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The Role of Perceived Control and Overconfidence in Pathological Gambling

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Two studies sought to determine whether perceived control has different effects on confidence assessment and betting decisions among pathological and problem gamblers than among non-problem gamblers. In Study 1, 200 college students who were frequent gamblers (80 female and 120 male, median age 20) completed the South Oaks Gambling Screen (SOGS) and then engaged in a task in which they answered questions, assessed confidence in each answer, and considered bets on their answers that were fair if they were well-calibrated, but unfavorable if they were overconfident. Probable pathological and problem gamblers earned significantly fewer points than non-problem gamblers. This was due to greater overconfidence among pathological and problem gamblers, which led to systematically less favorable bets. In Study 2, using 384 participants (105 female and 279 male, median age 20), control was independently manipulated and bets were constructed to make point value independent of overconfidence. Problem and pathological gamblers showed both greater overconfidence and greater bet acceptance. They were less affected by control in their betting decisions than non-problem gamblers, but more affected in the slope of their betting function. It is concluded that pathological and problem gamblers process information about confidence and control differently from non-problem gamblers.

KEY WORDS: illusion of control; overconfidence; decision-making; pathological gambling.

Gambling, especially problem gambling, is intimately related to a perception of the gambler that, to some extent, he or she can control

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the uncertain event that is being bet on. For example, the illusion of control (Langer, 1975), an exaggerated belief in one's ability to determine the outcome of an uncertain event, is a prominent explanatory construct in gambling studies. The illusion of control has intuitive appeal, and a number of studies have reported the presence of illusory control and related cognitive fallacies in gambling populations, often using talk-aloud methods (e.g., Breen & Frank, 1993; Dickerson, 1993; Ladouceur & Gaboury, 1988; Ladouceur et al., 1991; Ladouceur, Walker, & Becona, 1998; Toneatto, 1999). Some studies have reported positive correlations between perceived control and gambling measures (Kweitel & Allen, 1998; Moore & Ohtsuka, 1999), and some have made it a central feature of models of pathological gambling (e.g., Frank & Smith, 1989; Griffiths, 1990; Rosenthal, 1986). There is evidence that only a few wins are sufficient to increase the illusion of control (Ladouceur, Gaboury, Dumont, & Rochette, 1988).

Still, some studies have found little or no relation between measures of control and gambling (Dickerson & Adcock, 1987; Dickerson, Walker, England, & Hinchy, 1990; Moore & Ohtsuka, 1997). Furthermore, the success of the illusion of control as a basis of therapy has been constrained. Instructing pathological gamblers about the illusion of control has been effective where it has been reported, but such reports have been scarce, and generally come in small, uncontrolled studies (Ladouceur, Sylvain, Letarte, Giroux, & Jacques, 1998) or as one component of a multifaceted therapy (Sylvain, Ladouceur, & Boisvert, 1997).

Toneatto (1999) defined the illusion of control for purposes of gambling research as ''... a tendency to believe that there is a greater probability of obtaining a chance-determined outcome than would be dictated solely by random chance'' (p. 1594). The cognitive processing of control can be usefully separated into two components: the belief that one can increase the probability of winning, and the belief that the probability of a win, having been increased, is greater than it really is. Toneatto's definition primarily addresses the second part of the process. It is clear that an inflated belief about the probability of winning, whatever its origin, can lead to bad betting decisions. But it is equally clear that this is not the whole picture. For example, Dickerson et al. (1990) did not find a significant impact of perceived control on off-course betting involvement, but they operationalized control as simple perceived probability of winning.

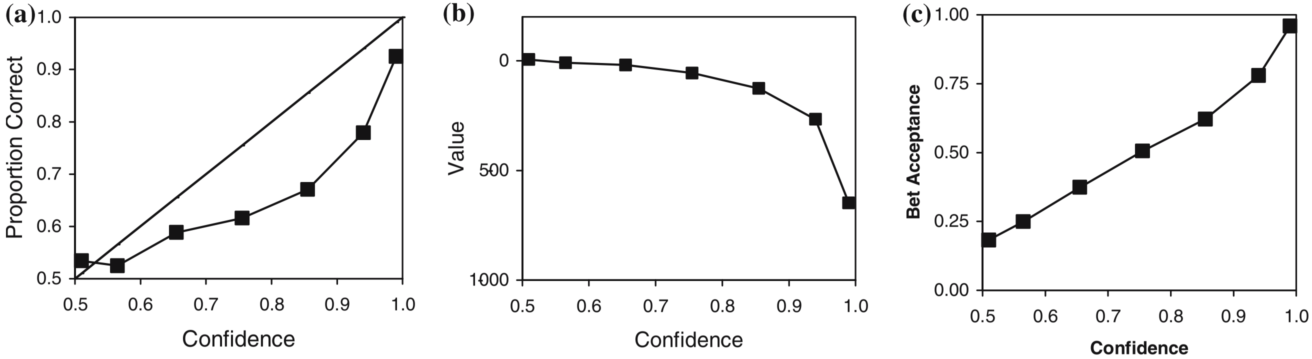
What of the belief (whether true or false) that one can change the probability of winning? There are several advantages to focusing on this aspect of control. One is that there are many tasks over which control can be exerted to some degree—that is, in which one can take steps that truly increase the probability of success. In gambling settings with some skill component, such as poker, blackjack or off-track betting, study, attention and consistent strategy application make a real—if small—difference in the probability of winning. Also, recent research has demonstrated systematic and frequently deleterious impact of perceived control on risk taking decisions. Goodie (2003) has shown that people are dramatically more willing to bet on events over which skill prevails, compared with random events, even when the perceived probability of winning, and all possible outcomes, are kept constant. Furthermore, this work has shown that betting is a more increasing function of subjective probability with control than without control, even when the value of bets declines with perceived probability. This effect has been termed ''paradoxical betting'' (Goodie, 2003).

Using this paradigm, participants answer many general knowledge questions and assess their confidence in each answer. Then, bets are constructed that are fair (having zero average value over the long run, or in other words favoring neither the player nor the house) if confidence is well calibrated. The bets have positive average value (i.e., favor the player) if participants are underconfident, and negative average value (favor the house) if participants are overconfident. Figure 1 depicts typical results (Goodie, 2003). The calibration curve, showing accuracy as a function of confidence, is depicted in Figure 1a. Participants were slightly underconfident (displaying accuracy greater than confidence) at the lowest confidence level, and overconfident (with accuracy less than confidence) at higher confidence levels. Underconfidence leads to greater average value than overconfidence, and because underconfidence usually turns to overconfidence as confidence increases, it is evident in Figure 1b that average points earned systematically decline as confidence increases. Because of this, betting should be a declining function of confidence. However, betting was paradoxically an increasing function of confidence, as depicted in Figure 1c.

The two studies presented here examined whether problem gamblers perform differently in this betting-on-knowledge task than

Figure 1

Betting, calibration and bet value observed in previous research (Goodie, 2003). (a) The calibration curve, accuracy as a function of confidence. (b) The average points earned by betting as a function of confidence. (c) Betting proportions as a function of confidence. Copyright© 2003 by the American Psychological Association. Adapted with permission.



non-problem gamblers, and whether this difference was attributable to the impact of perceived control. This paradigm has been used to investigate decision-making under uncertainty generally, but it differs from natural gambling settings in a number of ways. Most important, perhaps, no real money or other commodities are won or lost. In addition, the surface features do not attempt to mimic natural gambling settings. These studies do not explore gambling behavior directly, but rather the basic cognitive processes that underlie gambling and other risk-related behavior. It was sought to discover whether problem and pathological gamblers show distinctive features in their basic cognitive processing of uncertainty that may underlie their gambling problems.

STUDY 1

Experiment 1 replicated the paradoxical betting results of Goodie (2003) while measuring PG status among frequent gamblers, to explore whether problem and pathological gamblers would perform differently in the same task as non-problem gamblers.

Methods

Participants

Two hundred participants (80 female, 120 male) were recruited from the research pool of the University of Georgia Psychology department, and were compensated with credit toward lower-division courses. College student populations have been found to have high rates of gambling (91% of men and 84% of women), frequent gambling (19% of men and 5% of women), and significant financial losses (10% of gamblers; all percentages from Winters, Bengston, Dorr, & Stinchfield, 1998).

Most participants (156 out of 200) were 17–20 years old, 39 were 21–22 years old, and five were older than 22. The sample included 169 white participants, 12 African-Americans, 8 Asian-Americans, 5 Hispanic-Americans and 6 other non-Caucasians. These values are consistent with the proportional representation of racial and ethnic groups at the University of Georgia. Pilot recruiting attempts had yielded markedly few problem gamblers, and so participants were recruited with the following restriction: ''ONLY people who gamble frequently. This may include playing cards or other games for money, betting on sporting events, playing the lottery, or other forms of gambling.''[1]

One participant's data became compromised and it was necessary to exclude them from analysis. The demographic characteristics of the sample provided above do not include this participant.

Procedure

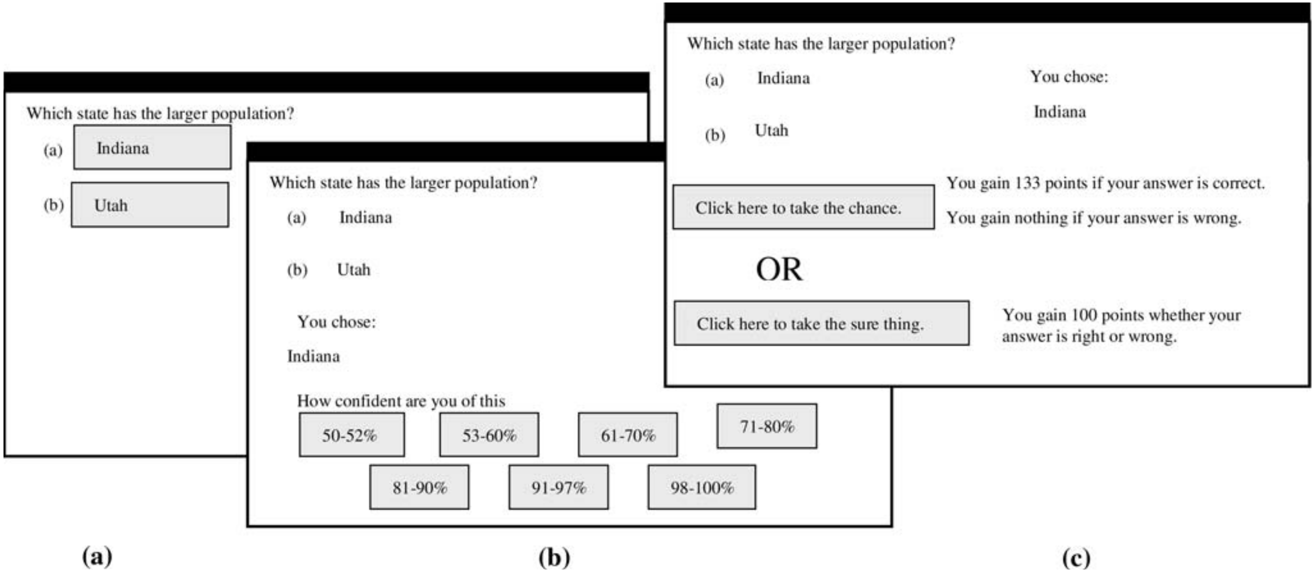
After providing informed consent, participants completed a computer-administered version of the South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987). SOGS has been criticized for not being grounded in DSM-IV pathological gambling (PG) criteria and for its relatively high false positive rate. Alternative screens have been developed in recent years (e.g., Winters, Specker, & Stinchfield, 2002). However, SOGS was used in these studies to enhance the ease of relating them to the large body of studies that used SOGS exclusively prior to the recent development of a new generation of DSM-IV-based screens for PG.

SOGS data were recorded in two ways: as raw SOGS scores, and as ''PG status'': 1 for probable pathological gambling (SOGS score of 5 or higher), 0.5 for problem gambling (SOGS score of 3–4), and 0 for non-problem gambling (SOGS score of 0–2). After completing the SOGS, participants completed a demographic questionnaire asking for sex, age and racial self-identification.

The betting-on-confidence task was then administered by a computer. The task employed three kinds of questions, each asked about each of 120 test items. The question types are depicted in Figure 2. The first (Figure 2a) was the underlying test item: a two-alternative multiple-choice version of a general knowledge question. This always consisted of comparing two U.S. states on the dimension of population. For each trial, two states were selected at random, and the participant guessed the one with the larger population. The second kind of question (Figure 2b) asked for an assessment of confidence in each general knowledge question to be placed in one of the following categories: 50–52%, 53–60%, 61–70%, 71–80%, 81–90%, 91–97%, and 98–100%.

It should be noted that although the questions were selected randomly from a single question population, this process led to a task in

Figure 2
Three types of questions that were asked: (a) general knowledge question; (b) confidence assessment; and (c) betting decision.



which some questions were much easier than others, leading to both higher confidence and higher accuracy. For example, most participants would be expected to find a comparison between the populations of New York and Wyoming to be easier than a comparison between North Dakota and Vermont. Some factors that may have made the comparisons more or less difficult include: the size of the objective difference between the states' populations, their relative proximity to Georgia, where most participants in these studies reside permanently, and the inclusion of states that are famous for extremely large or small populations.

The third kind of question (Figure 2c) asked for acceptance or rejection of a bet based on the answer given to the question. The bet was designed to be fair, having average value that was equal to the value of the certain option, if the participant was well calibrated. The certain option, which was obtained any time the participant chose not to bet, was always a gain of 100 points. The outcome if the participant bet and had answered incorrectly was no gain. The amount that was gained if the participant bet and had answered correctly was 100/confidence points. So, for example, when the participant was 99% confident of a particular answer, she would win 100/0.99 = 101 points if she bet and had answered correctly. If she was only 51% confident, she would gain 100/0.51 = 196 points.

The reason these bets are fair can be seen by considering the outcomes of these examples over many plays. Over 100 answers in which a participant had 99% confidence, by accepting all the bets, she would expect to win 99 times, gaining $99 \times 101 \approx 10{,}000$ points. The ''average value'' of the bet is given as:

total gain/number of plays = 10,000/100 = 100

This is the same as would be gained by rejecting all 100 bets, which would be 100 points per item, or 10,000 total points.

Over 100 items with 51% confidence, if the participant accepted all bets, she would expect to win 51 times and gain $51 \times 196 \approx 10{,}000$, which is the same amount she would gain by rejecting all bets. Fairness defined in this way can always be achieved by offering gains of 100/confidence points for betting on a correct answer.

Immediately following the betting decision, participants were told the correct answer, any change in points, and their cumulative point total. Points were not backed by money or any other external incentive.

Data were collected in two phases. In the first phase, 120 general knowledge questions were asked, and confidence was assessed in each answer before the next question was asked. In the second phase, participants were reminded of each question, the possible answers, and their answer, and were offered the bet.[2]

Independent and Dependent Measures

In addition to the demographic measures of sex, age and race, and the PG measures of raw SOGS score and PG status, the following performance measures of each participant were used: accuracy (proportion of questions answered correctly), confidence (the average of confidence assessed in all questions), overconfidence (the difference between confidence and accuracy), bet acceptance (proportion of offered bets that were accepted), points earned, and betting slope (the slope of each individual's betting curve, such as the one depicted in Figure 1c).

Results

Demographic Characteristics of the Sample

Thirty-two participants (16%) scored 5 or higher on the SOGS and are classified as probable pathological gamblers. Another 34 (17%) scored 3 or 4 and are considered problem gamblers. Of the 134 (67%) non-problem gamblers (scoring 0–2), 69 (34%) scored zero. It is thought that the high rate of observed problem and pathological gambling arises from two principal sources. First is the recruitment message that deliberately increased the representation of problem and pathological gamblers in the sample. This sample is not representative of the proportional representation of problem and pathological gamblers in the student population at large. Second, SOGS is a screening tool that errs on the side of increased false positives in order to minimize false negatives. This increases the observed rates of problem and pathological gamblers in the sample, and also increases variability, decreasing the statistical power of the analysis and reducing observed effect sizes.

Men in the sample had higher SOGS scores than women (R=.15, $p < .05$) and consequently higher PG status ($R = .16, p < .05$); were more confident in their answers ($R = .31$, $p < .01$) without being more accurate ($R = -.07$, *n.s.*) and were consequently more overconfident ($R = .20$, $p < .01$); and as a result of this earned fewer points ($R = -.18$, $p < .01$). Men also had a lower betting slope than women ($R = -.24$,

$p < .01$). Age correlated significantly with sex, PG status ($R = .15$, $p < .05$), bet acceptance ($R = .18$, $p < .05$), and confidence ($R = .17$, $p < .05$). There was a statistically significant eect of race on betting slope ($F(5, 194) = 3.63$, $p < .01$), but not on any of the other measures. In light of the many statistical tests that were performed and the absence of any theoretically grounded explanation for this eect, it is attributed to Type I error.

Performance Correlates of Pathological Gambling

Correlations between SOGS score, PG status and the relevant betting outcomes are presented in Table 1. Because six potential effects of problem gambling were assessed without prior data to support the existence of an effect, to correct for alpha inflation using the Bonferroni method, the criterion for significance was set at $p < .05/6 = .017$.

Pathological gamblers gained significantly fewer points than non-problem gamblers. The average probable pathological gambler finished with 10,900 points, the average problem gambler with 11,300 points, and the average non-problem gambler with 12,200 points. This effect is not attributable to pathological gamblers accepting more bets, as neither SOGS score nor PG status correlated significantly with overall bet acceptance. In fact, the pattern of bet acceptance is in one sense superior among pathological gamblers. The paradoxical aspect of paradoxical betting is that as the value of betting declines with confidence, bet acceptance increases. The steeper the slope of this

Table 1
Pearson Correlations Between SOGS Score, PG Status and the Performance Scores in Study 1

	PG status[a]	*SOGS score*
Points	−.322**	−.276**
Bet Acceptance	−.010	.026
Acceptance Slope	−.179*	−.172*
Overconfidence	.307**	.274**
Confidence	.314**	.289**
Accuracy	−.189*	−.162

*$p < .017$; **$p < .001$.

[a]Probable pathological gambling (SOGS ≥ 5) = 1; problem gambling (SOGS = 3 or 4) = 0.5; non-problem gambling (SOGS ≤ 2) = 0.

increasing curve, the fewer points are earned. A lower slope is thus better, and PG shows a significant negative relationship with the slope of the betting curve. Pathological gamblers' average betting slope was .33, that of problem gamblers was .44, and that of non-problem gamblers was .62.

What was responsible for pathological and problem gamblers performing less well than non-problem gamblers in points earned? To a large extent, it was due to overconfidence, which correlated significantly with PG status. Figure 3a depicts the calibration curves for participants grouped by PG status. The calibration curve for probable pathological gamblers is least closely aligned to the identity diagonal. This is reflected in overall overconfidence of 13.8%. Problem gamblers had average overconfidence of 10.4%. Non-problem gamblers had average overconfidence of only 1.1%. The positive correlation between overconfidence and PG was caused by greater confidence among pathological gamblers, in the absence of any greater accuracy. Indeed, they showed significantly less accuracy.

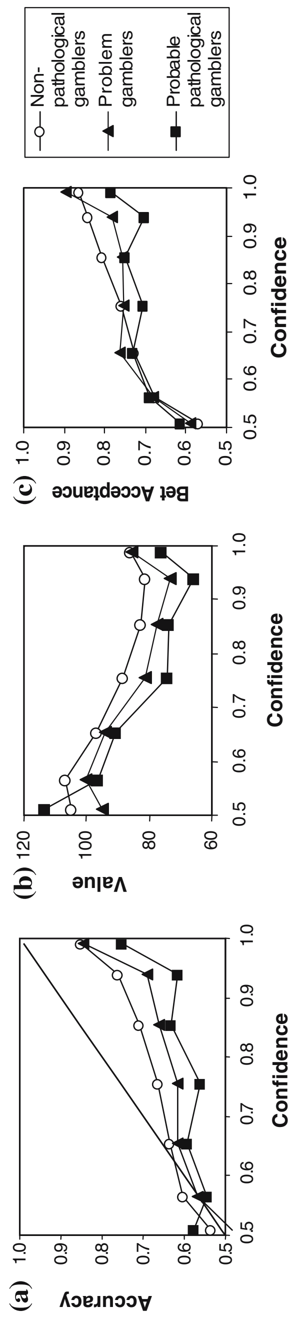
Discussion

In Study 1, PG was associated with greater overconfidence, leading to less favorable bets, which were accepted at equal rates, which led to greater losses relative to other frequent gamblers.

The effect of overconfidence in the betting task is to create bets that are less favorable. Participants were always offered the same bet on answers in which they were 99% confident: a gain 101 points if their answer is correct, or nothing if the answer is incorrect; or a certain gain of 100 points if they choose not to bet. A well-calibrated participant would win this bet 99% of the time it was accepted, because her answers would be correct 99% of the time. For her, bets would have average value of $101 \times 0.99 = 100$ points. Another participant who is only 95% accurate when 99% confident would win the same bet only 95% of the time. For this participant, bets would have average value of only $101 \times 0.95 = 96$ points. In this task, the greater the overconfidence is, the less the average value of the bet is. The average value of bets in this study is depicted in Figure 3b, which shows that, as a consequence of their overconfidence, pathological gamblers faced less favorable bets than non-problem gamblers. Yet, pathological gamblers were equally willing to bet. The slopes of their betting functions were

Figure 3

Calibration, bet value and betting proportions observed in Study 1. (a) The calibration curve, accuracy as a function of confidence. (b) The average points earned by betting as a function of confidence. (c) Proportion of bets accepted as a function of confidence.



less than those of non-problem gamblers, to a degree that was statistically significant but relatively modest, as can be seen in Figure 3c. This effect was not sufficient to stop pathological and problem gamblers from earning fewer points than their non-pathologically gambling peers.

The performance differences in pathological gamblers in Study 1 suggest a differential role of perceived control on the cognitive processes of pathological gamblers, even in a task that differs in important ways from natural gambling. The fact that pathological gamblers won fewer points than other frequent gamblers is suggestive of a role of these differential processes in the development of the cascading losses that characterize PG.

STUDY 2

Study 2 addressed two questions that are raised by the results of Study 1. First, in Study 1 control was not independently manipulated. Pathological gamblers responded differently than others in a betting task characterized by control, but differences need to be shown with control manipulated to demonstrate that control is responsible for the differences. In Study 2 control was manipulated between subjects while holding constant all other statistical aspects of the betting decisions.

Second, it was a counterintuitive finding of Study 1 that pathological and problem gamblers did not accept any more bets than other frequent gamblers. One possible explanation for this is the differential value of bets. Because of their greater overconfidence, in Study 1 pathological and problem gamblers were offered bets that were less advantageous than the bets offered to others. It is possible that if pathological and problem gamblers were offered bets that were equally valuable as those offered to non-problem gamblers, they would accept them at a higher rate. In Study 2, therefore, the bet was changed such that the gain if the participant bet and had answered the question correctly was no longer 100/*confidence* points, but rather 100/*accuracy* points. For example, if the participant expressed 75% confidence in a particular answer, then accuracy was computed among all answers in which 75% confidence was expressed. If the participant was 70% accurate among answers assigned 75% confidence, then she was oered a bet in which she would win

100/0.70 = 143 points. With this betting structure, the value of accepting bets was always equal to the value of rejecting them, and also equal to the value for all other participants of accepting bets. Thus pathological and problem gamblers did not face bets with lower average values than non-problem gamblers, as they did in Study 1.

Methods

Participants

We recruited 384 participants (105 female and 279 male) in the same manner as Study 1, preventing the return of any who participated in Study 1, and divided them by order of participation into Control (N = 193) and No-Control (N = 191) groups. Of the participants, 315 were 17–20 years old, 57 were 21–22 years old, and 10 were older than 22. Two participants did not report their ages. The sample included 323 white participants, 16 African-Americans, 29 Asian-Americans, 7 Hispanic-Americans and 6 other non-Caucasians. Two participants did not report their racial/ethnic identity. The same recruiting message was used as in Study 1.

Procedure

The SOGS and demographic data were collected in the same manner as Study 1, as was the first phase of the betting-on-confidence task, in which questions were answered and confidence was assessed. The betting phase of the task was altered in two ways. First, the structure of the bets was changed. As before, participants could refuse each bet and gain 100 points. Also as before, if they bet and lost, the outcome was no change in points. The amount that was gained when participants bet and won changed from 100/*confidence* points to 100/$accuracy_i$ points, where $accuracy_i$ refers to observed accuracy within the confidence category i to which the answer was assigned.

The second change to the betting phase was in the introduction of a between-subjects manipulation of whether participants bet on their answers (the ‘‘Control group’’) or on a seemingly random event (the ‘‘No-Control group’’). The bets were identical in every other way.

To ensure that the bets offered the two groups did not differ in any statistical way, the bets faced by the No-Control group were constructed in the following way, which was previously used by Goodie (2003, Experiment 3). Recall that the No-Control group answered questions and assessed confidence in these answers in the first phase, just as the Control group did. During the betting phase, each answer from the confidence assessment phase was converted into a bet on a seemingly random event. The stated probability of winning that was equal to the confidence assessment, and possible outcomes computed as they were for the Control group. For example, if a participant expressed 75% confidence in her answer to the first question, and if she was 70% accurate among answers assigned 75% confidence across the entire first phase, then the first bet she encountered in the betting phase informed her that a number would be chosen at random between 0 and 100, and to win the bet, the Chosen number must be less than or equal to 75. If the chosen number was less than or equal to 75, she would gain 143 points. If the chosen number was greater than 75, she gained nothing. Or, she could reject the bet and gain 100 points with certainty.

If accepted, the bet was won if the answer to the corresponding question was correct and lost if the answer was wrong. The stated probability of winning, the magnitude of the gain if the bet was won, and whether the bet was won or lost on each betting trial reflected the confidence expressed in the corresponding question from the first phase and whether it was answered correctly.

Results and Discussion

Demographic Characteristics of the Sample

Eighty-nine participants (23%, 46 in the Control group and 43 in the No-Control group) scored 5 or higher on the SOGS and are classified as probable pathological gamblers. Another 68 (18%, 30 in the Control group and 38 in the No-Control group) scored 3 or 4 and are considered problem gamblers. Of the 227 (59%) non-problem gamblers (scoring 0–2, 117 in the Control group and 110 in the No-Control group), 93 (24%) scored zero. Men in the sample had higher SOGS scores than women ($R = .28$, $p < .001$) and consequently higher PG status ($R = .22$, $p < .001$); were more confident in their answers ($R = .18$, $p < .01$) but were also more accurate ($R = .25$, $p < .001$), resulting in no significant dierence in overconfidence ($R = -.07$, n.s.) or points ($R = -.01$, n.s.). Age correlated significantly with SOGS ($R = .18$, $p < .001$) and PG status ($R = .20$, $p < .001$).

Main Effects of Pathological Gambling and Control

PG status correlated significantly with confidence ($R = .26$, $p < .001$) but not with accuracy ($R = -.08$, n.s.), resulting in a significant correlation with overconfidence ($R = .28$, $p < .001$). SOGS scores showed the same pattern, correlating .24 with confidence ($p < .001$), −.09 with accuracy (n.s.), and .27 with overconfidence ($p < .001$). With the value of bets made independent of overconfidence, unlike in Study 1, PG status and SOGS scores were associated with increased bet acceptance (R's = .17 and .14 respectively, both p's < .001).

Because of random assignment, the variable of Control should not have correlated with sex, age, PG status, SOGS score, confidence, accuracy or overconfidence. Indeed none of these effects approached significance (all F's < 1.05, all p's > .30). However, control did aect betting, bet slope and points significantly. Those in the Control group bet 70% of the time, while those in the No-Control group bet only 54% of the time, a dierence that is significant ($F(1, 378) = 30.2$, $p < .001$). Recall that the two groups faced bets that were statistically identical in every way, making this finding particularly important. Furthermore, the group without control showed a greater average slope of the betting function, .68 versus .13 ($F(1, 378) = 33.0$, $p < .001$). There was also a dierence between groups in points: those in the Control group averaged 12,400, whereas those in the No-Control group earned an average of 12,000 ($F(1, 378) = 124$, $p < .001$).[3]

Interactive Effects of Control and Pathological Gambling

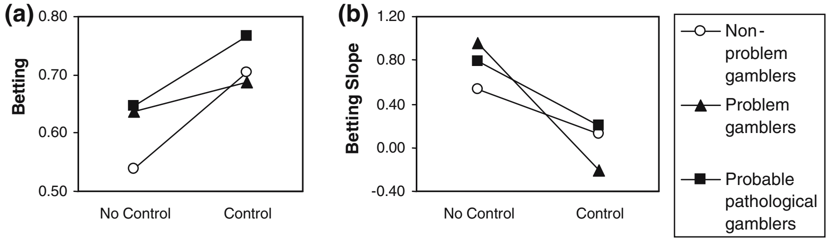
The main question addressed by this study was about the two-way interaction of PG with control: Does the perception of control affect pathological and problem gamblers' decisions differently than it affects others? As with control, this interaction should not have had any impact on confidence, accuracy, or overconfidence. All these were non-significant except the interaction effect on overconfidence. Because it depends on a difference in their treatment that occurred after the measurement was taken, this effect must be attributed to chance.

The impact of control on betting among problem and pathological gamblers was less than that among non-problem gamblers ($F(2, 378) = 3.12$, $p < .05$), as can be seen in Figure 4a. In general, all groups bet frequently when they had control over the task; problem and pathological gamblers additionally bet frequently when they did not have control. The interactive effect of control and PG on betting slope was also statistically significant ($F(2, 378) = 3.85$, $p < .05$), such that the slope was diminished more by control for problem and pathological gamblers than for non-problem gamblers. This can be seen in Figure 4b. It is interesting to note that while control affected pathological and problem gamblers differently than others in both overall betting and the slope of the betting function, the effects were opposite from each other. Control affected the overall betting of problem and pathological gamblers less than non-problem gamblers, but it affected the betting slope of problem and pathological gamblers more than the non-problem gamblers.

GENERAL DISCUSSION

The two studies reported here suggest that pathological gamblers differ systematically in their cognitive processes relating to confidence calibration, risk attitude and control from other frequent gamblers. First, pathological gamblers are more overconfident. In Study 1, this overconfidence led probable pathological gamblers to be offered less favorable bets that they were willing to accept as often as non-problem gamblers accepted their more-favorable bets. This led them to acquire

Figure 4
Interactive effects of control and PG status on betting and betting function slope in Study 2. (a) The impact of control and PG status on betting. (b) The interactive effect of control and pathological gambling on betting slope.



significantly fewer points than non-problem gamblers. In Study 2, with the value of bets made independent of overconfidence, PG was additionally associated with bet acceptance. And, with control experimentally manipulated, pathological gamblers were affected differently than others by control, with overall betting being more affected by control while the slope of the betting function being affected less in non-problem gamblers relative to problem and pathological gamblers, even in a setting that differed in important ways from natural gambling settings.

The task used in these studies differs from hundreds of others in the decision-making literature in that the object of the bet is not a random event but one's own knowledge. The fundamental difference between random events and one's own knowledge is control: one can increase one's knowledge and thereby increase the odds of winning, but one can do little to increase the odds of winning a blackjack hand, and nothing to increase the odds of winning at bingo or the lottery. Goodie (2003) defined control as probability alterability. Games over which a gambler has control are those in which there are steps the gambler could take to improve the odds of winning. One can alter the probability of winning at blackjack, but not bingo or the lottery. Goodie (2003) showed that people are more willing to bet on tasks characterized by control, compared with random events. It appears from the results of Study 2 that pathological gamblers differ from others in the cognitive processing of control over the probabilities of uncertain outcomes. It is seems, from both Studies 1 and 2, that they differ in the cognitive processing responsible for the calibration of confidence assessments.

The pattern of betting observed both here and in Goodie (2003) is different from what is observed in most studies of betting on random events. There, people most often accept risk at low probabilities and reject risk at high probabilities. For example, many people are willing to pay a premium to play the lottery, or in other words seek out risk where they have a low probability of winning a substantial sum. But people are also willing to buy insurance, again paying a premium to do so. In an insurance setting, if the risk is accepted (i.e., if insurance is *not* purchased), the probability of a favorable outcome (for example, that one's house does not burn down) is very high. Yet, people pay a premium to avoid any risk at all in this setting. A wealth of evidence in the area of judgment and decision-making (for reviews, see Gonzalez &

Wu, 1999; Kahneman & Tversky, 1982), argues that risk is sought when the probability of winning is low but avoided when the probability of winning is high.

However, in the present studies and others (Goodie, 2003), using a task that was characterized by control rather than being random, the reverse was found—greater acceptance of risk as probability increased. The observed correlation of PG with betting slope can be interpreted in light of these results. Goodie's (2003) results suggest that one effect of control is to affect the pattern of probability weighting across the probability spectrum. The slope of the betting curve is one way of assessing differences in the probability weighting function, and the significant slope differences among PG status groups suggest that PG may be associated with a different probability weighting function.

Recent research sheds additional light on individual differences in performance on the betting on knowledge task. Campbell, Goodie, and Foster (in press) found a pattern of correlations between performance measures and the personality construct of narcissism that closely mirrors that observed in the present studies. Narcissists, like pathological gamblers, were more overconfident, equally or more willing to bet, and therefore prone to earn fewer points. These effects were limited to the construct of narcissism: measures of self-esteem, self-control and self-efficacy were not significantly correlated with any of the performance measures used in the present studies. These findings bolster the nexus between PG and a narcissistic personality (Kroeber, 1992; Rosenthal, 1986; Selzer, 1992; Steel & Blaszczynski, 1998).

Limitations and Future Directions

There are limitations to the interpretation of the present results. Their generalizability may be limited by the range restrictions of demographic variables such as age, income, occupation, and race and ethnicity. Also, there were elements of the task that differ from commonly used gambling modalities. The event that was wagered on was an existing fact, rather than future events that are more commonly bet on, such as sporting events or random drawings.

Finally, bets were not tied to money or other external incentives. It may be noted, however, that the many significant effects observed in these studies suggest that pathological gamblers differ from other gamblers in their basic cognitive processing and decision strategies, not only in their actions within customary betting environments. It would be interesting to replicate these results in more realistic gambling settings, and not only for reasons of ecological validity. Toneatto, Blitz-Miller, Calderwood, Dragonetti, and Tsanos (1997) observed more cognitive distortions when gamblers played games with an element of control than when they played games of pure chance. An effect comparable to that observed in the present Study 2 would be expected when extended to real games with and without control.

It is also important to bear in mind certain limitations that are inherent in the current conception of control. For example, control does not necessarily refer to the ability to determine, or even to know with certainty, the outcome of an event that is bet on. In the original demonstrations of the illusion of control (Langer, 1975), people bet on familiar symbols more than unfamiliar ones, uncertain events of their own choosing more than similar events that were chosen for them, and so on. There is no hint that anybody believes they are certain to win a hand of familiar cards, or a sports pool when they can choose their own team. Control must thus be defined probabilistically. While people cannot increase the probability of a win to 100%, control is still well viewed as the ability to increase the probability of a win, even if there are limitations on this ability.

Conclusion

The present results suggest that perceived control may affect pathological gamblers differently than it affects non-problem gamblers, leading to greater overconfidence and greater betting, which in turn can lead to impaired betting performance. The present results bolster the hypothesis that the perception of control, including the illusion of control, is involved in important ways in PG, and is therefore a promising avenue for further research and treatment approaches.

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NOTES

1. Due to experimenter error, the recruitment message failed to contain this statement during some periods of data collection. It is not believed that this error affected the representativeness of responding by pathological, problem or non-problem gamblers. The recruiting message resulted by design in rates of problem and pathological gambling within the sample that are much higher than those in the student population at large. The rates observed in the samples obtained in these studies should not be interpreted as being representative of the student population at large.
2. Bets were offered only after all confidence assessments had already been made, in order to prevent participants from strategically minimizing their confidence in order to be offered more favorable bets.
3. It was possible for systematic differences to occur in points, despite the manner of constructing bets that made their average value independent of overconfidence. Goodie (2003) observed that participants in the betting-on-knowledge task did not select bets randomly within confidence categories, but rather accepted bets on answers that were more likely to be correct than were the answers whose bets were rejected. Participants in the No-Control condition in this study had no opportunity to select bets strategically within confidence categories, accounting for their lower point total.

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