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The Analysis of Gambling Behavior (AGB) is a peer-reviewed publication that contains original general interest and discipline specific articles related to the scientific study of gambling

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The Analysis of Gambling Behavior (AGB) contains general interest and discipline specific articles related to the scientific study of gambling. Articles appropriate for the journal include a) full-length research articles, b) research reports, c) clinical demonstrations, d) technical articles, and e) book reviews. Each category is detailed below along with submission guidelines:

Research Articles – a manuscript of full length (20-30 double-spaced pages approximately), which may contain multiple experiments, and are original contributions to the published literature on gambling.

Research Reports – a manuscript of reduced length (no more than 10 double-spaced pages and a single figure or table page), which may be less experimentally rigorous than a Research Article, a replication of or failure to replicate a prior published article, or pilot data that demonstrates a clear relationship between independent and dependent variable(s). The Results and Discussion sections of Reports should be combined.

Clinical Demonstrations – a manuscript of reduced length (no more than 8 double-spaced pages and a single figure or table page) which lack the rigor of a true experimental design, yet do demonstrate behavior change of persons with gambling disorders under clinical care. This manuscript should contain an Introduction, Methods/Treatments, Results, and Discussion sections. The Results and Discussion sections of Clinical Demonstrations should be combined.

Technical Article – a manuscript of either full or reduced length, depending on necessity, that describes either a new technology available that would be of interest to researchers or a task-analysis style description of how to utilize existing technology for the conducting of research. Examples of appropriate topics may include, but are not limited to, the rewiring of a slot machine for the collection of data or controlling of win/losses, how to use computer software to simulate a casino game, or the way in which neuroimaging devices may interfaced with an experimental apparatus.

Book Review – a review of a contemporary book related to gambling not more than three years after the publication data of the book to be reviewed. The review should be no more than 15 doubled-spaced pages in length.

ANALYSIS OF GAMBLING BEHAVIOR

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Contents

A Brief Behavioral Intervention of Harm Reduction for Online Poker Players

Mack S. Costello & R. Wayne Fuqua
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Given the high rates of gambling in the United States and the growing population of problem and pathological (disordered) gamblers, there is a need for effective interventions which will eliminate or reduce disordered gambling, or, at minimum, reduce harm resulting from disordered gambling. High-risk populations for development of disordered gambling include college students and online poker players. This study sought to develop and test a brief behavioral intervention for decreasing monetary loss, time spent gambling, and risky betting for college-aged self-identified problem gamblers who play online poker. This study included four participants in a multiple baseline across participants. Post-intervention, all participants gambled fewer days overall, and three of four participants lost less money overall. The fourth participant was never at a net monetary loss.

Keywords: Poker, Online gambling, Disordered gambling, Experimental intervenetion, Behavior analysis

"If you're going to play the game, boy,
you've got to learn to play it right."
-Don Schlitz; *The Gambler*

Gambling is a popular form of recreation in the United States, where 86% of adults have admitted to gambling in their lifetime (see National Gambling Impact Study Commission [NGISC], 1999). Some form of gambling is legal in most states in the USA, as well as in much of the Western world. As the availability of legal gambling has increased, the prevalence of pathological and problem gambling has also increased (Shaffer, Hall, & Vander Bilt, 1999).

Pathological gambling is defined as a persistent pattern of recurring maladaptive gambling behavior, as evidenced by the presence of five (or more) of the 10 specified symptoms (DSM-IV TR, American Psychiatric Association, 2000). Problem gambling is a sub-diagnostic condition considered less severe than pathological gambling, and typically includes fewer symptoms than does pathological gambling. Together, pathological and problem gambling have been labeled "disordered gambling" (see Petry, 2009).

Not only is disordered gambling prevalent, but also it has a well-documented social and financial impact. Disordered gambling has been linked to criminal activity, other psychological problems, financial problems, and suicide (Meyer & Stadler, 1999; Petry & Armentano, 1999; Phillips, Welty, & Smith, 1997).

Research suggests that online gamblers are more likely to have disordered gambling behavior patterns than live (in-person) gamblers (Ladd & Petry, 2002). There is evidence that college students, who are online poker players, are at particular risk of developing disordered gambling behavior (e.g., Wood, Griffiths, & Parke, 2007). Given the popularity of poker (e.g., televised tournaments) and the increasing access to poker via casinos and local fund-raising events, it is im-

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portant to develop and evaluate treatment options that are specific to poker.

Abstinence from gambling is difficult to achieve even with disordered gamblers who voluntarily seek treatment. Harm reduction strategies, such as interventions targeting responsible gambling, have the potential to reach and help gamblers for whom abstinence is not a preferred treatment goal. Gambling experts have suggested that treatment goals other than abstinence are viable options for some disordered gamblers (e.g., Ladouceur, Lachance, Fournier, 2009).

Treatment packages for disordered gambling have been described, some of which require a considerable investment of time and resources (Petry, 2009). Brief interventions may be attractive treatment alternatives for disordered gamblers who are not motivated to commit to lengthy, abstinence-focused treatment programs (e.g., Petry, Weinstock, Ledgerwood, & Morasco, 2008). It is estimated that a very small portion of disordered gamblers (3%) seek treatment, and of those who do, 50% drop out (Ladouceur, Gosselin, Laberge, & Blazcynski, 2001; Ladouceur, Lachance, & Fournier, 2009). Thus, there is need for the development of brief and effective interventions that do not incur high dropout rates.

One approach that does not require abstinence but does focus on harm reduction is a strategy to reduce risky betting and the accompanying financial losses. For example, Xuan and Shaffer (2009) have shown that betting on longer odds (i.e., probabilistically unlikely outcomes) may contribute to the maintenance and adverse impact of disordered gambling. This suggests the need for interventions that are designed to alter betting patterns so that disordered gamblers consider the odds before placing a bet, thus reducing the risk of monetary loss.

The purpose of this study was to examine a brief intervention for online poker players who self-identify as problem gamblers with no interest in abstinence from gambling. Brief interventions have potential to be effective for problem gamblers (Petry et al., 2008). The intervention reported herein consisted of two sessions delivered over one day: one session of education about rules regarding pot-odds and poker betting (explained below) and one session of practice with performance feedback in applying these rules to various poker scenarios. In general, the participants learned to state the betting rules and calculate pot-odds before risking money on a bet. Performance feedback has previously been shown to reduce errors in video poker play among casual gamblers (Dixon & Jackson, 2008); we hypothesized that performance feedback similarly could reduce risky betting among disordered gamblers in this study. This intervention was evaluated for its effects on: 1) time engaged in online gambling, 2) the pattern of pot-odds betting, and 3) the impact on monetary loss/gain from gambling.

METHOD

Participants

Participants were recruited from flyers posted in campus buildings or from announcements in undergraduate Psychology classes. The flyers and announcements described a research study for online poker players. Interested students were given instructions on how to contact the first author to confirm interest and set up an initial meeting to review the purpose of the study. In the initial meeting the first author explained and read through the informed consent document with potential participants. There was no compensation offered to participants. The Human Subjects Institutional Review Board at Western Michigan University approved the study.

Nine people consented to participate in this study, of which four met inclusion criteria (explained below) and subsequently completed the study. The four participants were assigned the pseudonyms Joe, Sam, Jane, and

John. They were aged between 19 and 26 years, and all played Texas Hold-Em Poker (For a summary of Texas Hold-Em rules and terms, see Appendix.). Joe played primarily no-limit tournaments. Sam played primarily no-limit tournaments and occasional cash games. Jane played primarily limit cash games. John played primarily limit cash games with varying blind levels (see Appendix for terms).

Materials and Setting

Participants completed a questionnaire to assess inclusion eligibility, and a modified version of the South Oaks Gambling Screen to assess disordered gambling (SOGS; Lesieur & Blume, 1987), which is explained below.

To be included in this study, participants were required to:

1) already play for real money on active accounts on at least one online gambling website that tracks hand history (hand history is a record of activity from the online poker website, including hands played, time of hands, and bets made),
2) be willing to share the hand history with the researchers,
3) agree to play online poker exclusively on a single site that tracks hand history,
4) indicate either that: a) they were at a net loss in terms of their gambling bankroll for the year, or b) they typically lose when online gambling, and
5) report that they were not interested in abstinence training.

The inclusion questionnaire also asked participants about their knowledge of strategies associated with poker success including pot-odds, poker-odds, and expected value (see below in Intervention Procedures). In addition, participants reported if they typically used any of the aforementioned strategies while playing poker.

The SOGS is frequently used to identify potential disordered gamblers. Originally developed as a measure of lifetime pathological gambling, SOGS has been validated as a gambling measure over more finite time frames (Wulfert et al., 2005), including a past month version of the SOGS (e.g., Petry et al., 2008). The past month version of SOGS was used in this study to assess severity of disordered gambling and to document changes in gambling across the course of the study. Scores on the past month SOGS range from 0 to 20, with scores between a 1-4 indicating problem gambling, and scores of 5 or higher indicating pathological gambling.

Participants who met the inclusion criteria tracked their hand histories for their online poker account and sent daily or weekly data to the experimenter via e-mail or flash drive. Participants were scheduled for their intervention sessions after a review of their hand history revealed relatively stable levels of monetary gains/losses over time. A total for money won or lost via gambling per day, was calculated as the primary dependent variable.

The research was conducted in a session room in the Behavioral Medicine Laboratory on Western Michigan University campus. The room contained one large desk and one small personal desk attached to a chair, a personal computer with a keyboard and mouse, a monitor, a calculator, two chairs, and a few bookcases. The computer contained a customized program, written by the first author, with a variety of card and bet combinations able to be displayed.

Procedure

Sessions were run individually for each participant. The intervention consisted of two sessions over one day. The sessions took 20-30 minutes each. Participants had a short break (approximately five minutes for restroom use or to consume a refreshment) between the sessions.

Participants provided hand history for a month after the intervention sessions, and then completed the SOGS for a second time.

Participants also completed a questionnaire that required them to calculate pot-odds to assess if the calculation skill was still in participants' repertoire.

Intervention Procedures. Participants completed two sessions with the first author or trained research assistants as described below.

In the first session the experimenter trained participants regarding pot-odds, poker-odds, and expected value (EV). The experimenter explained that poker is a chance game, and introduced the concept of EV. EV in the context of poker is the amount of money to be won or lost in the long term. A simple version of EV consists of pot-odds and poker-odds. Pot-odds are readily calculable. The amount of money a player must bet to continue in a game is compared to the amount of money that could be won. The less money a player must invest to win a bigger pot, the better. If a player has to bet only $10 into a $100 dollar pot to continue (10 / 100 = .01), he or she can be wrong nine times out of ten and still have money to continue. Poker-odds are the odds of a hand being a winning hand. These are not readily calculable because the hands of the other players cannot be known in Texas Hold-Em poker. Thus, poker-odds depend on a player's ability to "read" an opponent to determine hand strength. Reading is a skill set with which poker players guess hands of opponents based on body language and experience with betting patterns and previous hands of opponents. Reading is not reliable or easily defined as a skill set, so reads can often be wrong. However, if a player reads what cards an opponent has, the player can then calculate the poker-odds. For example, in a deck there are 52 cards, but 2 cards are accounted for right away (the player's hand). So there are 50 unknown cards, and this number shrinks as the flop, turn, and river occur (See Appendix for terms). So, if a player is holding a pair (say a pair of tens), and the opponent bets such that the player reads accurately that the opponent may be holding a higher pair, there are two tens in the deck that could help the player's hand. For the sake of simplicity, we will limit the cards that can help to the two tens. So there are two cards that will help the hand and 48 cards that will not. The chances of improving from the pair to three-of-a-kind are 24 to 1 (48 / 2 = 24). To conservatively call the bet, the pot-odds should indicate that there is 24 times the amount required to call in the pot. The EV formula here is:

[(The bet) * {cards that will not help/remaining cards}] + [(the pot) * {cards that will help/remaining cards}] = EV

The experimenter explained that every time a participant is going to bet, call, or raise, he or she should assess how risky a move that is with a pot-odds calculation, and not depend on poker-odds, as poker-odds cannot be known due to reading not being a reliable skill.

The experimenter presented hand examples step by step, and explained the pot-odds in each example using a formula sheet (given to participants to keep) and a calculator. The experimenter then presented poker examples to the participant and asked the participant to: 1) identify how to assess the pot-odds and 2) calculate the pot-odds. When the participant successfully calculated the pot-odds in two consecutive examples, the experimenter then discussed poker-odds. Poker-odds cannot be known because they depend on knowing other players' hands, so participants were encouraged to generally play strong starting hands such as those on poker experts' top-ten hands lists or successful hands in online poker lists.

In the second session (after the short break), participants practiced applying pot-odds calculations. During the break the experimenter prepared the computer so that participants were presented with an image of a poker table similar to online poker user interfaces. Multiple betting scenarios in poker were presented for participants to practice calculating pot-odds. At each round of betting, the experimenter prompted participants to state the pot-odds rule and prompted participants to calculate and vocalize the current pot-odds. If participants successfully paraphrased why to calculate pot-odds and successfully calculated the pot-odds, then the next betting scenario was presented on the monitor. If participants did not state the rule or did not state the pot-odds correctly within one minute, the hand was checked or folded. Though it never occurred, if a participant had gone four rounds of betting (equivalent of a full hand in Texas Hold-Em) without stating a rule or correctly stating pot-odds, the experimenter would have halted the simulated poker and reviewed pot-odds examples and rules again, as in the first session. When participants correctly identified pot-odds and stated the rule during the simulated poker play, the experimenter provided praise. When participants incorrectly identified pot-odds or rules, the experimenter would provide prompts to recalculate.

When participants correctly stated the rule and the pot-odds 24 consecutive times (the equivalent of six hands, each with four rounds of betting), the simulated portion ended.

Experimental Design

The current study utilized a non-concurrent multiple baseline across subjects design. The multiple baseline was chosen for the advantages of closely examining data in this study and to rule out general time effects.

RESULTS AND DISCUSSION

Figure 1 shows the participants' dollars gained/lost per day while gambling as reported in the hand history. The baseline was characterized by variable monetary outcomes with a number of participants reporting winnings (scores above 0) and others reporting losses (scores below 0). In most cases, the implementation of pot-odds training and calculations is associated with a reduction in monetary losses.

Table 1 shows the participants' net dollars gained and lost per phase, average pot-odds played per phase, the mean number of minutes spent gambling per day in each phase, and the pre- and post-intervention SOGS scores.

During training in the second session, all participants demonstrated mastery of pot-odds calculations for 24 consecutive attempts. Jane made no errors on any trial. John, Joe, and Sam made one, two, and three pot-odds calculation errors respectively but still met mastery criterion.

The participants in the study all showed a post-intervention decrease in one or more gambling measures. More specifically, all participants saw reductions in their SOGS scores, amount of time playing, and number of days with dollars lost.

Shortly after intervention for Joe (day 22) was "Black Friday" as dubbed by the online poker community (day 24; marked with an asterisk in Figure 1). The United States Department of Justice indicted the owners of three major poker sites and seized the .com domains associated with the poker sites (United States Attorney, Southern District of New York, 2011). The poker site that Joe played on was one of the seized websites. Joe tried two other functional websites and settled on one. Joe reported that he was not able to save the data from the new sites when trying them, but that he had winning sessions on each. Day 39 was the last day we received data from Joe, which was the second highest gain of all his days. We stopped data collection on day 49. Black Friday did not affect other participants.

Interestingly, the intervention produced only relatively minor changes in the pot-odds of hands played. It is possible to obtain significant outcome improvements (e.g., dollars

Participant	Net $ gained/lost	Average pot-odds played	Average min gambling/day	SOGS scores pre, post
Jane	-154.33, +9.99	18.68, 19.78	91.88, 14.69	6, 0
John	-107.84, -.14	21.4, 16.91	68.9, 14.23	3, 0
Joe	+36.21, +98	27.87, 27.17	22.86, 3.5	6, 0
Sam	-730, -20	25.47, 23.91	19.44, .98	4, 0

Table 1. Results for each participant. All data are formatted X(baseline data), Y(post-intervention data) except SOGS scores pre, post which are X(beginning of data collection), Y(end of data collection)

lost) by changing the playing strategy for only a small number of low probability hands and produce only very modest changes in the pot-odds when averaged across multiple hands. In addition, the calculation of pot-odds increased the time involved in playing a poker-hand. The calculation and possible covert rule stating may have increased response effort for, or competed with, betting behavior. These are variables that may have deterred impulsive gambling responses and decreased overall levels of gambling. Unfortunately, we did not include measures of impulsivity, response effort, or other behavioral processes. Our measures were selected to evaluate effects related to harm reduction, of which money lost and time spent playing were of use. However, these measures are behavioral products (money won/lost) and topographical as opposed to functional aspects of behavior (time spent playing, pot-odds played). Future research could test effects of this kind of intervention at a more behavioral process level.

This study has several limitations. The intervention tested here did not involve a functional assessment or analysis of each individual's gambling behavior (i.e., we did not identify the controlling variables for gambling for each individual). While it is true that each of the participants reported 1) to primarily play poker, and 2) little or no pre-intervention use of calculated pot-odds, it is possible that the identification of additional motivational variables for each gambler (e.g., social reinforcement, absence of competing recreational activities) might allow for the development of more effective interventions that are tailored to the controlling variables for each gambler.

Another limitation is that the disordered gamblers in the study were self-identified. The authors postulate that the participants in this study, although they had some problems with gambling, did not have severe problems. An additional limitation is that while dollars gained/lost over days was tracked and SOGS scores were evaluated, we had to rely on self-report to verify that participants had not shifted their gambling to other forums (e.g., other websites or live games), which were not open to data collection. Additionally, there is the possibility that the participants returned to previous gambling behavior after data collection when potential reactivity to demand characteristics of the experiment ended. A related limitation is the possibility of participants tampering with their hand histories; the hand histories are text or spreadsheet files. Participants could have changed information

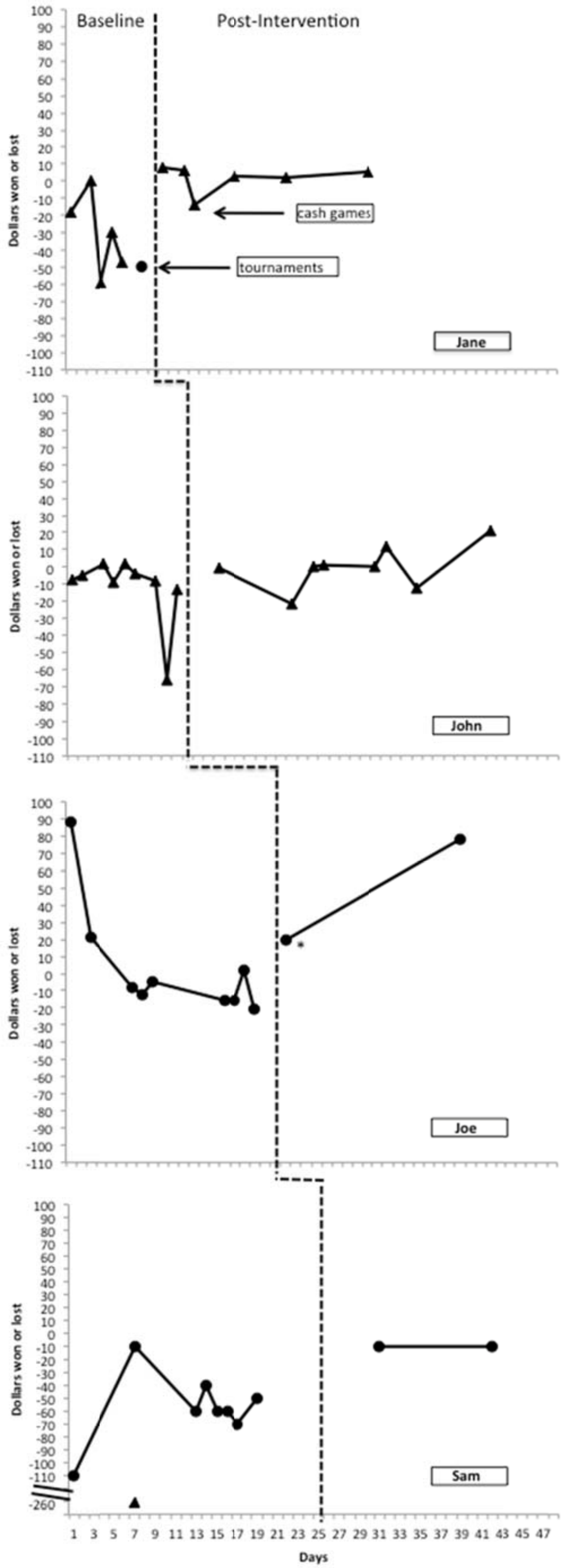

Figure 1. The multiple baseline graph of all four participants' dollars gained/lost per day gambling occurred. Not all days include gambling. The triangle points indicate days made up of cash games, the round data points are made up of tournaments. The asterisk (*) in Joe's graph indicates "Black Friday" for Joe. Sam's graph includes an ordinate axis break between -110 and -260 for an outlier cash game.

in the files, though doing so without causing inconsistencies in the data would have been a response-heavy task simply to hide some of the data from the researchers. Nevertheless, the possibility remains. When they were turned in, hand histories were checked for modification history and no inconsistencies in time stamps were found. However, this does not eliminate the possibility that entire files were omitted from being turned in to the researchers. Despite the potential integrity issues with hand history, they provide detailed information on behavior and are perhaps more reliable than pure self-report.

In conclusion, the intervention described herein, (calculation of pot-odds) appeared to produce one or more positive results for all four of the gamblers in this study. Future research should examine long-term effects of such interventions, behavioral processes involved, and perhaps find more systematic ways to tailor interventions to the unique controlling variables for each gambler.

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Appendix

Poker Rules and Terms

In Texas Hold-Em Poker, a hand consists of four rounds of betting. A hand begins with each player being dealt two face-down cards (i.e. hole cards), followed by a round of betting. Then three cards are dealt face-up, which everyone may use (i.e. the flop), followed by another round of betting. A fourth face-up card is dealt (i.e. the turn), followed by another round of betting, then the last (i.e. the river) face-up card is dealt, followed by a final round of betting. If more than one player is left after the final round of betting, the players turn over their face-down cards, and the player with the best five card combination wins the money bet throughout the hand (i.e. the pot).

Players can buy-into either cash games or tournaments. In a cash game a player buys in with a set amount of money that is directly transformed into chips for play. The player can play for as long or as short as he or she wishes or until his or her chips are gone. In a tournament the buy-in money is transformed into some set amount for all players (e.g. buy-in for $10 and receive 100 chips for play) and the game continues until a winner is decided when all but one player loses his or her chips.

Texas Hold-Em Poker can be played in a limit or no limit version. In the limit version, betting is capped at a particular amount each round. In no limit, players may bet as much of their money as they wish in a round of betting.

Terms used in this paper:

Blinds are money put into the pot before the hand starts (i.e. before any cards are dealt). Typically there is a Big Blind (minimum bet amount) and a Small Blind (usually half the minimum bet amount). Blinds represent the minimum amount of money that can be won in a hand.

Bets are amounts of money put into the pot during rounds of betting which any player who wishes to continue in the hand must match with his or her own money.

Calls are made when players match a bet and continue in the hand.

Raises are made when players put more money in the pot than the bet required for continuing in the hand, thereby raising the amount of money players must match to continue in the hand.

Checks are made when there are no bets to be called and a player does not bet, but indicates he or she will continue in the hand.

Folds are made when players discard their hole cards and discontinue the hand.

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Gambling Behavior and Temporal Discounting Among Military-Affiliated and Civilian Students

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The present study explored whether the contingencies maintaining gambling behavior differed for military-affiliated and non-military-affiliated students. It also tested for differences in how these groups discounted delayed outcomes. Three groups of students participated: Reserve Officer Training Corps (ROTC) students (n = 36), students with a relative in the military (n = 62), and students with no relative in the military (n = 58). Participants completed the Gambling Functional Assessment-Revised and a delay-discounting task. Results indicated that all participants' gambling behavior was maintained primarily by positive reinforcement. Moreover, ROTC students scored significantly higher on gambling for positive reinforcement, and significantly lower on gambling for negative reinforcement, than non-ROTC students. No differences were found across groups in terms of delay discounting. The results suggest that there are differences in the contingencies maintaining the gambling behavior of military-affiliated and non-affiliated students. Implications of the results are discussed.
Keywords: Gambling, GFA-R, Discounting, Military

There are approximately 1-3 million United States citizens currently serving in the military, the vast majority of whom are male (Bray et al., 1999). Kindt (2007) reported that 5% of personnel serving in the military were problem gamblers and 2% were pathological gamblers. In the general population, the prevalence rate of problem and pathological gambling is 2-4% and 1-2%, respectively (Petry, 2005). Although these prevalence rates appear similar, the contingencies maintaining military and non-military personnel's gambling behavior may be different. For example, Bray, Marsden, and Peterson (1991) compared rates of alcohol, drugs, and cigarette use between military and civilians. Their results indicated that military personnel were less likely to use drugs, and more likely to use alcohol and cigarettes, compared to civilians. They attributed these results to military policies, programs, and the military environment.

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Extending Bray et al.'s (1991) argument to gambling behavior, the contingencies in the environment that maintain gambling behavior for military personnel may be different than the contingencies that maintain civilians' gambling behavior. Understanding the factors that maintain military and civilians' gambling behavior and whether one group is more impulsive than the other will aid our understanding of factors that affect military personnel and civilians' gambling behavior. The present study was a step in that direction.

Gambling Behavior

In order to identify whether individuals have problems related to gambling, clinical screening measures such as the South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987), have been created and administered to determine the prevalence of problem gambling in the general population. In addition, two indirect measures of assessing behavioral function, the 20-item Gambling Functional Assessment (GFA; Dixon & Johnson, 2007) and 16-item Gambling Functional Assessment-Revised (GFA-R; Weatherly, Miller, & Terrell, 2011), have been used to determine the controlling variables and contingencies that maintain respondents' gambling behavior. For example, the 16-item GFA-R is composed of eight questions that measure gambling for positive reinforcement and eight questions that measure gambling for negative reinforcement. Past research indicates that gambling behavior maintained by negative reinforcement, as opposed to positive reinforcement, has been associated with a higher frequency of gambling behavior (Miller, Dixon, Parker, Kulland, & Weatherly, 2010). With a well-represented collection of studies that have used the SOGS to determine the prevalence rates of problem and pathological gambling in different populations in the research literature (e.g., Neighbors, Lostutter, Cronce, & Larimer, 2002; Winters, Benston, Dorr, & Stinchfield, 1998), a need has been voiced to extend the investigation beyond prevalence rates of problem gambling to factors that control or sustain gambling behavior (Dixon & Johnson, 2007).

A number of explanations can be forwarded to expect that the gambling behavior of military personnel would be maintained by different contingencies than those that maintain the gambling behavior of civilians. Firstly, it could be that military personnel are limited in their recreational options and in an attempt to escape from an aversive situation, they choose to gamble. Secondly, military personnel may view gambling as a social event that gives personnel an opportunity to get together with others when off duty. Thirdly, it could also be that individuals in the military who experience greater exposure to violent combat may seek out activities (e.g., gambling) where risk taking is involved (Killgore et al., 2008). Theoretically, these possibilities would be reflected in scores on the GFA-R.

Discounting

One form of temporal discounting occurs when an individual is forced to make a choice between a small, immediate reinforcer and a large, delayed reinforcer. Although the relationship between rates of temporal discounting and impulsivity has been tenuously established (Mobini, Grant, Kass, & Yeomans, 2007), rates of discounting have been used to infer comparative value between outcomes (e.g., Smith & Hantula, 2008). For example, if two people were asked to discount cigarettes, the differences in their rates of discounting would provide a measure of which individual valued the cigarettes more/less (Baker, Johnson, & Bickel, 2003), with steeper rates of discounting indicating less value for the commodity. Past discounting research has also examined the relevancy of rates of discounting in determining the efficacy of treatment methods for pathological gamblers (Petry, 2011), the discounting of money in relation to how one discounts environmental outcomes (Hardisty & Weber, 2009), and how commodities within certain domains are discounted (Weatherly, Terrell, & Derenne, 2010). However, no discounting research to date has been conducted on military personnel.

Military personnel may discount commodities to a greater extent than civilians as military personnel have been known to behave more impulsively in terms of alcohol consumption and cigarette use (Bray et al., 1991). For example, if military personnel discount certain outcomes differently than civilians, then one could infer that they place different values on those outcomes than civilians. If those outcomes are gambling related, then the results would be informative as to how gambling-related decision making might differ between military personnel and civilians.

Present Study

The present study was conducted to determine (A) if the contingencies maintaining gambling behavior differed between military-affiliated (i.e., Reserve Officer Training Corps [ROTC] students[1]) and non-affiliated students' (i.e., non-ROTC students) gambling behavior and (B) if rates of delay discounting would differ between military-affiliated and non-military-affiliated students. Not only is this study the first to compare the contingencies maintaining the gambling behavior of these populations, it is the first study to examine potential differences in temporal discounting between these populations. The GFA-R (Weatherly et al., 2011) and a discounting questionnaire were given to three groups of university students with varying degrees of military affiliation.

METHOD

Participants

In total, 156 (150 male, 6 female) participants were recruited to participate: 36 ROTC students, 62 students with at least one relative (e.g., father, sister, uncle, grandparents) in the military and 58 students with no relative (past or present) in the military. The non-military-affiliated students were dichotomized into two groups based on a self-report measure of military affiliation. The 36 Army ROTC students were recruited directly from the Army ROTC facility on the University of North Dakota campus. In terms of sex, six females were in the ROTC group whereas all non-ROTC participants were male. Non-ROTC participants received one hour's worth of extra credit, whereas ROTC participants received $5.00 cash in return for their participation. Demographic information related to participants' age, grade point average, and income can be found in Table 1.

Materials and Procedure

Before participants completed the measures, informed consent was obtained from every participant as approved by the Institutional Review Board at the University of North Dakota. To complete the study measures, non-ROTC students were directed to the SONA system, which allowed participants to complete the study online. For the ROTC students, the researcher had students complete a hard-copy form of all measures in a classroom housed in the ROTC department.

The demographic questionnaire consisted of questions related to participants' age, sex, gender, military affiliation, and relative(s) military affiliation. Next, the participants were directed to complete two measures: the GFA-R (Weatherly et al., 2011) and a delay-discounting task. On the GFA-R (Weatherly et al., 2011) participants were asked 16 questions related to experiences they may or may not have had as a result of gambling and responded to these question using a 7-point scale (0=Never; 6=Always). Of the 16 items on the GFA-R, eight questions measure gambling for positive reinforcement and eight questions measure gambling for negative reinforcement. The questions on the GFA-R that pertain to positive reinforcement included: gambling that is maintained by sensory stimulation associated with gambling, social reasons, and financial reasons. For example, one questions on the GFA-R related to gambling maintained by positive reinforcement reads,

[1] For 39% of active-duty military personnel, the transition between non-military to military personnel was preceded by enrollment into a ROTC program (ROTC Colleges, 2011). Enrollment into an ROTC program entails additional course work for college students, as students are expected to meet the same graduation requirements as non-ROTC students. The ROTC course work consists of classes, courses (e.g., Leader's Training Course), and trips that expose cadets to different aspects of a military environment. For example, in the Leader's Training Course, Army ROTC cadets are expected to successfully complete four phases of leadership training (e.g., solider, warrior leader, bold leader, and future leader phase). Throughout each phase, cadets are exposed to weapons and field training which allow the cadet to experience a military environment (US Army, 2001).

Table 1. Demographic information for the no relative, relative, and ROTC group. Mean scores and standard deviations are presented for age, grade point average, and annual income.

		Age	GPA	Income
Groups	n	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
No Relative	58	19.25 (3.02)	3.63 (.52)	$12,100 ($4,530)
Relative	62	19.10 (3.06)	3.53 (.59)	$13,400 ($9,450)
ROTC	36	19.45 (1.91)	3.83 (.38)	$13,700 ($9,380)

"After I gamble, I like to go out and celebrate my winnings with others." Questions on the GFA-R that pertain to negative reinforcement included gambling that is maintained by escape from interpersonal and intrapersonal problems (e.g., family problems or stress). For example, one question on the GFA-R related to gambling maintained by negative reinforcement reads, "I gamble after fighting with friends, spouse, or significant other." Scores from the eight positive and eight negative reinforcement columns were summed to provide a subscale score for each reinforcement category.

On the discounting measure, participants were asked to discount four outcomes at different delay intervals and amounts (See Appendix). The four outcomes consisted of: lottery tickets ($1,000 & $100,000 worth) and money owed ($1,000 & $100,000). Each outcome was tested at five delays: one week, one month, six months, two years, and 10 years. Gambling and non-gambling related outcomes were included to determine if military-affiliated participants would discount all outcomes more steeply than non-affiliated participants, or if military-affiliated participants would only discount outcomes related to gambling at a greater rate compared to non-affiliated students. Past research suggests that outcomes in different domains (e.g., gambling and non-gambling) are discounted by individuals at different rates, thus lending support to the claim that certain outcomes serve functionally different roles (Weatherly et al., 2010).

The present study employed the fill-in-the-blank (FITB; Chapman, 1996) and area-under-the-curve (AUC; Myerson, Green, & Warusawitharana, 2001) method for collecting and analyzing discounting data. The FITB method was used because it requires fewer questions than other methods (e.g., the binary-choice method). The FITB method is also a reliable and efficient way to collect discounting data as past researchers have utilized this method on a variety of outcomes (Chapman, 1996; Smith & Hantula, 2008). The AUC method was used to analyze the discounting data because AUC values are generally found to be normally distributed, and because a model fit does not have to be obtained (Smith & Hantula, 2008).

The equation for calculating the AUC for a particular outcome is found below, where X_1 and Y_1 represent one indifference point (i.e., point at which a smaller-sooner portion of an outcome is of equal subjective value to that of larger-delayed portion of the same outcome) and X_2 and Y_2 represent another indifference point at a different delay period:

$$(X_2 - X_1)[(Y_1 + Y_2)/2] \quad \text{(Equation 1)}$$

Thus, the x-values represent the predetermined range of delays until receipt of the full amount of an outcome (e.g., one week, one month, six months, two years, and 10 years), and the y-values represent the percentage of an outcome that a participant would accept immediately rather than having to wait a predetermined amount of time to receive the full amount of the outcome. The area between each indifference point (e.g., the area between X_1 and Y_1 and X_2 and Y_2) were computed and summed to derive participants' AUC value for each outcome. Smaller AUC values reflect steeper discounting and, theoretically, more behavioral impulsivity than larger AUC values.

RESULTS

Gambling Behavior

The results in Figure 1 indicate that participants' mean positive reinforcement scores on the GFA-R were greater than their negative reinforcement scores. Between groups, ROTC participants' scores on the positive and negative reinforcement subscales relative to the non-ROTC participants' scores suggests that the effect found for all participants (i.e., higher positive and lower negative reinforce

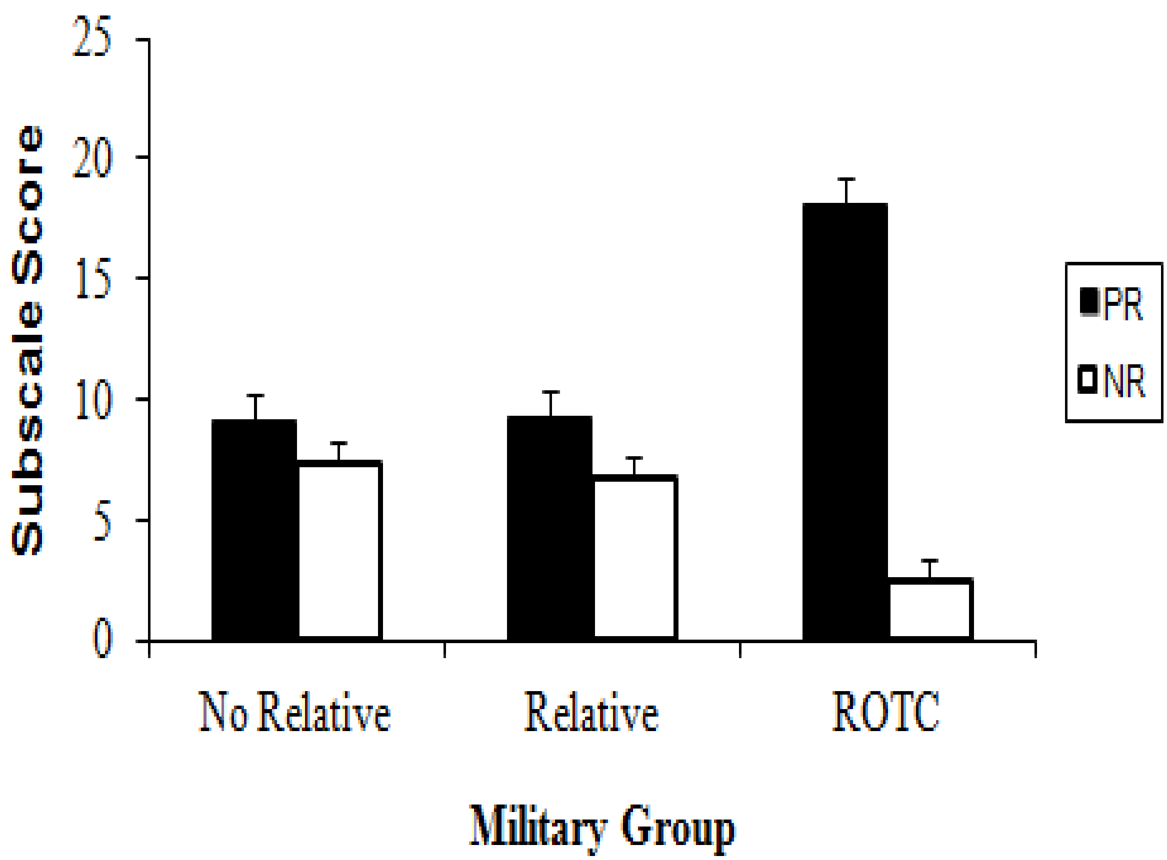

Figure 1. Presented are the mean GFA-R subscale scores for each group. The error bars represent one standard error of the mean.

ment scores) was especially pronounced for ROTC students.

A two-way mixed-model analysis of variance (ANOVA) was conducted on the GFA-R data (group x contingency), with group affiliation (no relative, relative, & ROTC) serving as the grouping factor, and contingency (positive or negative reinforcement) serving as the within-subjects factor. The main effect of group was not significant, $F(2, 152) = < 1$, $p = .49$, $\eta^2 = .01$, but the main effect of contingency was significant, $F(1, 151) = 101.09$, $p = .001$, $\eta^2 = .40$. The interaction effect for group by contingency type was also significant, $F(2, 151) = 61.96$, $p = .001$, $\eta^2 = .45$. Results for this analysis, and all that follow, were considered significant at $p \leq .05$.

When examining the within-subjects factor of contingency type for all participants using a Tukey HSD *post-hoc* test, results showed that participants scored significantly higher on gambling for positive reinforcement ($M = 11.31$, $SD = 10.85$) than on gambling for negative reinforcement ($M = 7.10$, $SD = 8.07$). In terms of interpreting the significant interaction effect, Tukey HSD *post-hoc* tests showed that the ROTC group had a significantly higher positive reinforcement mean subscale score ($M = 18.45$, $SD = 14.74$) compared to the relative-in-the-military ($M = 9.26$, $SD = 8.25$) and no-relative-in-the-military ($M = 9.14$, $SD = 8.61$) groups. Conversely, the ROTC group had a significantly lower negative reinforcement mean subscale score ($M = 2.88$, $SD = 6.02$) when compared to both the relative ($M = 8.02$, $SD = 7.88$) and no relative ($M = 8.69$, $SD = 8.56$) group.

Discounting

A three-way mixed-model ANOVA was conducted on the discounting data (group x outcome x monetary amount). Group affiliation served as the grouping factor. Outcome and monetary amount served as the within-subject factor. The main effect of group was not significant, $F(2, 153) = 2.43$ $p = .09$, $\eta^2 = .02$. Additionally, the main effects of outcome, $F(1,153) = 2.67$, $p = .10$, $\eta^2 = .17$, and monetary amount, $F(1, 153) = 1.00$, $p = .32$, $\eta^2 = .01$, were not significant. Likewise, none of the potential interactions reached statistical significance (all Fs < 2.57, ns, $\eta^2 < .02$).

DISCUSSION

The results indicate that all participants' gambling behavior was maintained predominantly by positive, rather than negative, reinforcement. Moreover, military-affiliated participants had a significantly higher positive reinforcement subscale score and significantly lower negative reinforcement subscale score than the other participants. This outcome is potentially good news for both military-affiliated and non-affiliated individuals because gambling maintained by negative reinforcement, but not positive reinforcement, appears to be strongly linked to problem or pathological gambling (Miller et al., 2010). Moreover, rates of discounting for lottery tickets and money were not significantly different across groups. This outcome is also good news for military-affiliated personnel because rates of discounting have been used as a behavioral measures of impulsivity, and with the rates of discounting for both affiliated and non-affiliated participants being relatively similar, one could state that military-affiliated students are no more impulsive than non-affiliated students.

It could be posited that what maintains students' gambling behavior is the sensory stimulation that results from gambling or the tangible benefits that infrequently occur when a student gambles. That is, students gamble because they enjoy engaging in certain gambling activities or because they enjoy winning money. These types of reinforcers seem to play a more significant role in the gambling behavior of military-affiliated, rather than non-affiliated, students. Past research using self-report measures of gambling behavior have also found that college students' gambling is predominantly maintained by positive (e.g., money, fun, and excitement), rather than negative reinforcement (escape; Neighbors et al., 2002). Why military-affiliated and non-affiliated students' gambling behavior is maintained mainly by positive reinforcement is unknown, but the present results are consistent with the literature (Neighbors et al., 2002; Raylu & Oei, 2002).

The discounting results indicate that the differences in the lottery tickets and money-owed outcomes between and within groups did not reach statistical significance. The fact that no differences were found indicates that groups did not differ in their valuation of these outcomes. It would not appear that the failure to find differences in discounting were the outcome of anomalous data. The mean AUC values for the money-owed outcome ($100,000) for all participants in the current study were similar to rates found in another study where the same population of students were asked to discount a similar outcome (Weatherly et al., 2010).

Based on ROTC students' higher positive and lower negative reinforcement scores relative to non-ROTC students, one might conclude that positive reinforcement contingencies exert more of an effect on ROTC than non-ROTC students. Overall, this result is encouraging for all involved as college students generally, and military-affiliated personnel specifically, gamble for positive, rather than negative reinforcement. How these contingencies specifically maintain military-affiliated or non-affiliated students' gambling behavior has yet to be empirically determined as gambling behavior maintained by positive reinforcement may be qualitatively different for college students than military personnel. The difference between military-affiliated and non-affiliated students' positive reinforcement scores could reflect the degree and amount of exposure to a military-like environment (e.g., ROTC classes, summer camp). That is, the pattern of results could be generalized to active-duty military personnel such that one could predict higher positive reinforcement scores for military personnel compared to both military-affiliated (i.e., ROTC students and students who have a relative in the military) and non-affiliated students as a result of increased exposure to a military environment.

The present study is not without its limitations. First and foremost, some may question the validity of generalizing these results to active-duty military personnel based on data collected from ROTC students. This concern is valid and future research should address this limitation by administering the GFA-R to active-duty military personnel. However, 39% of active-military personnel who are currently serving the military were previously in a ROTC program, indicating that the results may generalize to some active-duty military personnel. If positive and negative reinforcement play different roles in the maintenance of gambling behavior as a function of exposure to a military environment (e.g., physical fitness, stress associated with military placement or combat), then the current results would be a better predictor of recently enlisted active-duty military personnel than personnel who have served in the military for a longer duration of time. Future studies can address this limitation by using a cohort-sequential design where the GFA-R is administered to examine reinforcement trends across individuals with different levels of military experience as well as to examine how certain contingencies exert differential effects across an individual's own military service.

Second, the SOGS was not administered in the current study. The focus of the current study was to better understand the contingencies maintaining military-affiliated and non-military affiliated students' gambling behavior as well as to examine if military-affiliated students value gambling and non-gambling outcomes differently from non-military affiliated students. The focus of the current study was not to compare rates of problem or pathological gambling between groups as a number of comprehensive reports and studies comparing rates of problem and pathological gambling between active-duty military personnel and civilians have been written elsewhere (see Bray et al., 1999). Absent from such reports and studies were a clear rationale for why one would expect military personnel and civilians to engage in certain behaviors, most notably behaviors that are typically associated with negative consequences (e.g., gambling). Thus, the focus of the current study is consistent with Dixon and Johnson's (2007) comments concerning the need to examine the "function that gambling serves" (p. 48) rather than merely focusing on the differences in rates of problem and pathological gambling between military and civilian populations.

Third, an administration of behavioral and self-report measures is warranted to determine if the dominant reinforcement contingency actually maintains gambling behavior. That is, along with GFA-R, it would be of interest to determine whether an actual increase in positive reinforcement (e.g., money or sensory stimulation) would in fact maintain participants' gambling behavior. Triangulation of behavioral and self-report measures of gambling behavior will improve the construct validity of the GFA-R.

The results indicate that the dominant contingency maintaining all students' gambling behavior is positive reinforcement, which has not been found to be as strongly associated with problem gambling (Miller et al., 2010). The present discounting results lend support to the claim that ROTC and non-ROTC students are equally impulsive. Taken together, students in the ROTC program who traditionally enlist in the military are no different going into the military (in terms of contingencies maintaining gambling behavior and impulsivity) than students who may never enlist in the military. The present study is just one step in the direction of elucidating the differences between military and civilian populations. A better understanding of the differences between military and civilians will benefit researchers, clinicians, and most importantly, the individuals who have served, and who are currently serving in the military.

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APPENDIX

For each outcome, "X" could represent five different delays: 1 week, 1 month, 6 months, 2 years or 10 years.

1. You have won $1,000 in scratch-off lottery tickets but you will not be able to receive your scratch-off lottery tickets for "*X*" week/month/year. What percentage of the $1,000 in lottery tickets would you accept immediately given that it would take 1 week to receive the full $1,000 in lottery tickets? ______________

2. You have won $100,000 in scratch-off lottery tickets but you will not be able to receive your scratch-off lottery tickets for "*X*" week/month/year. What percentage of the $100,000 in lottery tickets would you accept immediately given that it would take 1 week to receive the full $100,000 in lottery tickets? ______________

3. You are owed $1,000. What percentage of the $1,000 would you be willing to accept immediately as repayment rather than waiting "*X*" week/month/year to receive the full $1,000? ______________

4. You are owed $100,000. What percentage of the $100,000 would you be willing to accept immediately as repayment rather than waiting "*X*" week/month/year to receive the full $100,000? _______________

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Evaluating Preference and Rate of Gambling on Video Slot Machines

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Casinos increasingly are providing access to five-reel video slot machines and as a result are decreasing the use of traditional three-reel slot machines. Limited research has been conducted on the characteristics of play associated with video slot machines. The present study examined participant's play on a five-reel video slot machine, comparing the number of trials played while wagering one credit on five lines versus five credits on one line. After participants were exposed to both conditions they were asked to choose their preferred condition. The results found that participants played significantly more trials while playing during the five credits on one line setting. The results also found that 12 out of 16 participants selected to play on the five lines on one credit setting when given the option to choose the settings of the slot machine.
Keywords: Gambling, Video slot machine, Rate, Five Reel, Preference

Slot machine gambling has been cited as the largest contributor to the profit margin of casinos, with researchers estimating that 60-70% of casino revenue originates from slot machines (Kilby, Fox, & Lucas, 2004). While the profit margin may vary across casinos, some states have cited even higher profit percentages for slot machines. For instance, Illinois obtained 83% of the state's gross gaming wins from slot machines in 2010 (Illinois Gaming Board, 2011). Modern video slot machines allow participants to alter the number of credits and lines (pay lines) played. The term credit refers to the amount of money an individual bets on one pay line during each spin. The number of lines played is the number of times an individual elects to bet per spin (e.g., playing five lines means five separate bets are being placed on five different sets of stimuli). An individual wins when multiple matching stimuli land on the same line (e.g., three cherries in a row, starting with the left-most symbol).

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Dixon, Harrigan, Sandhu, Collins, and Fugelsang (2010) examined the design documents for a video slot machine and found that as the number of lines bet increases, the likelihood of a win increases. According to the documents participants playing on one line have a 5.1% chance of a win in comparison to 11.9% when playing on five lines. The odds of winning on various line settings relates to a study by Dixon, MacLin, and Daugherty (2006) who evaluated whether participants preferred a smaller payout occurring more frequently (approximately every 10 trials) versus a larger less frequent payout (approximately every 50 trials). The slot machines were programmed to provide equal total monetary wins; therefore the only difference between conditions was the frequency of wins. The results indicated that 83% of participants preferred playing on a machine that had smaller but more frequent payouts. The findings from Dixon et al. (2010) would suggest that the win percentage playing on five lines more closely resembles the more frequent reinforcement schedule that participants preferred from the Dixon et al. (2006) study.

Weatherly and Brandt (2004) also investigated the effects of various payback percentages and credit values on participants' gambling behavior. On a simulated slot machine the authors used payback percentages of 75%, 83%, and 85% and credit values of $0.00, $0.01, and $0.10. The authors examined the number of trials and credits bet during a session. The results displayed that the payback percentage did not significantly alter the behavior of the participant; however the credit value did alter the participants' behavior. As the value of the credits increased the participant's overall betting behavior decreased. While Weatherly and Brandt found that the machine settings may alter participants betting behavior, Harrigan, Dixon, MacKaren, Collins, and Fugelsang (2011) found that participants' selection of various machine settings did not alter the likelihood of the machine paying out more money. The authors found that the number of lines played or the amount wagered per line did not affect the payback amount of a slot machine. In other words, a machine will pay out the same amount regardless of the player's betting behavior. The authors noted that individuals playing on numerous lines are likely to have more frequent wins in comparison to playing on fewer lines; however the overall payback percentage is not affected.

Little research has been conducted examining the behavior of individuals using video slot machines, and no previous research has been conducted examining rate of play on such games.

The first purpose of this exploratory study was to compare the number of trials played while wagering fives lines with one credit versus one line with five credits on a video slot machine. The second purpose was to evaluate which machine setting was more preferred after participants were exposed to both settings.

METHOD

Participants

Sixteen graduate students took part in the study (13 female, 3 male). Participants' ages ranged from 22 to 30 with an average of 25 (*sd* = 2.51). Recruitment was conducted by one of the experimenters. The recruiter informed the class of the ability to receive course extra credit or a $10 gift card for participating. The class was informed that the study involved playing on a slot machine. An alternative extra credit option was provided to individuals who did not want to participate in the study. All participants were asked to complete the South Oaks Gambling Scale (SOGS), which is a 16-item questionnaire designed to determine if an individual is a pathological gambler (Lesieur & Blume, 1986). Scores of five or higher indicate pathological gambling behavior. Scores ranged from 0-8, with one participants scoring as pathological gambler. The average SOGS score was .75 (*sd* = 2.01). There was no exclusion criterion in regard gambling history or prior experience playing slot machines. Prior to beginning the study each participant was instructed on the characteristics of the machine (e.g., lines, credits, ect.) and how to play, and were informed that they were allowed to leave the study at any time without penalty.

Setting and Materials

All sessions took place in a university laboratory, in a small individual therapy room. The small therapy room (8 feet by 6 feet) contained a desk with a computer, three chairs, a couch, and a slot machine. The slot machine was a Tabasco five reel (five columns where the symbols rotate or "spin") video slot machine, with credit betting levels of 1, 3, 5, 12, and 24. The machine allowed participants to play the line combinations of 1, 3, 5, and 12. Prior to the arrival of the participants all of the buttons on the machine were covered except for the repeat bet button and the machine was preset to 2000 credits.

Outcome Measures and Data Collection

The outcome measures were the number of trials played and the participants' preference for the settings of the slot machine after being exposed to both conditions. Data was collected from a program designed on Microsoft Visual Studio 2008.

Procedure

Each participant was exposed to three 10 minutes conditions (two forced choice conditions and a choice condition). The two forced choice conditions involved participants playing on two different machine settings: five credits wagered on one line and one credit wagered on each of five lines. Thus, the amount bet per spin in both choice conditions was always five credits. The order of the forced choice conditions was randomly determined and counterbalanced across participants. The third phase provided the participant the choice to select their preferred condition. Participants were instructed to choose either the five lines or one line condition. Participants were not provided a "no preference" option; however none of the participants expressed having no preference between the two conditions.

Upon entering the experimental setting participants were asked to complete a consent form, the SOGS, and demographics questionnaire. Participants were then directed to sit in front of the slot machine and were provided with the following instructions.

> "You will now be asked to play on a video slot machine until told to stop. You may not change the number of credits or lines bet. You will be playing the slot machine *wagering one credit on five lines/five credits on one line* (depending on the condition). To play the machine, push the repeat bet button. Do you have any questions? Please begin."

If participants asked any questions the applicable parts of the instructions were restated. After completing both forced choice conditions participants were provided the following instructions.

> "You will now be asked to play on a video slot machine until told to stop. You may choose the machine settings with which you would like to play. You may play on the machine wagering one credit on five lines or five credits on one line. On which setting would you prefer to play?"

Once the participant provided their choice, the experimenter set the machine to the appropriate setting. Participants were then instructed to begin. Upon completion of the third condition the participant was debriefed and provided either course extra credit or a gift card.

Interobserver Agreement

Interobserver agreement was recorded regarding the number of total trials played and was measured for 32% of sessions and was calculated by dividing the total number of agreements by the number of agreements plus disagreements and multiplying by 100%. Agreement was calculated between the experimenter taking data on a laptop using Microsoft Visual Studio and an observer taking written data. Agreement between observers was 98.4% during the one line condition and 97.6% during the five lines condition.

RESULTS AND DISCUSSION

Figure 1 displays the average number of trials played during the one line and five line conditions. A paired samples *t* test was conducted on the number of trials played. There was a significant difference in the number of trials played for the one line (M=130.31, SD=20.25) and five lines (M=112.06, SD=12.85) conditions; $t(15)=3.14$, $p<.05$, p =

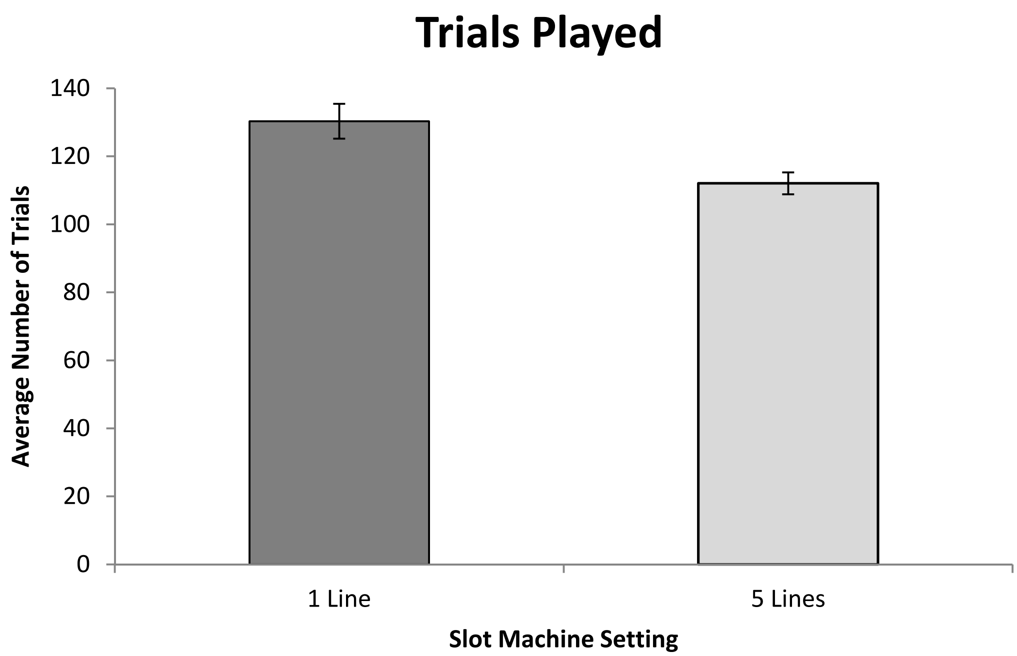

Figure 1. Displays the average number of trials played on the one line and five line settings. Participants played a significantly greater number of spins while betting on one line than when betting on five. The error bars represent one standard error of the mean across participants in each group.

0.0066. Twelve of 16 participants (75%) chose to play on five lines instead of one line when asked to select their preferred setting.

These results suggest that participants played more trials on the slot machine in the same amount of time when they were betting on one line than when they were betting on five lines. The results also display that the majority of participants chose to play on five lines when given the choice to select the machine settings. The present findings are consistent with those of Dixon, MacLin, and Daugherty (2006), who found that 83% of individuals preferred to play on machine settings that provided higher rates of reinforcement. While data was not taken on the number of wins that occurred, numerous participants stated they chose the five line condition because wins were more frequent. The claims of the participants are supported by the findings of Harrigan et al. (2011), which found that wins were more likely to occur as the number of lines increased, suggesting that wins were likely to occur while playing on the five line condition.

The present study was the first to compare participants' rate of play on different slot machine settings. The participants' higher rate of play while playing on one line can potentially be explained through previous research. As previously stated by Dixon and colleagues (2010), placing bets on an increased number of lines results in a greater rate of winning outcomes, and participants tend to follow this betting pattern. Therefore an increased number of wins may be a contributing factor to the decrease in the rate of play during the five lines condition, perhaps due to a more frequent post-reinforcement pause. Based on the present results, there may be an inverse relationship between rate of play and the number of pay lines bet on by an individual. That is, as the number of lines bet increases, the rate of play of the individual will likely decrease. Another potential reason for the slower rate of play during the five line condition is that participants may have spent more time analyzing the outcome of the spin. While the slot machine automatically notifies the individual of a win, participants may have taken time examining the outcome of the spin. While playing on one line, there was only one outcome to examine, in comparison to five outcomes during the five line condition, which were not all simple horizontal pay lines. For example, on the slot used, the first three pay lines require symbols to line up straight across the row for a win, while the fourth and fifth pay line require symbols to be lined up diagonally. This more convoluted arrangement of pay lines may increase the amount of time required to examine the results of a bet. Therefore the decrease in rate while playing on five lines may originate from extended time analyzing the spin outcome. Subjectively, while some participants were observed analyzing the outcome after each spin, numerous participants would immediately begin the next trial if no win occurred. While participants may gamble at a higher rate while playing on one line, participants tend to prefer playing on five lines. The preference for an individual to play on five lines may lead to gamblers spending longer durations on slot machines potentially increasing the revenues of the casinos. Further research needs to be conducted to test whether gambling will persist for a greater number of trials when playing on a large number of pay lines, or if gambling on one line will cause the greatest loss due to increased rate of play.

A potential confound to the present study involves a lack of tangible motivation for the individual to win as many credits as possible. While the majority of participants behaved as if they had the desire to win, the possibility remains that their rate of play may have been altered if there was a tangible reinforcer for winning during a session (e.g., a chance to win additional extra credit or a second gift card). A second limitation may be the inclusion of the pathological gambler in the data. While only one participant was scored as pathological, the data of that participant was consistent with the majority of the data from those scored as non-pathological gamblers. The pathological gambler played 124 trials during the one line condition and 93 during the 5 lines condition and preferred the five line condition. However, future research may consider an examination of a larger pool of pathological gamblers under the same conditions.

Another potential limitation was the inability to control the payout of the slot machine. The number of wins and the amount paid by the slot machine occurs on a random basis, so no two participants contacted the exact same experience while participating in the study. Further, other specific random combinations of symbols result in access to a minigame. In these minigames, the gambler does not simply win a predetermined amount based on the number and type of symbols aligned, but a bonus event is triggered that allows for increased winnings. In the first possible minigame, the screen displayed three mosquitoes, and the gambler could choose among them. Each provided a fixed amount of credits, the value of which was hidden until one was selected. The second minigame displayed a video of a man cooking chili where ingredients were added to a pot at random, and different combinations netted the gambler varying amounts of credits. The last minigame showed a matching game where the user was provided several attempts to flip over squares and match symbols. The more symbols matched resulted in increased winnings. Once again, as the procedures took place on a real slot machine, contact with these outcomes occurred on a random basis. Studies in this area could be conducted on a simulated slot machine to decrease potential confounding variables.

Last, the study utilized only a small sample of participants. Only 16 participants took part in the study. Though the behavior observed within the experimental sessions allowed for the detection of a significant difference in gambling behavior, a much larger sample size may produce a more stable, convincing result. Additionally, to investigate the phenomenon further, investigations of participants' rate of play and preferences when playing on different line and credit combinations could produce a greater difference. For example, allowing participants to bet on 20 lines rather than 5 may produce a greater effect, potentially due to an increase in winning outcomes and relevant stimuli to examine following a spin.

The present exploratory study was the first to examine the relationship between the number of lines bet and the rate of play of an individual. On average participants played at a higher rate while playing on one line in comparison to five lines; however the majority of participants displayed a preference for the five line condition. With casinos more frequently using five reel video slot machines, more research needs to be conducted on the characteristics of play associated with these types of machines.

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Gambling in a Laboratory Setting: A Comparison of Gambling for Positive Reinforcement Versus as a Potential Escape

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Research has shown that most individuals' gambling is maintained more by positive, than by negative, reinforcement but that disordered gambling is more strongly related to gambling maintained by negative, than positive, reinforcement. Forty five participants were recruited to play video poker in two different sessions: one in which they competed for a $50 gift card and one in which they could play after trying to solve unsolvable anagrams. Higher measures of gambling were observed in the gift-card, than in the anagram, session, but none of the differences were statistically significant and the observed effect sizes were small. Participants' annual income did predict their behavior in the gift-card, but not the anagram, session while their endorsing gambling as an escape on the Gambling Functional Assessment – Revised predicted their behavior in the anagram, but not the gift-card, session. Thus, the procedure failed to produce different gambling behavior as a function of manipulating the contingencies in the laboratory. However, the results replicate previous ones showing that certain subject variables are predictive of gambling behavior under certain situations.

Keywords: Gambling, Positive reinforcement, Escape, Video poker, University students

A great deal of effort has been exerted by the research community to identify potential pathological gamblers. Perhaps the most famous of these attempts was the creation of the South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987), which is a self-report questionnaire that asks about the respondent's gambling history. SOGS scores identify potential problem or pathological gamblers, which is an important contribution to the field given that problem and pathological gambling are huge societal problems (see Petry, 2005, for a review). For better or worse, however, more research has been devoted to identifying when people display problem or pathological gambling than to the contingencies that may maintain disordered gambling behavior.

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The first major attempt to do so was the creation of the Gambling Functional Assessment (GFA; Dixon & Johnson, 2007). The GFA was a 20-item self-report measure based on a similar measure developed for individuals displaying self-injurious-behavior (Durand & Crimmins, 1988). The GFA was designed to identify four possible maintaining contingencies for the respondent's gambling behavior (i.e., tangible outcomes, social attention, sensory experience, and/or escape). Subsequent research with the GFA has found several things. First, the GFA appears to measure two contingencies (positive reinforcement & escape) rather than the four it was designed to measure (Miller, Meier, Muehlenkamp, & Weatherly, 2009). Second, respondents generally tend to endorse gambling for positive reinforcement more than they do gambling as an escape (e.g., Miller et al., 2009). Third, endorsing gambling as an escape is more predictive of problem and pathological gambling than is endorsing gambling for positive reinforcement (Miller, Dixon, Parker, Kulland, & Weatherly, 2010).

The GFA has since been revised (GFA-R; Weatherly, Miller, & Terrell, 2011) so as to specifically measure gambling for positive reinforcement and/or escape. Research with the GFA-R has further supported the latter two of the above findings. Specifically, research continues to show that respondents endorse gambling for positive reinforcement to a greater degree than they endorse gambling as an escape (Weatherly, 2011; Weatherly et al., 2011; Weatherly, Miller, Montes, & Rost, 2012). Further, endorsing gambling as an escape is more predictive of problem and pathological gambling than is endorsing gambling for positive reinforcement (Weatherly & Derenne, 2012; Weatherly, McDonald, & Derenne, 2012).

Perhaps interestingly, results from laboratory-based studies have not always produced similar outcomes, at least not when it comes to positive reinforcement. Specifically, a number of studies have demonstrated that when participants "gamble" in a laboratory environment for something of value (e.g., money or a chance to win a gift card), indices of their gambling behavior decrease as the value of that something increases (Weatherly & Brandt, 2004; Weatherly & Meier, 2007; Peterson & Weatherly, 2011). Overall, results from these studies indicate that participants' risk less as the value of what is being risked increases.[1] Given that the vast majority of people tend to report gambling to get something more than gambling to get away from something, these results might seem counterintuitive. One might expect to see an increase in gambling behavior as the magnitude of the positive reinforcer is increased.

On the other hand, results have found that behavior in a laboratory setting does vary as a function of endorsing gambling as an escape on the GFA or GFA-R. For instance, Weatherly, Montes, and Christopher (2010) found that endorsing escape on the GFA was directly related to the number of credits participants bet on video poker. Martner, Montes, and Weatherly (2012), using the GFA-R, found that endorsing escape was directly related to the number of hands participants played on video poker.

A related aspect of Martner et al.'s (2012) procedure, however, failed to produce an effect of "escape." Specifically, these researchers had participants complete two sessions. In one, participants were asked to solve a series of anagrams for up to 10 minutes. After 10 minutes had elapsed, or when the participant decided to quit solving the puzzles, the participant played video poker. The other session was identical with the exception that the anagrams were unsolvable. Martner et al. postulated that the unsolvable anagrams would constitute an aversive situation, and thus participants would display increased gambling to escape the unsolvable anagrams. However, the results did not show differences in video-poker play as a function of whether the anagrams were solvable or unsolvable. Martner et al. offered several potential reasons for why the predicted results were not observed. One was that the solvable and unsolvable anagrams were equally aversive. Another was that the relationship of escape and gambling represented a general behavior pattern that was not necessarily sensitive to moment-to-moment environmental influences.

The present study was designed as a systematic replication of these previous laboratory-based studies. Specifically, participants were recruited to play video poker in two different sessions. In one, they were informed that the participant who won the most credits would win a $50 gift card to a national retail

[1] Peterson and Weatherly (2011) did report, however, that this effect was only observed when controlling for the participants' annual income. That is, the monetary value of the outcome did not alter the behavior of participants who reported having a high annual income.

outlet. In the other session, they were asked to solve a series of unsolvable anagrams for 10 minutes, which they could quit doing at any time to play video poker.[2]

Given previous research has shown that gift cards appear to maintain similar rates of gambling behavior in the laboratory as cash (Peterson & Weatherly, 2011) and that most people gamble more for positive reinforcement than as an escape (e.g., Weatherly et al., 2011, 2012), our primary hypothesis was that participants would show heightened levels of gambling behavior when playing video poker for the chance to win the gift card than when playing after experiencing a potentially aversive situation. Our secondary hypotheses were that certain subject variables would be predictive of video-poker play. That is, Peterson and Weatherly (2011) showed that participants' gambling behavior maintained by monetary incentives varied as a function of participants' annual income. We therefore predicted to find the same effect in the present study. Likewise, Martner et al. (2012) and Weatherly et al. (2010) found that participants gambling behavior was related to their endorsement of gambling as an escape on the GFA or GFA-R. We therefore predicted to find the same effect here.

METHOD

Participants

The participants were 45 (31 female; 14 male) undergraduate psychology students attending the University of North Dakota. The mean age of the participants was 21.2 years (*SD* = 4.6 years) and their mean self-reported grade point average was 3.3 out of 4.0 (*SD* = 0.5). Forty one of the participants (91.1%) self-reported as Caucasian, while two self-reported as American Indian (4.4%) and two as Asian (4.4%). Thirty nine of the participants reported an annual income of below $10,000 per year, with three reporting earning between $10,000 - $25,000 per year, and the remaining three reporting earning more than $25,000 annually. Participants received (extra) course credit in their psychology class in return for the participation, as well as the opportunity to win a $50 gift card.

Apparatus and Materials

The study was conducted in 1.5- by 4.0-m room containing a desk, two chairs, and a file cabinet. An IBM-compatible computer, equipped with dual monitors, was located on the desk. The computer ran WinPoker 6.0 video poker software (see Jackson, 2007, for a description). Participants played "Loose Deuces," which is a five-card draw poker game in which 2's are wild. This particular game was chosen because participants typically play this particular game inefficiently (i.e., make a large number of non-optimal choices; Weatherly, Austin, & Farwell, 2007), which potentially allowed for significant differences in accuracy of play to be observed as a function of the manipulation of the independent variable (i.e., it help to avoid potential ceiling effects). The game allowed participants to wager between 1 – 5 credits per hand.

Participants completed several paper-pencil measures. The first was an informed consent form, which the participant signed after completing the informed-consent process with the researcher. The present study was approved by the University of North Dakota's Institutional Review Board. The second measure was a brief demographic survey that asked participants about their sex, age, grade point average, race, and annual income.

[2] Pathological gamblers were not specifically targeted for participation for two different reasons. First, from a behavioral perspective, pathological gambling is at the extreme end of a continuous spectrum of level of gambling behaviors and is not a "disease" *per se*. From this perspective, pathological and non-pathological gamblers do not represent mutually exclusive populations. Second, we had no theoretical reasons to expect our independent variables (i.e., a gift card & unsolvable anagrams) to differentially influence pathological vs. non-pathological individuals.

The third measure was the GFA-R (Weatherly et al., 2011). The GFA-R is a 16-item self-report measure that has eight items that are designed to measure gambling maintained by positive reinforcement and eight that are designed to measuring gambling as an escape. Answers are provided on a scale of 0 (never) to 6 (always) and scores on the eight items in each subscale are summed to provide a score for that subscale. No items are reverse coded. Research on the GFA-R has demonstrated that is has sound construct validity (Weatherly et al., 2011), very good internal consistency (Weatherly et al., 2012), and good temporal reliability (Weatherly et al., 2012).

The final paper-pencil measure was a series of 16 unsolvable anagrams that ranged in length from five to ten letters. The list of unsolvable anagrams was identical to that used by Martner et al. (2012).

Procedure

Participants were run individually. Upon the participant entering the room, the participant was seated at the desk and the researcher initiated the informed-consent process, which culminated in the participant signing the informed-consent form. The participant then completed two sessions, with the order of the two determined randomly across participants.

One of the sessions was the gift-card session. Prior to this session, the researcher had the participant complete the demographic survey and the GFA-R. After the participant had completed these measures, the researcher read the participant the following instructions:

> You will now be given the opportunity to play video poker. Specifically, you will be playing the game Loose Deuces, which is a 5-card-draw poker game in which 2's are wild. You have been staked with 100 credits. These credits have no monetary value. However, at the end of this study, the participant who had the most credits at the end in this particular session will receive a $50 gift card to Target®. Your goal should be to end the session with as many credits as you can. The game will end when you have lost all your credits, you choose to quit, or 15 minutes has elapsed. Do you have any questions?

Any questions by the participant were answered by repeating the relevant portion of the above instructions. This session then proceeded until one of the three criteria for ending the session was met.

The other session was initiated by the researcher presenting the participant with the series of unsolvable anagrams. The instructions given to the participant were identical to those in Martner et al. (2012). The participant was given 10 minutes to solve as many anagrams as s/he could, but could quit at any time to play video poker. Prior to playing the video-poker segment of the session, the researcher read the participant the following instructions:

> You will now be given the opportunity to play video poker. Specifically, you will be playing the game Loose Deuces, which is a 5-card-draw poker game in which 2's are wild. You have been staked with 100 credits. These credits have no monetary value, but we ask that you treat them as if they did. Your goal should be to end the session with as many credits as you can. The game will end when you have lost all your credits, you choose to quit, or 15 minutes has elapsed. Do you have any questions?

Questions were again answered by repeating the relevant portion of the instructions. After the second poker session had been completed, the participant was debriefed and dismissed.

Upon completion of the study, the $50 gift card was provided to one participant whose name was drawn at random from all participants.

Dependent Measures and Data Analysis

There were three main dependent variables in the study that pertained to playing video poker. One was the number of hands played per session, which can be interpreted as a measure of persistence. A second was the number of credits bet per session, which can be interpreted as a measure of risk. The number of hands played and the number of credits bet are positively correlated. However, because participants could bet between 1 – 5 credits per hand, this correlation will be less than perfect. The third dependent measure was the percentage of hands played correctly (i.e., choosing to keep and discard the cards that maximize the player's overall rate of return), which can be interpreted as a measure of accuracy.[3]

To determine whether the manipulation of the gift card vs. the unsolvable anagrams produced different video-poker play, the above dependent variables were subjected to a repeated-measures analysis of variance (ANOVA).

To determine whether participants' annual income and/or endorsement of gambling as an escape was related to their video-poker play, both annual income and GFA-R escape subscale scores were coded into categorical variables.[4] These measures were then entered as predictor variables in a series of simultaneous linear regressions, one each for each of dependent measures in each video-poker session. The results from all statistical analyses were considered significant at $p \leq .05$.

RESULTS AND DISCUSSION

Participants played more hands in the gift-card poker session (Mean = 85.5, *SD* = 41.8) than in the anagram poker session (Mean = 77.2, *SD* = 46.3). Likewise, they bet more credits in the gift-card poker session (Mean = 224.1, *SD* = 128.4) than in the anagram poker session (Mean = 211.3, *SD* = 114.3) and played more accurately in the gift-card poker session (Mean = 50.4% correct, *SD* = 41.8) than in the anagram poker session (Mean = 49.5% correct, *SD* = 46.3). However, none of these differences were statistically significant. That is, analyses of the number of hands played, $F(1, 44) = 1.71$, $p = .198$, $\eta^2 = .037$, number of credits bet, $F(1, 44) = 0.39$, $p = .537$, $\eta^2 = .009$, and percentage of hands played correctly, $F(1, 44) = 0.09$, $p = .761$, $\eta^2 = .002$, all failed to reach statistical significance.

The first three linear regressions were conducted on the dependent measures from the gift-card poker sessions. The regression on the number of hands played showed that the overall model was significant, $F(2, 42) = 3.62$, $p = .036$, $R^2 = .147$. The only predictor variable that was significant was annual income, $\beta = -0.290$, $p = .048$. Thus, participants with lower reported annual incomes tended to play more hands than those with higher reported annual incomes. Analysis of the number of credits bet per session yielded no sig-

[3] One could argue that, because we did not screen for poker knowledge or experience, that accuracy of play would be expected to vary widely across participants. Not screening for these things was done by design. Not only did we not have a theoretical reason to predict that the factors under study (i.e., gambling for positive vs. negative reinforcement, annual income, & endorsing gambling as an escape) would vary as a function of poker knowledge/experience, allowing variance in this measure potentially allowed for any existing relationships to be identified, which would not necessarily be the case if this measure was constrained.

[4] Both of these variables were positively skewed and therefore there is reason to believe that their relationship with the dependent measures of video-poker play would not be linear unless recoded. Annual income data were coded into five categories. GFA-R negative reinforcement subscales scores were coded into three categories (0 = 0; 1 – 5 = 1; >5 = 2).

nificant effects. With percent of hands played correctly, the overall regression model was significant, $F(2, 42) = 3.92$, $p = .028$, $R^2 = .157$. Again, the only predictor variable that was significant was annual income, $\beta = -0.390$, $p = .009$, indicating that those participants reporting high levels of annual income tended to play video poker more inefficiently than those reporting low levels of income in the gift-card session.

The last three linear regressions were conducted on the dependent measures from the anagram poker sessions. The regression on the number of hands played showed that the overall model approached significance, $F(2, 42) = 3.20$, $p = .051$, $R^2 = .132$. The only predictor variable that was significant was the escape subscale score on the GFA-R, $\beta = -0.356$, $p = .017$. Thus, participants who tended to endorse gambling as an escape tended to play an increased number of hands in this session. Analysis of the number of credits bet per session yielded no significant effects, which was also the case when percent of hands played correctly was the dependent measure.

The first goal of the present study was to determine whether participants' video-poker play would differ as a function of whether they were playing for a gift card with monetary value or as a potential escape from unsolvable anagrams. Although all behavioral measures were higher in the gift-card video-poker session than in the anagram session, none of these differences reached statistical significance. Thus, one cannot say from the present results that participants' behavior was differentially motivated in these two conditions. Likewise, it is possible that the contingencies in both conditions were equally reinforcing.

Results from the linear regressions would appear to support the latter of these possibilities. That is, a subject variable known to be related to how participants gamble for monetary rewards in a laboratory situation (i.e., the participants' annual income) was again shown to be related to such behavior in the present study, but only in the gift-card session. Likewise, the present results also showed that participants' endorsement of gambling as an escape on the GFA-R was predictive of how many hands they played, but only in the anagram poker session. Together, these results suggest that the gift card and anagram manipulations did alter the contingencies in the situation, but that these manipulations interacted with certain subject variables and ultimately resulted in similar measures of video-poker play.

With that said, the present results further support the idea that there are important subject variables that researchers who study gambling behavior experimentally should try to control. The present study, for instance, replicates the finding that a manipulation intended to maintain gambling behavior via positive reinforcement (i.e., a gift card with monetary value) varies in its effectiveness as a function of the participants' annual income (Peterson & Weatherly, 2011). Thus, researchers who use this reinforcement contingency in their procedures might wish to either screen participants based on annual income or ensure that the offered monetary incentive is sufficient to control the behavior of all participants regardless of annual income. On the other hand, it should also be noted that participants in the present study were university students and thus the modal annual income across participants was less than \$10,000. One cannot assume that similar results would be observed if the sample had a large amount of variance in income levels, which should be investigated in future research.

Likewise, the present study joins others that have found that gambling behavior in the laboratory is related to participants' endorsement of gambling as an escape (Martner et al., 2012; Weatherly et al., 2010). Like Martner et al., the present results found such a relationship in the number of hands participants played. Unlike Martner et al., who found such a relationship in the number of hands played in both anagram conditions (i.e., solvable and unsolvable), however, the present study found such a relationship only in the anagram session and not in the gift-card session. The difference in results between the studies suggests two things. First, it suggests that the failure of Martner et al. to find a difference in video-poker play as a function of the anagrams being solvable vs. unsolvable was potentially the outcome of both sets of anagrams being aversive. Second, it suggests that participants' endorsement of gambling as an escape will differentially predict behavior as a function of the contingencies in effect in that particular gambling context.

The failure of either Martner et al. (2012) or the present study to find significant differences in gambling behavior using the same unsolvable anagram procedure should, however, warn researchers against using this particular approach. Of course it is possible that, under certain conditions (e.g., using extremely large sample sizes), such a manipulation would alter gambling. However, it would seem wise at this point for future researchers to pursue other methodology. For instance, instead of setting up the gambling session as a potential escape from something the participant has been doing, one could inform the participant that after the gambling session they would be asked to engage in a behavior that might be aversive (e.g., calculating square roots by hand). Such a manipulation might increase gambling behavior even in individuals who do not typically report gambling as a means of escape.

As with any study that relies on university psychology students as the participants, the results of the present study should be generalized with caution. Different results may have been observed had a more diverse sample been employed. For instance, one could legitimately argue that different results would have been observed had the present study specifically targeted pathological gamblers. Likewise, one could also legitimately argue that the generalizability of the present results are further limited by the fact that participants did not complete the SOGS (Lesieur & Blume, 1987) and thus it is not known what percentage of participants in the study may have displayed problems with gambling.

It is also the case that although several of the analyses yielded statistically significant results, the variance accounted for by these variables was not extremely high. That result indicates that other factors not measured in the current study likely play a large role in controlling behavior. Thus, while the present results help identify several factors that are related to gambling behavior, at least in the laboratory, much remains to be learned about the conglomeration of factors that control gambling behavior in general.

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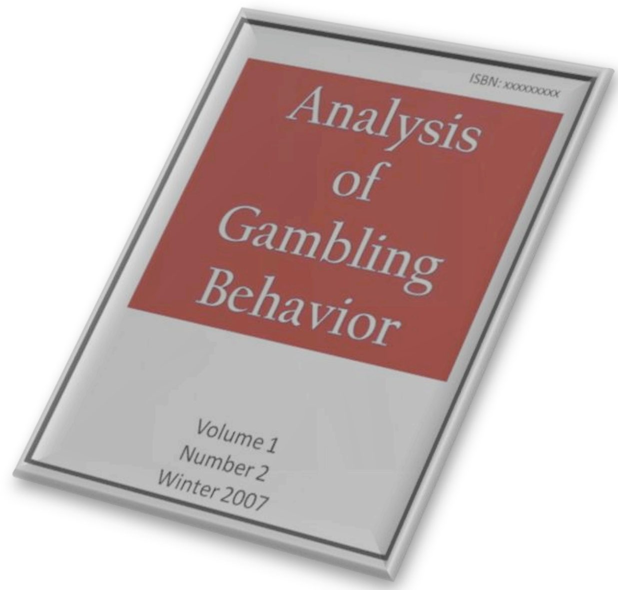

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