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INVESTIGATING ILLUSION OF CONTROL IN EXPERIENCED AND NON-EXPERIENCED GAMBLERS: REPLICATION AND EXTENSION

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The illusion of control is a phenomenon in which one erroneously believes he or she can exert control over the contingencies of chance events. To date, many of the studies investigating this phenomenon as it applies to gambling have used artificial gambling contexts and participants with no history of gambling behavior (i.e., undergraduates). This study replicated the procedures outlined in Dixon, Hayes and Ebbs (1998) using experienced and inexperienced gamblers in a more natural gambling setting. Participants played 20 rounds of a game of roulette in which the default procedure was for the dealer to choose the bets. However, players could choose their own bets by paying extra chips. Results indicated that most participants did not buy control of chip placement, indicating an absence of illusion of control. However, the two participants with the highest scores on the South Oaks Gambling Screen engaged in behaviors consistent with illusion of control across almost every trial.

Keywords: illusion of control, experienced gamblers, non-experienced gamblers

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Illusion of control has been defined as an "expectancy of a personal success probability inappropriately higher than the objective probability would warrant" (Langer, 1975, p. 313). When present in gamblers, such faulty beliefs can prompt individuals to wager more money across gambling opportunities (Dixon, Hayes, Rehfeldt, & Ebbs, 1998; Joukhador, Blaszczynski, & Maccallum, 2004) and to engage in riskier betting (Dixon, Hayes, & Ebbs, 1998). Further, such beliefs appear to be the most commonly self-reported heuristic for people who gamble regularly or heavily (Toneatto, Blitz-Miller, Calderwood, Dragonetti, & Tsanos, 1997) and tend to be more prevalent in those with gambling problems (Joukhador et al., 2004; Moore & Ohtsuka, 1999).

Several factors appear to influence whether behaviors consistent with illusions of control actually reveal themselves. Langer's (1975) classic study displayed a range of stimulus situations that might influence engagement in behaviors consistent with a belief that chance events can be personally controlled. Specifically, her analyses suggested

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that illusion of control is more prevalent in situations where one's competitor looks less confident, when the game allows the player a choice, and when the player is familiar with or has practiced the game. Her study also revealed that simply thinking about a game across time can increase the tendency to believe in one's ability to control chance outcomes. It does appear, however, that behaviors associated with illusions of control can be altered. For example, Dixon (2000) demonstrated the malleability of illusion of control behaviors via the provision of accurate (e.g., "it does not make a difference who picks the number") and inaccurate (e.g., "you'll win more if you choose your own numbers") rules. Participants in the study played a series of rounds of roulette and could bet as many chips as they chose on 8:1 bets. However, on some trials the participants were allowed to choose the number, whereas as the number for the remaining trials was selected by the researcher. Each participant was exposed to three conditions: no rules, inaccurate rules, and accurate rules. Results showed that the majority of participants wagered more chips in the no rules and inaccurate rules phases than they wagered when accurate rules were provided. These results suggest that external sources of information potentially can exert a strong effect on illusions of control and the behaviors associated with such beliefs. In fact, Ferland, Ladouceur, and Vitaro (2002) found that adolescents' misconceptions about gambling decreased after viewing an informational video explaining the chance nature of gambling and the uselessness of one's behaviors in controlling gambling outcomes. Lectures and activities designed to further explain the video's points produced even stronger effects on participants' reports of beliefs in illusory control.

One potential hypothesis to explain illusion of control is that people who foster such beliefs are insensitive to probabilities and thus cannot discern when outcomes are related to chance. Koehler, Gibbs, and Hogarth (1994) tested this hypothesis by measuring betting behavior on dice games that involved one chance to bet ("single shot") or multiple opportunities ("multi-shot) on a simple dice game with 2:1 odds. Results showed that when the game consisted of one trial, participants who were allowed to throw the dice themselves bet more than those whose throws were made by the researcher. However, when participants were required to bet over a series of trials, they began to make their bets based on the obvious 50% probability of winning on any given trial. Moreover probability-sensitive behavior occurred regardless of whether participants threw the dice themselves or the throw was controlled by the researcher. These results suggest that although illusion of control might be present initially, repeated trials "shatter" the illusion.

In a related study, Dixon, Hayes, and Ebbs (1998) sought to discern illusory control on risk-taking behaviors across multiple trials of roulette. During the course of each game, the amount of each player's bet was kept constant and was provisionally restricted to corner bets. However, participants could pay an additional chip for the opportunity to choose the number on a corner bet, and an additional chip to place their chips on a lower risk bet. Unlike Koehler et al. (1994), Dixon et al.'s participants repeatedly paid additional chips to gain control of chip placement and lower their risks, suggesting that repeated exposure to chance events does not alter illusions of control. However, it is possible that these differences can be accounted for by differences in the games played. Specifically, Koehler et al. used a relatively simple game where the odds remained at 2:1. Roulette could be considered a more complicated game in which odds vary depending on chip placement, thus making probabilities more difficult to discern. In any event, the conflicting results of the two studies raise interesting questions about the effects of repeated exposure to probabilistic

outcomes on illusion of control, as well as the influence of familiarity with the game and consistency of the odds.

Clearly, the extant literature examining illusion of control demonstrates the complexity of this phenomenon and the need for additional research. Such investigations have and likely will continue to shed light on important variables in the treatment of pathological gambling (Petry, 2005). However, a potential problem in much of the research examining the role of illusion of control on gambling behavior is that is relies very heavily on self report measures (e.g., Joukhador et al., 2004; Moore & Ohtsuka, 1999; Strickland, Taylor, Hendon, Provost, & Bizo, 2006; Toneatto et al., 1997) as opposed to direct measures of behavior. There is probably good reason for this. First, one's ethics might be challenged if people with serious gambling problems were allowed to engage in potentially dangerous behavior for the sake of participating in a study. Additionally, because casinos in the United States are required to pay-out at a prespecified regulations and rates, experiments which require altering the pay-out and rules are not permitted on the premises (Weatherly & Phelps, 2006). Though some venues may allow direct observation of consenting participants, this still limits investigations of factors which may directly affect gambling behavior. Given the constraints of examining such behaviors in the environments in which they are likely to occur, researchers have used computer simulations (Haw, 2008; MacLin, Dixon, & Hayes, 1999), which allow flexibility with manipulating the parameters and more precision in gathering behavioral data, such as response latency, decision-making periods, and subjective probability estimates.

Despite a strong reliance on self report measures within the gambling literature, some studies have endeavored to directly assess behaviors consistent with illusion of control (Dixon et al., 1998; Dixon et al., 1998a; Dixon 2000; Dixon et al., 2000; Koehler et al., 1994; Langer, 1975). However, the populations from which these measures are collected are comprised exclusively of convenience samples of college students. It is clear that examination of behavior with this particular population is sometimes valuable. For example, Dixon et al. (1998) stated "No subjects had previous experience playing roulette and therefore were chosen to control for any preconceived strategies of how to best play the game" (p. 960). This statement indicates that some studies may have used such samples deliberately to control for particular confounds. There is no doubt that the use of these populations also might allow researchers to construct and run important pilot studies crucial for informing future research.

Despite the potential advantages of using convenience samples for the study of gambling behavior, it is unclear whether the findings from these studies generalize to actual gamblers. The leap of inferring the behaviors of gamblers from non-gamblers may lead to an inaccurate understanding of important behaviors. Inasmuch as this research may provide a foundation for more effective treatments for pathological gambling, accurate understanding of behavior is imperative.

The purpose of this study was to examine the illusion of control and risk-taking behaviors using participants with and without histories of gambling. Additionally, we sought to systematically replicate the procedures of Dixon et al. (1998) to determine whether results attained with college students generalize to those who gamble regularly. We also examined gambling behaviors under more naturalistic stimulus conditions in an attempt to improve the external generality of the procedures and results.

METHOD

Participants and Setting

Seventy nine potential participants were recruited via advertisements published in the local newspaper, on the premises of a local

Table 1

Participant Demographics

Participant	*Age*	*Sex*	*Years of Experience*	*Is participant a student?*	*SOGS Score*	*Roulette Quiz Score*
E1	27	Female	9	Yes	2	4
E2	54	Female	33	No	0	5
E3	31	Male	16	No	4	4
E4	45	Male	27	No	3	4
N1	22	Female	0	Yes	0	0
N2	22	Female	0	Yes	0	0
N3	27	Male	0	Yes	0	0

university, and through word-of-mouth. Each of the 79 respondents subsequently were mailed a package containing an informed consent form, a questionnaire about gambling experience, a five-question assessment on the rules of roulette, the South Oaks Gambling Screen (SOGS, Lesieur & Blume, 1987), information about the local Gamblers Anonymous chapter, and a stamped return envelope. Twenty nine potential participants returned the required forms and were considered for inclusion in the study.

SOGS scores subsequently were reviewed by the first author to further narrow the participant pool. Out of the pool of 29 potential participants, 7 scored $\geq$5 on the SOGS, indicating a potential risk for pathological gambling. Because inclusion of pathological gamblers would raise ethical concerns (i.e., participation in the study would allow engagement in dangerous behavior) and was not approved by the university's Institutional Review Board (IRB), only respondents with scores $\leq$4 were eligible to participate in this study. Of those who scored $\leq$4 on the SOGS, a score of at least 4 on a 5-item questionnaire regarding rules of roulette play was required for inclusion as an experienced participant. Five respondents met this criterion. Further, a score of 1 or 0 on the questionnaire was required to be classified as a non-experienced participant. Five respondents met this criterion. A follow-up phone call was made to those individuals to provide additional details about participation and to confirm interest. Given the monetary costs associated with conducting the study (i.e., staking participants with real money), only 8 of the 10 potential participants were invited to participate in the study. These participants were selected via a random draw.

Seven of the 8 participants reported to the experiment as requested. The 4 experienced gamblers included 2 men (ages 31 and 45) and 2 women (ages 27 and 54). Three of the experienced gamblers held various job vocations in the community while the fourth was an undergraduate student. All had played the table-top version of American roulette on at least three occasions. The 3 inexperienced participants included a man (age 27) and 2 women (both age 22), all of whom were college post-baccalaureate students. None of these participants had prior experience playing any form of casino-related games. A detailed table of the participants' demographics is provided in Table 1.

The games were held in a classroom at California State University, Fresno. The roulette table was rented from a local company which specialized in hosting casino-themed parties, and a dealer was hired to run the games for experimental sessions. On the day of the study, participants' IDs were verified for their name and age before they were allowed to participate in the study.

They also were assured that all personal information would be kept confidential as specified in their informed consent. All procedures were approved by the university's Institutional Review Board prior to participant selection.

Procedure

Participants played the game with all other participants of similar experience (i.e., all 4 experienced gamblers played during a single session and all 3 inexperienced gamblers played during a single session). Prior to beginning play, participants were staked with 80 chips with a value of $20 (i.e., each chip was worth $.25). The following instructions, modeled after the procedures of Dixon et al. (1998a), were then given verbally by the dealer:

> "This is a fair roulette wheel. It is identical in all ways to the roulette wheel found in the casinos in America. You will be given 80 chips which are equivalent to $20. Each chip is worth 25 cents. You will be playing for 20 rounds, and there is no limit to the amount you can win. Each round will start with a default wager of five chips on 8:1 odds, where I will choose the number to bet on. If you wish to choose your own numbers to bet on, it will cost one extra chip. Though you gain control of placing all your five chips, you still need to stake it on a corner bet. If you wish to make a lower risk bet, that being 2:1 or 1:1 bet only, each additional lower-risk bet will also cost an additional chip, and it will permit all your bets to be placed in areas of lower risks. Hence, if you want to control and reduce the risks, it will cost you two chips. Keep in mind that these additional chips are not applied to your bet. Rather, it will always remain a 5-chip bet; only the numbers chosen or the odds will be different. In addition, the wagered chips cannot be split in to different bet ratios or choose to gain partial control of the chips. In the event of someone ending the game before the 20 rounds are completed, he/she will still have to wait for the other players to complete their game. Remember, each chip is worth 25 cents, and at the end of the game, your remaining chips can be cashed in for money, only if you had wagered on all the 20 rounds. There is no borrowing or lending of chips in this experiment. Do any of you have any questions before we start the game? You can still ask questions about the game when it is in play."

Subsequently, participants' questions were answered. The participants then played 20 games of roulette. To ensure that players knew the option to purchase control or lower risks was available each game, the dealer asked each player individually how they would like to place their bets on each round. At the end of the 20 rounds, each player was paid in cash according to the number of chips he or she had remaining.

Procedural Fidelity

An experienced roulette dealer was employed to ensure the proper procedure of the game was conducted. He was trained to read the above instructions and to carry out the procedures as specified in the instructions (e.g., taking a chip from a participant when the participant decided to purchase control). Subsequently, he was assessed for his adherence by role-playing with the primary experimenter and several research assistants. During these sessions, a trained observer recorded adherence to each step of the procedure on a checklist. The dealer performed all the correct steps on 10 consecutive practice rounds before the start of the study. Subsequently, treatment integrity was assessed for each experimental session. Adherence to the protocol was 100% for every round conducted during the study.

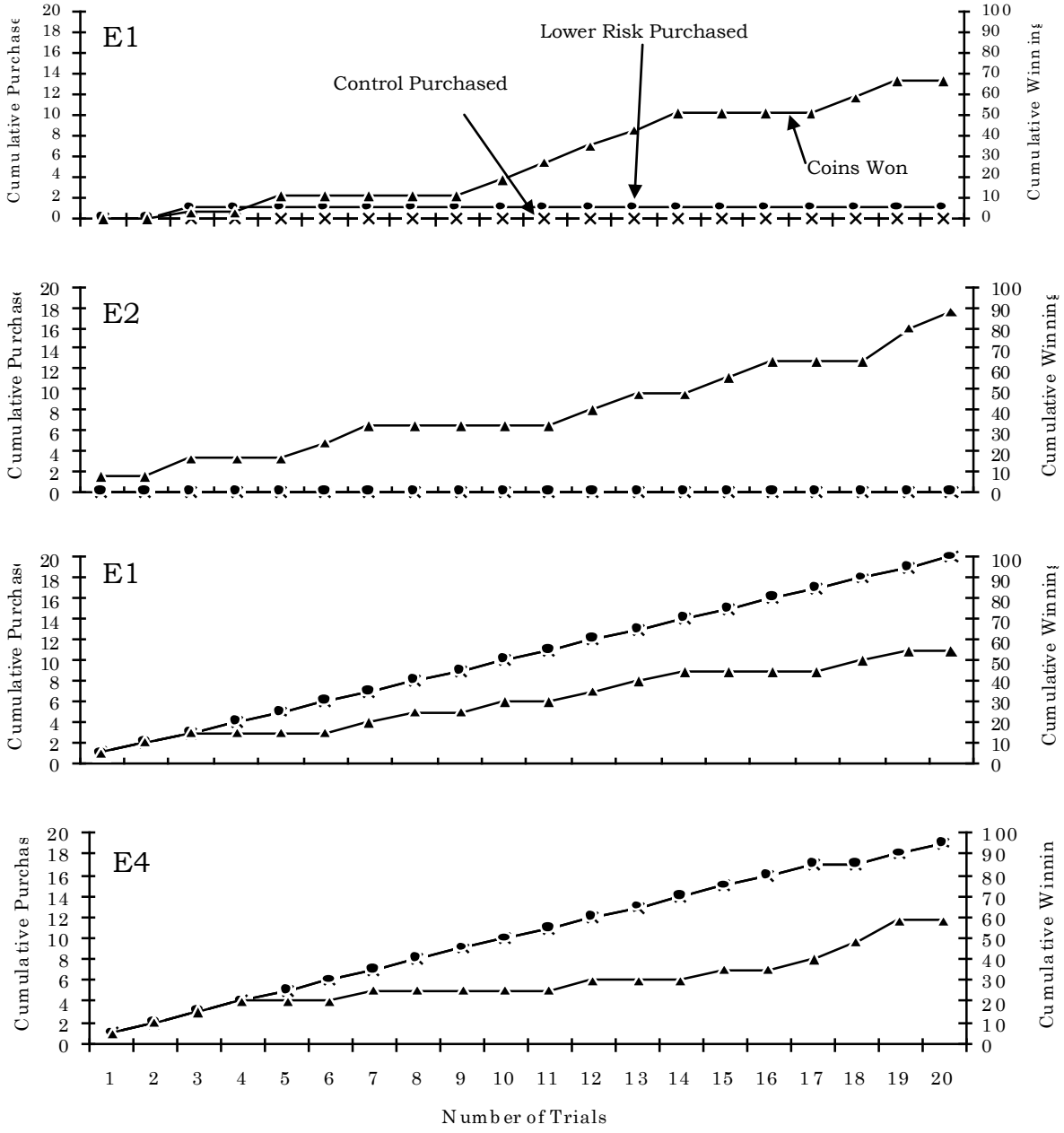

Figure 1. Cumulative winnings in comparison to the cumulative number of trials in which control and decrement of risk were purchased by participants.

Dependent Variables and Measurement

Three primary dependent variables were measured. A *purchase of a decrement in risk* was defined as any trial which a participant paid an extra chip (beyond the five chips allowed for each trial) to have his/her chips placed somewhere other than a corner bet. A *purchase of control* was defined as any round

in which a participant paid an extra chip to gain control of the numbers selected for the bet. A *win* was defined as any situation in which the participant was given a payout due to a match between placement of chips and the number selected on the roulette wheel spin. A win was scored (and the number of chips was recorded) even when a participant's total winnings did not exceed the amount wagered for that trial.

A frequency count of the purchase of a decrement in risk and/or control and the outcome of each trial was recorded using a paper-and-pencil data sheet, which also allowed for recording the amount won on each trial. Two video cameras were used to record all sessions. One camera was placed on each side of the roulette table to capture footage from both perspectives.

Interobserver Agreement (IOA)

IOA was assessed for 100% of the experimental sessions and was calculated for each dependent variable by dividing the smaller observed frequency by the larger observed frequency and multiplying by 100% (Bailey & Bostow, 1979; Repp, Deitz, Boles, Deitz, & Repp, 1976). IOA for purchase of decrement of risk averaged 97.5% (range, 95% - 100%). IOA for purchase of control was 100%. IOA for wins averaged 97.5% (range, 95% - 100%).

Self Reports of Winnings and Social Validity

At the end of the study, participants were asked to estimate the total number of trials in which they won and the total number of chips they won across all trials. In addition, a questionnaire was given to each participant at the conclusion of game play to provide an indication of how the setting for the study compared to roulette play at a casino and whether the participants felt their responses during the experimental sessions were similar to those they would have made if they were gambling in a casino.

RESULTS

Table 2 displays a summary of the number of trials in which control and decrement of risk were purchased and the number of chips won for each participant, along with information regarding gambling experience. Figure 1 displays the cumulative winnings in comparison to the cumulative number of trials in which control and decrement of risk was purchased by experienced participants. Participants E1 and E2 (SOGS scores 2 and 0, respectively) never purchased the opportunity to gain control of their chips. However, E1 paid to increase her odds of winning by lowering her risk on one occasion, whereas E2 stayed with the corner bets throughout all 20 trials. The participants' cumulative winnings were 67 chips and 88 chips respectively. Participants E3 and E4 (SOGS scores 4 and 3, respectively) purchased both control and the opportunity to decrease their risk on almost every trial. Their total winnings over 20 trials were 55 chips and 58 chips, respectively.

Figure 2 displays the cumulative winnings in comparison to the cumulative number of trials in which control and decrement of risk was purchased by non-experienced participants. The non-experienced participants bought relatively few opportunities to control the placement of their chips or to improve their odds of winning. N1 and N2 never bought control during the experiment, while N3 did so on only four occasions. However, N1 improved her odds of winning twice, while N2 and N3 maintained their wagers on the corner bets throughout. Their cumulative winnings were 36, 88, and 64 chips, respectively.

An independent samples *t*-test, after adjusting for a significant difference in the homogeneity of variance, revealed that the experienced participants did not purchase significantly more control (m = .49, sd = .5) than the non-experienced participants (m = .07, sd = .25), $t(3.33) = -1.454$, p = .233, d = 1.06. Similarly, an independent samples t-test, after adjusting for a significant difference in the

Table 2
Total Number of Chips Won, Control and Decrement of Risk Purchased by Each Participant

Participant	Total Chips Won	Control	Risk Decrement	Years of Experience	SOGS Score	Roulette Quiz Score
E1	67	0	1	9	2	4
E2	88	0	0	33	0	5
E3	55	20	20	16	4	4
E4	58	19	19	27	3	4
N1	36	0	2	0	0	0
N2	88	0	0	0	0	0
N3	64	5	0	0	0	0

homogeneity of variance, revealed that the experienced participants also did not purchase significantly more decrement of risk (m = .5, sd = .5) than the non-experienced participants (m = .33, sd = .18), t(3.08) = -1.687, p = .188, d = .452. However, Pearson r coefficients revealed that SOGS scores were correlated with purchase of control (r (6) = .843, p = .01) and purchase of risk decrements (r (6) = .887, p = .008).

Self Report and Social Validity

Participants from both groups reported that the dealer performed professionally or very professionally throughout the experiment. All but one of experienced participants indicated that they would make most of the same decisions they made during the experiment at an actual casino, whereas one reported he/she would have made some of the some decisions in an actual casino.

The estimated number of winning trials as indicated by the non-experienced participants ranged between 5 and 12, while the experienced participants ranged from 7 to 13. The actual number of winning trials for the non-experienced participants varied between 6 and 10, and the experienced participants varied between 9 and 11 trials. Thus, both groups appeared relatively accurate in estimating the number of trials in which they won.

Experienced participants estimated winning between 30 and 70 chips, while the inexperienced participants reported winning between 32 and 96 chips. The actual range of number of chips won by the experienced and the inexperienced participants were 55 to 88 and 36 to 88, respectively. By comparison, the non-experienced gamblers better estimated their winnings than the experienced participants.

DISCUSSION

This study examined illusions of control in experienced and inexperienced gamblers using a simulated casino roulette game. Results indicated that the behaviors of the inexperienced participants were relatively uniform throughout the game, and that they rarely purchased control and decrement of risk. Interestingly, two of the experienced participants also displayed the same pattern of behavior, whereas the other two experienced players bought control of chip placement and a decrement of risk on the majority of trials. One purpose of the current study was to assess the generality of Dixon et al.'s (1998)

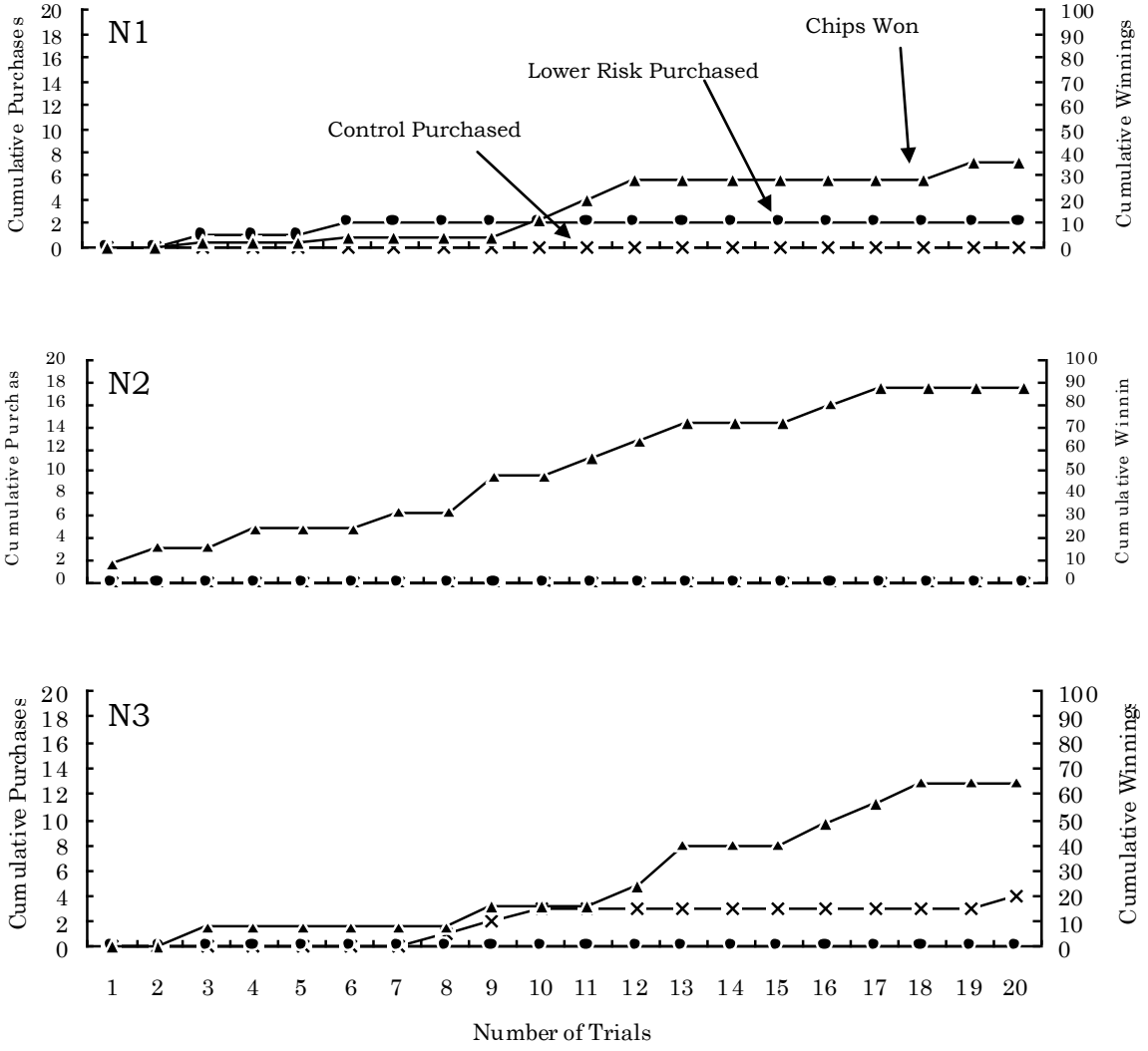

Figure 2. Cumulative winnings in comparison to the cumulative number of trials in which control and decrement of risk were purchased by non-experienced participants.

results to participants with a history of gambling and to measure behavior within a more natural context. To this end, we recruited participants with various histories of gambling from both community and university populations, whereas Dixon et al. focused mainly on undergraduate students who might or might not have had experience gambling (although they did not have experience with roulette). We also attempted to more closely approximate actual casino betting by using a regular roulette table and hiring a professional dealer.

Interestingly, the outcomes of this study differed substantially from those obtained by Dixon et al (1998). Specifically, all of the participants in the prior study bought control of their chips on at least 10 out of 20 trials. Further, 4 out of 5 participants chose to lower their risk on more than half of the trials. In the current study, 5 out of the 7 participants rarely purchased control or decrement of risk. Therefore, the behavior of the majority of the current participants demonstrated responding inconsistent with illusions of control.

It is difficult to determine exactly which variables might have accounted for differences in responding between participants in the two studies or which study represented a more authentic sample of behavior. However, it is imperative to note that the studies differed substantially with regard to stimulus conditions. Dixon et al. (1998) used a graduate research assistant or professor in the role of the dealer, whereas we used a professional dealer. Moreover, payouts in Dixon et al.'s study were in the form of extra course credit, as opposed to the real money used in our study. It is possible that in Dixon et al.'s study, these variables exerted stimulus control over behavior that might not be analogous to typical gambling situations, and produced potential "false positives" of illusions of control. In other words, the participants knew they were in an experiment with someone who had direct influence over their grades; therefore, they might have thought that they needed to continue engaging in behavior (i.e., buying control and risk decrement) to be a "good participant" in the study. It also is unclear as to whether the students who participated in Dixon et al.'s study *needed* extra credit. A better understanding of the motivating operations (Laraway, Snycerski, & Poling, 2003) for the stimuli used as reinforcers would probably assist in understanding gambling behavior, both in Dixon et al.'s study and the current study.

Another difference between the prior and current study was the manner in which participants played the game. Dixon et al.'s (1998) players were run individually, whereas the current study grouped participants according to their level of experience. It is possible that such groupings might have facilitated interaction between the players. For instance, the players might have been influenced by each other's playing strategies based on how much the other players won throughout the game. In fact, N3 mentioned that his purchase of control was somewhat mediated by N2's winnings. On the few occasions when N3 purchased control, he was deliberately trying to follow the placement of N2's chips. Thus, the effects of grouping the participants might have altered some of their responses, whereas Dixon et al. probably provided a better indication of individual responding. However, given that roulette is typically played in groups in most gambling environments, research aimed at understanding the effects of group processes on illusions of control might provide valuable insights into influences on gambling behavior.

Although the failure to replicate Dixon et al.'s (1998) findings raises interesting questions, the current study poses some intriguing findings in its own right. First, although our results were not consistent with Dixon et al.'s, they also were not consistent with of Koehler et al. (1994). Specifically, most participants in the current study never engaged in behaviors consistent with illusions of control, even on the initial trials. These results suggest that our participants were sensitive to the random nature of roulette from the beginning and behaved accordingly.

The striking differences in responding within the experienced group of gamblers were unexpected. Specifically, we anticipated that all the experienced gamblers would be more inclined to demonstrate illusions of control than inexperienced gamblers, given likely histories of reinforcement for engaging in these behaviors. However, it appeared that current (as opposed to remote) reinforcement histories might have exerted substantial influence on behavior. For example, E1 and E2 quickly experienced wins when they let the dealer place their bets at the start of the game, and continued to let the dealer place bets throughout most of the game. Similarly, E3 and E4 experienced wins for buying control and reducing risks early in the game and continued to engage in these behaviors relatively consistently across the study, even when the strategy no longer paid off for them. Given

the odds of a fair roulette wheel, any even bets would pay off 47.3% of the time (although each trial is independent from the previous trial). However, E3 and E4 began switching between the colors and later between bets. Further, it appeared that access to a win on a previous trial did not necessarily predict behavior for a subsequent trial. For example, E4 allowed the dealer to place his chips for him on trial 18 and won. Yet on trial 19, E4 purchased both control and risk decrement. These behaviors suggest that both immediate and remote reinforcement contingencies are relevant in predicting gambling behavior. Specifically, it could be that E3's and E4's histories with gambling engendered beliefs about their abilities to control the outcome of the game.

It is interesting to note that the two participants who displayed behaviors consistent with illusion of control (E3 and E4) also had higher scores on the SOGS relative to other players. These findings are consistent with those of Toneatto et al. (1997), who found a significant relationship between SOGS scores and self-reported cognitive distortions. However, this study represents a substantial improvement over prior studies that have compared the beliefs of participants with different gambling histories (e.g., Joukhador et al., 2004; Moore & Ohtsuka, 1999; Strickland et al., 2006; Toneatto et al., 1997), in that we directly observed behaviors indicating illusions of control rather than simply asking participants to report whether they engaged in such behaviors. Although the small sample size limits generality of the findings, it raises interesting questions about differences in the actual behaviors and beliefs of different gambling populations (e.g., non-gamblers, social gamblers, problem gamblers, etc.). Future research should seek to incorporate more direct behavioral measures to discern differential responding among populations. These findings might prove crucial to understanding gambling behavior and assessing the external validity of studies using convenience samples.

Another interesting finding was the positive correlation between SOGS scores and purchase of risk decrement. Whereas paying to control chip placement on an 8:1 bet would not influence winnings, paying to place one's bet on a 2:1 would. Dixon et al. (1998) suggested that both these behaviors are consistent with illusions of control, in that "while responses at these choice points may influence the size of a win or loss, the win or loss itself is randomly set" (p. 960). However, one might also argue that paying to wager on less risky bets represents a greater sensitivity to the *actual* odds of winning and losing. Like Dixon et al., our procedure allowed the subject to purchase control and risk decrement concurrently, so the relative value of each could not be determined. Future research might seek to isolate these variables and assess their relative importance for people with different histories of gambling behavior.

Although the current methodology improved upon that of Dixon et al. (1998), this study is not without its limitations. First, the practical exigencies of conducting the study limited the number of participants we could include. Therefore, it is possible that there were differences between our experienced and inexperienced groups, but the small sample sizes precluded significant findings. Our effect sizes were large for purchase of control (d = 1.06) and medium for decrement of risk (d = .452), which suggests that significant findings might have been obtained had the samples been larger (Hoyle, 1999). However, our results might also have been influenced by the fact that we allowed people with SOGS scores lower than 4 to participate in our study, which might have mitigated differences between players.

Second, although procedures were designed to replicate a casino roulette game as closely as possible, it was clear to participants that they were in a university laboratory par-

ticipating in an experiment. Therefore, it is possible that the extra stimulus conditions altered typical betting behavior. Almost all the participants overtly wondered about the purpose of the study. In fact, one of the experienced participants even claimed that the study's purpose was to examine his strategy for playing roulette. It is also worth noting that participants were not betting with their own money, and that betting behavior might have been different if their own money was at stake (cf., Weatherly & Brandt, 2004). Despite these limitations, most of the participants reported that they would have placed the same or similar types of bets if they playing roulette in a casino. Given these self reports, it is plausible that the results obtained are accurate reflections of the participant's beliefs about their abilities to control the game, even though evidence of these beliefs was sometimes subtle.

Third, we only assessed illusion of control on the game of roulette. Further replications of this and related research (e.g., Dannewitz & Weatherly, 2007) might address whether illusions of control tend to be more probable with particular games.

A fourth limitation is that we excluded participants with SOGS scores higher than 4. Although it was not our intention to study illusions of control in pathological gamblers relative to non-pathological gamblers, it is not a minor point that individuals with high SOGS scores are more likely to engage in activities that cause difficulties for them and their families. Thus, more research is needed to determine the generality of responding of university undergraduates and "casual" gamblers to those with serious gambling problems.

REFERENCES

Bailey, J. S., & Bostow, D. E. (1979). *Research methods in applied behavior analysis.* Tallahassee, FL: Copygrafix.

Dannewitz, H., & Weatherly, J. N. (2007). Investigating the illusion of control in mildly depressed and nondepressed individuals during video-poker play. *The Journal of Psychology: Interdisciplinary and Applied, 141*, 307-320.

Dixon, M. R. (2000). Manipulating the illusion of control: Variables in gambling as a function of perceived control over chance outcomes. *The Psychological Record, 50*, 705-719.

Dixon, M. R., Hayes, L. J., & Aban, I. B. (2000). Examining the roles of rule following, reinforcement and pre-experimental histories on risk-taking behavior. *The Psychological Record, 50*, 687-704.

Dixon, M. R., Hayes, L. J., & Ebbs, R. E. (1998). Engaging in "illusory control" during repeated risk-taking. *Psychological Reports, 83*, 959-962.

Dixon, M. R., Hayes, L. J., Rehfeldt, R. A., & Ebbs, R. E. (1998a). A possible adjusting procedure for studying outcomes of risk-taking. *Psychological Reports, 82*, 1047-1050.

Dixon, M. R., & Schreiber, J. E. (2002). Utilizing a computerized video poker simulation for the collection of data on gambling behavior. *The Psychological Record, 52*, 417-428.

Ferland, F. Ladouceur, R. & Vitaro, F. (2002). Prevention of problem gambling: Modifying misconceptions and increasing knowledge. *Journal of Gambling Studies, 18*, 19-29.

Haw, J. (2008). The relationship between reinforcement and gaming machine choice. *Journal of Gambling Studies, 24*, 55-61.

Hoyle, R. H. (1999). *Statistical strategies for small sample research.* Thousand Oaks, CA: Sage.

Joukhador, J., Blaszczynski, A., & Maccallum, F. (2004). Superstitious beliefs in gambling among problem and non-problem gamblers: Preliminary data. *Journal of Gambling Studies, 20*, 171-180.

Koehler, J. J., Gibbs, B. J., & Hogarth, R. M. (1994). Shattering the illusion of control: Multi-shot versus single-shot gambles. *Journal of Behavioral Decision Making, 7*, 183-191.

Lesieur, H. R., & Blume, S. B. (1987). The South Oaks gambling screen (SOGS): A new instrument for the identification of pathological gamblers. *American Journal of Psychiatry, 144*, 1184-1188.

Langer, E. J. (1975). The illusion of control. *Journal of Personality and Social Psychology, 32*, 311-328.

Laraway, S., Snycerski, S., Michael, J., & Poling, A. (2003). Motivating operations and terms to describe them: Some further refinements. *Journal of Applied Behavior Analysis, 36*, 407-414.

MacLin, O. H., Dixon, M. R., & Hayes, L. J. (1999). A computerized slot machine simulation to investigate the variables involved in gambling beha-

vior. *Behavior Research Methods, Instruments, & Computers, 31*, 731-734.

Moore, S., & Ohtsuka, K. (1999) Beliefs about control over gambling among young people and their relation to problem gambling. *Psychology of Addictive Behaviors, 13*, 339-347.

Petry, N. (2005). *Pathological gambling*. Washington, DC: American Psychological Association.

Repp, A. C. Deitz, D. E. D. Boles, S. M. Deitz, S. M. & Repp, C. F. (1976). Technical article: Differences among common methods for calculating Interobserver agreement. *Journal of Applied Behavior Analysis, 9*, 109-113.

Strickland, C-J. R., Taylor, A., Hendon, K. J., Provost, S., & Bizo, L. A. (2006). Erroneous beliefs among frequent fruit-machine gamblers. *Gambling Research: Journal of the National Association for Gambling Studies (Australia), 18(*2), 42-54.

Toneatto, T., Blitz-Miller, T., Calderwood, K., Dragonetti, R., & Tsanos, A. (1997). Cognitive distortions in heavy gambling. *Journal of Gambling Studies, 13*, 253-266.

Weatherly, J. N., & Brandt, A. E. (2004). Participants' sensitivity to percentage payback and credit value when playing a slot-machine simulation. *Behavior and Social Issues, 13(1),* 33-50.

Weatherly, J. N., & Phelps, B. J. (2006). The pitfalls of studying gambling behavior in a laboratory situation. In P. M. Ghezzi, C. A. Lyons, M. R. Dixon, and G. R. Wilson (Eds.), Gambling: Behavior theory, research and application (pp. 105-126). Reno, NV: Context Press.

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