a wide range of variance across participants, a square-root transformation was completed on all data. A square-root transformation was chosen because this transformation is recommended for ratio-scale data, which the present data represent.

RESULTS

An independent samples *t*-test showed that AI participants were significantly older than non-AI participants, $t(22) = 4.646, p < 0.001$. There was no significant difference in age between those participants who received alcohol and those who received the placebo, $t(22) = 0.655$. Results from these, and all the following, analyses were considered significant at $p < .05$. Because of the significant difference in age, age was used as a covariate in preliminary analyses. However, age never accounted for a significant amount of variance in any analysis and was therefore dropped from the analyses reported below.

Each participant began the gambling sessions after the second consecutive drop in BAL or at the assigned time if placebo was received. Those who received alcohol had an average BAL of 0.071 at the start of the gambling sessions. Those who received placebo had a BAL of 0.00.

Slot-Machine Gambling

The number of trials played by individual participants was analyzed by conducting a three-way (Ethnicity by Drink by Percentage of Near Misses) mixed-model analysis of variance (ANOVA) on the transformed data. Ethnicity (AI or non-AI) and drink (alcohol or placebo) served as between-subject variables. Percentage of near misses (0, 33, and 67%) served as the repeated measure. The main effect of ethnicity, $F(1, 20) = 1.75, p = 0.201, \eta^2 = 0.081$, drink, $F < 1, \eta^2 =$

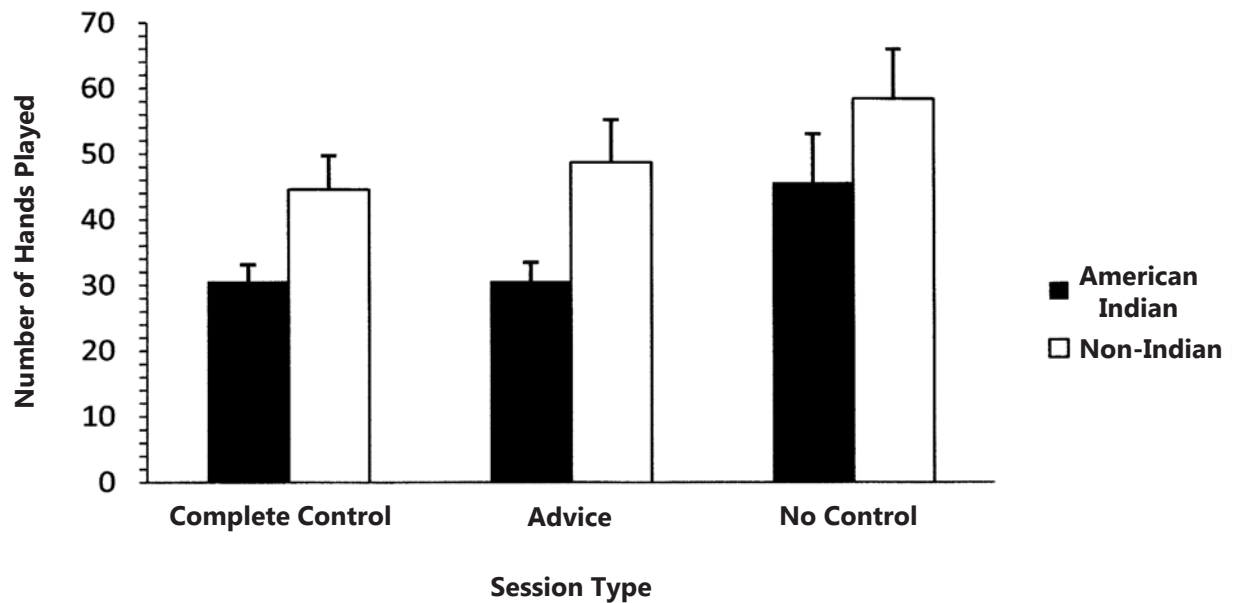
0.000, and percentage of near misses, $F < 1$, $\eta^2 = 0.034$, each failed to reach statistical significance. The interactions between ethnicity and drink, $F < 1$, $\eta^2 = 0.021$, between ethnicity and percentage of near misses, $F(2, 40) = 2.51$, $p = 0.094$, $\eta^2 = 0.111$, between drink and percentage of near misses, $F < 1$, $\eta^2 = 0.034$, and the three-way interaction, $F < 1$, $\eta^2 = 0.007$, also each failed to reach statistical significance. Together, these results indicate that none of the independent variables significantly altered the number of times participants played the slot-machine simulation.

An identical analysis was conducted on the total number of credits bet per session. That analysis indicated that the main effect of ethnicity, $F < 1$, $\eta^2 = 0.001$, drink, $F < 1$, $\eta^2 = 0.017$, and percentage of near misses, $F(2, 40) = 1.12$, $p = 0.336$, $\eta^2 = 0.053$, each failed to reach statistical significance. The interaction between ethnicity and drink, $F(1, 20) = 0.048$, $p = 0.829$, $\eta^2 = 0.002$, and between ethnicity and percentage of near misses, $F(2, 40) = 2.765$, $p = 0.075$, $\eta^2 = 0.121$, also failed to reach statistical significance. The interaction between drink and percentage of near misses was significant, $F(2, 40) = 3.856$, $p = 0.029$, $\eta^2 = 0.162$. However, tests of simple effects indicated that the differences were not significant between the alcohol and placebo groups at any percentage of near misses, all $F_s(1, 23) \leq 1.95$, $p > .177$, $\eta^2 < 0.081$. Furthermore, betting did not differ significantly across the three conditions for either participants who received a placebo, $F(2, 22) = 2.387$, $p = 0.115$, $\eta^2 = 0.178$, or an alcoholic beverage, $F(2, 22) = 2.399$, $p = 0.114$, $\eta^2 = 0.179$. Finally, the three-way interaction was not significant, $F < 1$, $\eta^2 = 0.006$.

Video-Poker Gambling

The number of trials played by individual participants during the three video-poker sessions was analyzed by conducting a three-way (Ethnicity by Drink by Control of Choice) mixed-model ANOVA on the transformed data. Ethnicity (AI or non-AI) and drink (alcohol or placebo) again served as between-subject variables. Control of choice (Complete Control, Advice, No Choice) served as the repeated measure. In this analysis, the main effect of ethnicity was significant, $F(1, 20) = 6.21$, $p = 0.022$, $\eta^2 = 0.237$. AI participants played significantly fewer trials than non-AI participants. The main effect of drink was not significant, $F < 1$, $\eta^2 = 0.010$, but the main effect of control of choice was significant, $F(2, 40) = 5.86$, $p = 0.006$, $\eta^2 = 0.227$. A *post hoc* Tukey HSD calculated by hand indicated that participants played more trials in the No Choice condition than in either the Complete Control or Advice sessions. The effect of ethnicity and control of choice can be seen in Figure 1. There was no significant interaction between the ethnicity and drink, $F < 1$, $\eta^2 = 0.043$, between ethnicity and control of choice, $F < 1$, $\eta^2 = 0.010$, or between drink and control of choice, $F(2, 40) = 2.83$, $p = 0.071$, $\eta^2 = 0.124$. The three-way interaction also failed to reach statistical significance, $F < 1$, $\eta^2 = 0.047$.

Figure 1
The number of Poker Hands Played Per 5-min Session by American Indian and Non-Indian Participants as a Function of Amount of Control Participants Had Over the Game



An identical analysis was conducted on the number of credits remaining at the end of each session. The main effect of ethnicity, $F < 1$, $\eta^2 = 0.012$, drink, $F(1, 20) = 1.69$, $p = 0.209$, $\eta^2 = 0.078$, and control of choice, $F < 1$, $\eta^2 = 0.002$, each failed to reach significance. The interactions between ethnicity and group, $F < 1$, $\eta^2 = 0.009$, ethnicity and control of choice, $F(2, 40) = 2.79$, $p = 0.074$, $\eta^2 = 0.122$, and drink and control of choice, $F < 1$, $\eta^2 = 0.016$, were not significant, nor was the three-way interaction, $F(2, 40) = 2.11$, $p = 0.134$, $\eta^2 = 0.096$.

DISCUSSION

Although the literature suggests that AIs suffer from pathological gambling at a greater frequency than non-AIs (e.g., Raylu & Oei, 2002), previous research from our laboratory (Gillis et al., 2008; McDougall et al., 2008) has failed to find significant differences in gambling between non-pathological AIs and non-AIs. We reasoned that the difference reported in the literature might be the outcome of some other factor(s), such as alcohol use or differences in responding to the gambling environment. These possibilities were tested in the present study by having AI and non-AIs consume an alcoholic or placebo beverage and then gamble on a slot-machine simulation across three sessions in which the percentage of near misses was varied and on video poker across three sessions in which player's control over the cards was varied. Overall, participants' gambling on

the slot machine was not influenced by ethnicity, type of beverage, or percentage of near misses. Participants' play on video poker, however, was significantly altered by both ethnicity and control over the game. Importantly, AI participants played fewer hands than did non-AI participants. Consistent with previous research from our laboratory (Dannewitz & Weatherly, 2007), participants also played the most when they had the least control over the game.

Unlike prior research from our laboratory, the present study produced a significant effect of ethnicity. This difference, observed for video-poker play, was in the opposite direction of the prevalence rates for pathological gambling in that AI participants played fewer hands of poker than non-AI participants. The present procedure included a number of features that could have potentially influenced the results, such as a relatively small sample size and 5-min sessions. Despite these features, a significant effect was still observed. Thus, the idea that the difference in gambling problems between AIs and non-AIs is due solely to ethnicity is not supported by the present results. It should be noted, however, that despite the fact that AI participants played fewer poker hands than did non-AI participants, they did not end the session with significantly more credits than did the non-AI participants.

The present study was designed to assess whether factors other than ethnicity would potentially influence gambling behavior. Alcohol use is linked to problem gambling (e.g., LaBrie et al., 2003) as well as with AI populations (e.g., McDonald & Chaney, 2003). Thus, we predicted that participants who drank alcohol would gamble more than those who did not. However, there was only one significant effect involving alcohol, an interaction between whether or not the participant received alcohol and the percentage of near misses programmed on the slot-machine simulation when amount wagered was the dependent measure. However, none of the subsequent *post hoc* tests revealed a significant effect of alcohol.

Several aspects of the present procedure may have limited the effect of alcohol consumption. One was the dosage level. The average participant peaked at a BAL below 0.08, which is the legal limit for intoxication in most states in the United States. An effect of alcohol might have been observed if higher doses had been administered and/or if we had recruited heavy drinkers. With that said, the observed BAL in the present study exceeded what prior research suggests can be discriminated by participants and that produces positive subjective effects (e.g., Davidson et al., 1997).

For the slot-machine simulation sessions, the percentage of near misses was varied across the sessions. Unlike the results reported by Kassinove and Schare (2001), no significant differences in the amount wagered or the number of trials played was observed as a function of the percentage of near misses. This failure may be the outcome of the short sessions that were employed in the present study. However, this possibility must be interpreted in light of the fact that a significant

effect of number of hands played was observed when participants played video poker in sessions of the same length. The different outcomes quite likely can be traced to other procedural differences. Kassinove and Schare had participants play a set number of trials and then measured how long they continued to play when they could freely choose to proceed or quit. The present procedure measured how much participants would play and bet from the beginning of their experience with the different percentages of near-miss outcomes.

For the different poker sessions, participants were provided with differing levels of perceived control to determine if it had an effect on gaming behavior. Participants played more hands when they had the least control over the game, a result that replicates previous research (Dannewitz & Weatherly, 2007). This result is likely the outcome of a decrease in decision-making time when the game automatically informs the player of the decision that needs to be made. However, finding an increase in gambling when this function is presented is of importance because, intuitively, one might think that providing the gambler with accurate information might safeguard him/her. Although doing so may indeed help maximize the player's chances of winning, one must weigh that against the possibility that it may also increase how rapidly the person gambles.

In closing, there are several limitations that should be noted regarding this research. First, data were collected from a relatively small area on a Midwestern university campus. Although not all of the participants were students, they all resided in the surrounding area. Also, blood-quantum level was not obtained for AI participants. This fact may be important because it has been hypothesized (Raylu & Oei, 2004) that AIs who are more traditional possess more risk factors which are correlated with problem gambling behavior. Blood-quantum level is one way of measuring the ancestry of an individual, so one could argue that those with higher blood-quantum levels would be raised in a more traditional manner. In addition, this research did not document the specific tribes to which AI participants belonged, which may limit the scope of AIs to which the results could be applied. Future research should specifically target demographic information such as educational level, socioeconomic status, and marital status. Such factors have been documented as risk factors for pathological gambling (Petry, 2005) and could aid in interpretation of the results of studies like the present one. Unfortunately, such data were not collected for the present study; thus, it is not possible to determine whether additional conclusions could have been drawn with this information.

The present study also suffered from relatively low power. Prior studies that have suggested differences in gambling behavior between AIs and non-AIs (e.g., Raylu & Oei, 2004; Volberg & Abbott, 1997; Wardman et al., 2001) did not report effect size. When determining the number of necessary participants, we therefore relied on previous work from our laboratory, which had found moderate effect sizes (e.g., Weatherly & Meier, 2007; Weatherly, Austin, & Farwell, 2007). Unfortunately, however, we did not ultimately observe moderate effect sizes and thus the design

suffered from low power across many of the analyses, suggesting that future research should utilize a greater number of participants than used in the present study. With that said, a *post hoc* analysis run with the same statistical program indicated that the present study would have required 180 participants to detect significant differences with a medium effect size. Given the present procedure, such a number is rather excessive.

Lastly, the present design had participants gamble across six relatively short (i.e., 5-min) sessions; therefore, one could legitimately argue that our measure of persistence in gambling was constrained. Such short sessions were employed to try to ensure that participants who had consumed alcohol were under the influence of alcohol during all six sessions. It is possible that significant effects would have been observed had we conducted sessions that were longer than 5 min. Future research that investigates the influence of alcohol on gambling might benefit from fewer independent variables (e.g., near misses or card control, but not both) and longer sessions at each level of the independent variable.

Jeffrey N. Weatherly, Ph.D.

Department of Psychology

University of North Dakota

Grand Forks, ND 58202

Phone: 701/777-3470

E-mail: jeffrey.weatherly@und.nodak.edu

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FOOTNOTE

¹Only males were recruited for participation because the literature indicates that males, rather than females, are more likely to display gambling problems. Furthermore, introducing gender as a pseudo-independent variable would have decreased our ability to detect differences in the variables of interest in the present study. Future research will need to determine whether the results of the present study can be generalized to the gambling behavior of females.

AUTHORS' NOTE

The present study was completed by the first author in partial fulfillment of the requirements for a Master's degree.