

Never Smile at a Crocodile: Betting on Electronic Gaming Machines is Intensified by Reptile-Induced Arousal

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Published online: 6 January 2010
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Abstract Tourists at the Koorana Saltwater Crocodile Farm in Coowonga, Queensland, Australia, including 62 males and 41 females, aged 18–66 ($M = 34.2$, $SD = 13.3$), were randomly assigned to play a laptop-simulated Electronic Gaming Machine (EGM) either: (1) prior to entry, or (2) after having held a 1-m saltwater-crocodile. Gambling behavior; including bet-size, speed of betting, final payouts and trials played on the EGM; was investigated with respect to participants' assigned arousal condition, problem-gambling status, and affective state. At-risk gamblers with *few* self-reported negative emotions placed *higher* average bets at the EGM after having held the crocodile when compared to the control. In contrast, at-risk gamblers with *many* self-reported negative emotions placed *lower* average bets at the EGM after having held the crocodile. The results suggest that high arousal can intensify gambling in at-risk players, but only if this feeling state is not perceived as a negative emotion.

Keywords Gambling · Pathological gambling · Physiological arousal · Sensation seeking · Affect · Poker · Fruit · Slot

Introduction

Gambling can be an exciting activity, and the exhilaration of winning, or nearly winning, can be a potent motivating factor in reinforcing betting behavior on Electronic Gaming Machines (EGMs). Gambling produces autonomic arousal (excitement), but likewise arousal itself is implicated in the intensification of gambling behavior among recreational players (Rockloff et al. 2007). In contrast, initial research (Rockloff et al. 2007) suggests experimentally induced arousal in gamblers with many gambling-related problems can moderate rather than intensify betting.

The purpose of the present study is two-fold: (1) to corroborate the impact of arousal on EGM gambling intensity by recreational and at-risk gamblers using alternative methods to

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Rockloff et al. (2007), and (2) to explore the potential moderating influence of negative affective states on betting behavior under high arousal.

Emotion

Evidence suggests that emotions are likely to be important determinants of gambling behavior (Rockloff and Dyer 2006). General dysphoria is often identified as a motivating factor in problem gambling behavior (Dickerson et al. 1991), whereby gamblers use betting to improve their mood states (cf., Blaszczvznski and Nower 2002). From a behaviorist perspective, aversive affective states negatively reinforce gambling as these bad feelings are temporarily alleviated during play (Leary and Dickerson 1985; McConaghy 1980).

Paradoxically, preliminary evidence suggests that negative emotions, although they may motivate gambling involvement, may also tend to moderate gambling intensity on EGMs (Rockloff et al. 2007). The present study therefore attempts to measure these negative emotions to help understand their potential influence on the EGM gambling behavior of both *non problem* and *at-risk* players.

Two Factor Theory of Emotion

Schachter and Singer (1962) provided an important early contribution to the understanding of how emotion affects behavior in their *Two Factor Theory of Emotion*. According to this theory, the experience of emotion is produced in two steps, consisting of: (1) physiological arousal, and (2) a cognitive label attached to that arousal. Normally, the stimulus or event that produces the arousal (e.g., the sight of an oncoming car veering into our lane) is consonant with our cognitive label (e.g., “I’m afraid”). The theory predicts, however, that arousal from one source can be misattributed to another salient source in the environment. Schachter and Singer (1962) demonstrated this effect by injecting people with either adrenaline (epinephrine) or a saline placebo. Participants, who were injected with adrenaline to raise arousal, were placed with an experimental confederate who acted either angry or playful. Those participants who were not informed of the influence of the drug on their arousal-level tended to misattribute their emotional state to be the same as the “angry” or “playful” displays of the confederate.

Another classic experiment in misattribution of arousal provided a model for the present “crocodile” experiment. Dutton and Aron (1974) conducted a study demonstrating that arousal produced from travel across a high suspension-bridge can be misattributed as sexual attraction. Male participants in the test-condition were interviewed by an attractive female experimenter on a fear-inducing 70-m wire-and-plank suspension bridge over Capilano Canyon in Vancouver Canada. Following the interview, the attractive female experimenter gave the male subjects her phone number, and offered to explain the study in more detail at a later date. As a control, other interviews by the same attractive experimenter took place over a 3-m high bridge of sturdy construction. The results of the study showed that subjects who were interviewed over the high suspension-bridge were more likely to call the experimenter than subjects who were interviewed on the low sturdy-bridge. In short, participants on the high bridge misattributed the physiological arousal resulting from fear of the high bridge to feelings of sexual attraction to the female experimenter.

Subsequent research and criticism on the Two Factor Theory of Emotion (Schachter and Singer 1962) have shown that a cognitive label is not always necessary to produce emotion

(Manstead and Wagner 1981). Nevertheless, the two-factor theory has been influential in suggesting that arousal from one source can be misattributed to another.

Based on the two factor theory, the results of arousal on gambling behavior should be a function of the cognitive interpretation of that feeling state. If the arousal is perceived as negative, producing an “unlucky” feeling, the result should lower expectations of gambling success and produce less intense gambling. In contrast, arousal without negative emotion should produce greater gambling intensity, as this feeling state is likely to increase expectations of success through a “lucky” feeling.

The Misattribution of Crocodile Induced Arousal

In the present study, saltwater crocodiles in the test condition are construed as a manipulation of arousal prior to an EGM gambling task, whereby each subject held a 1-m long saltwater crocodile immediately prior to the EGM gambling session. According to the Two Factor Theory of Emotion (Schachter and Singer 1962), some of the arousal from the exposure to the crocodile should be misattributed to the EGM gambling experience as a salient secondary source for the arousal.

High Arousal and Gambling

Both problem gamblers (Brown et al. 2004) and frequent gamblers (Leary and Dickerson 1985; Moodie and Finnigan 2005) experience high levels of arousal during play. Arousal can have either positive or negative valence, and problem gamblers may often associate gambling with poor outcomes (e.g., losing unbudgeted money) when compared to recreational gamblers (Rockloff et al. 2007). In partial support of this contention, Sharpe (2004) found that social gamblers are more aroused by wins than losses, whereas problem gamblers are equally aroused by both wins and losses. This observation supports that the affective reactions of frequent and problem gamblers may be more sensitive to negative valence arousal and the possibilities of loss and regret. In short, negative emotions may be particularly powerful in restraining the gambling of at-risk or problem gamblers.

The White Noise Study and Limitations

In a related preliminary study, Rockloff and Dyer (2007) used a loud “white noise” in an experiment to induce arousal and observe its effects on EGM gambling intensity. In the test condition, a 2-s 80 db blast of white noise was introduced into a simulated EGM gambling session. The experiment provided evidence that physiological arousal has a strong impact on EGM gambling intensity. Persons with many gambling problems had lower average bet-sizes in the white-noise condition compared to the control, while those with few or no problems had higher average bet-sizes. Rockloff and Dyer speculated that gamblers with few problems were likely to interpret their arousal as a “lucky feeling,” whereas gamblers with many problems were apt to have experienced negative mood states, and thus an “unlucky” feeling, which had the effect of moderating their gambling intensity.

Aims and Predictions

The present crocodile-study aims to compensate for the limitations of the white-noise study (Rockloff et al. 2007) by using a different manipulation of arousal (a crocodile rather than

a loud noise), and by including an explicit measure of emotion, the *Positive and Negative Affect Schedule* (PANAS, Watson et al. 1988). A limitation of the white-noise study was the disruptive effect that a blast of white noise potentially has on gambling behavior, in particular by creating an environment of uncertainty that may impinge upon betting in unknown ways. The current study avoids producing differences in uncertainty within the EGM session between the test-condition and the control by manipulating arousal prior to the start of the task. The study also examines the potentially moderating influence of negative emotions on the relationship between arousal and gambling, while the previous research (Rockloff et al. 2007) only speculated about emotional states.

To corroborate prior results (Rockloff et al. 2007), non problem and at-risk gamblers were predicted to gamble with less intensity when experiencing a high-arousal negative mood, as this combination is conducive to an “unlucky” interpretation of their feeling states. In contrast, non problem and at-risk gamblers were predicted to gamble more intensively under high arousal which otherwise *lacks* negative affect, as this is consistent with a “lucky” interpretation of their feeling states.

Methods

Participants

One-hundred and three subjects, 62 males and 41 females, who ranged in age from 18 to 66 years with an average of 34.2 years ($SD = 13.3$) were recruited during February to May 2007 from Koorana Saltwater Crocodile Farm in Central Queensland, Australia. Three other persons were excluded from the final data analysis for non-completion of the experiment. Recruitment criteria included all persons over the age of 18 years who were able to follow study directions. Participants were categorized into the following groups based on Problem Gambling Severity Index (PGSI, Ferris and Wynne 2001): (a) 81 (78.6%) no problems, (b) 13 (12.6%) low risk, (c) 8 (7.8%) moderate risk, and (d) 1 (1%) problem gambler. The cultural background of subjects included: 50 (48.5%) Australian; 13 (12.6%) English; 8 (7.8%) German; 7 (6.8%) Irish; 4 (3.9%) Swiss; 3 (2.9%) New Zealander; 3 (2.9%) Scottish; 3 (2.9%) Dutch; 2 (1.9%) American; and 10 (9.71%) other.

Apparatus

The experiment utilized an EGM that was simulated on a laptop computer, and programmed in Visual Basic by the first author (cf., Rockloff 2008; Rockloff et al. 2007; Rockloff and Dyer 2007). The EGM had three reels with four pictured “fruits” on each reel. Three matching reels indicated a win. The EGM had a minimum 5 s delay between spins and no special features. The simulated EGM was programmed (rigged) to payoff on trials 2, 6, 8, 13 and 20, with no more ‘wins’ after the 20th spin. Players could place bets of 25, 50, or 100 cents on each trial, with payoffs equaling 10 times the amount bet. Credits were presented in cents, with an initial bankroll of \$20 (or 2,000 cents) presented on the screen at the start of play. The theoretical maximum payout was \$61.50 (\$20 starting bankroll + \$50 maximum wins – \$8.50 in minimum bets required). The EGM produced typical noises of play, including the spinning of the reels and winning bells.

Galvanic Skin Response (GSR) was recorded using a ProComp + unit and Biograph Software for data processing. The measurement device was clipped to each subject’s non-dominant hand using a finger sensor.

Paper and Pencil Measures

The Positive and Negative Affect Schedule (PANAS, Watson et al. 1988) was completed by all participants after they finished play on the EGM as an indicator of their current affective state. Participants were asked to rate 10 positive ($M = 26.93$, $SD = 7.56$) and 10 negative emotions ($M = 14.33$, $SD = 4.07$) on a 5-point Likert type scale according to how they felt at the “present moment.” For analysis, the PANAS affect measures were dichotomized into two categories based on a median split (positive affect: median = 27, negative affect: median = 14). Nine participants (9%) failed to complete the positive affect schedule, whereas six participants (6%) failed to complete the negative affect schedule. The EM algorithm was used to replace these missing values, although the results reported below are substantially similar to results using list-wise deletion of cases.

The 9-item scoreable portion of the Canadian Problem Gambling Index, the *Problem Gambling Severity Index* (PGSI, Ferris and Wynne 2001), was used to categorize participants according to their gambling severity ($M = 0.62$, $SD = 1.66$). The categories included: no gambling problems, low-risk gambling problems, moderate-risk gambling problems, and problem gambler. For the analysis, the PGSI was divided into two categories, including (1) no gambling problems ($n = 81$), and (2) one or more gambling problems ($n = 22$). This broad division was necessary given the present sample, as relatively few persons had many gambling problems, which prevented a finer analysis.

Design and Procedure

Data collection took place during the course of 100 tours in total, which were conducted twice daily over 4 months. Potential participants in each tour most often arrived in several distinct small groups of two or more people who knew one another. The first six tourists to arrive for each crocodile tour were assigned by the experimenter to potentially take part in the study either: (1) prior to their participation in the crocodile tour (control condition), or (2) after participating in the crocodile tour and after holding a 1-m long crocodile (test condition). As a method of random assignment, the first six tourists arriving for the tour were conceptually organized into three pairs according to their serial order of entry. One person in each pair was assigned by coin-flip to the control condition, and the second member to the test/crocodile condition.

The crocodile tour involved a 10 min video, a 1 h tour, followed by a final opportunity to hold a 1 m juvenile crocodile. Although the crocodile’s jaw was taped shut, tourists were cautioned that it could still harm them due its sharp claws and protruding teeth.

Tourists in the test condition were asked to participate directly after holding the crocodile. The majority of tourists opted to hold the crocodile at the conclusion of the tour. Potential control condition subjects were recruited immediately after their arrival at the farm and prior to any contact with crocodiles. If a tourist refused participation in the experiment, the next potential participant was approached from previously identified pairs (six persons and three pairs, as described above). The overall participation rate in the study was 33.3%. Refusal reasons included: not interested (45.9%), spoke a foreign language (19.1%), wanted to have lunch (16.5%), wanted to leave (8.8%), “other” reasons (5.7%), and no reason given (4.1%).

In both conditions (crocodile and control), recruited study subjects were led to a table in the dining area, and were given \$20 compensation for their participation. Participants had the Procomp + GSR device (for measuring arousal) attached to a finger on their non-dominant hand. Subjects were then asked if they would like to gamble with the \$20

compensation. Some participants were initially reluctant to gamble with the \$20 compensation, but the research assistant gently encouraged all study volunteers to proceed to the gambling task. The \$20 was retrieved from participants, and 2,000 1-cent credits were displayed on the simulated EGM. This procedure was intended to reinforce the (correct) perception that participants were gambling with their own money. Subjects were told that they could leave the game at any time and that they would keep any amount that was remaining on the EGM. A \$500 grand prize lottery draw was an additional inducement, with a ticket offered for every dollar remaining on the machine.

At the end of their gambling session participants completed the following questionnaires (in order): (1) Positive and Negative Affect Schedule (PANAS, Watson et al. 1988), (2) basic demographic questionnaire, and (3) the Problem Gambling Severity Index (PGSI, Ferris and Wynne 2001).

Data Analysis

The outcomes of “gambling intensity” in the experiment included Average Bet-size, Final Payouts, Speed of Betting and Total Trials Played. Given that the expected value of each dollar bet in a commercial gaming venue is less than \$1 (as the odds favor the house), each of these dependent variables is behaviorally indicative of long-run gambling losses.

Analyses were conducted for each of the outcomes using a factorial $2 \times 2 \times 2$ ANCOVA models, with Gender and Age as covariates. The independent factors for each model included Condition (crocodile and control), PANAS Affect Level (high, low) and PGSI Problem Gambling Status (no problems, some problems). The PANAS measure (Watson et al. 1988) includes subscales for both Positive Affect and Negative Affect. By design these subscales are not necessarily correlated, and were not significantly correlated in the current sample, $r(101) = .15$, $P = .14$, ns. Subsequent analyses showed, however, that Positive Affect was *not* a significant contributing factor to gambling-intensity outcomes for any of the models explored, either as main effects or interactions. For simplicity of exposition, therefore, only models involving Negative Affect are reported in detail below.

Lastly, some participants ended the experiment with no credits remaining (13 or 12.6%), and thus the outcomes of the Final Payouts variable were not normally distributed. To aid in the analysis of this variable, therefore, the payouts were converted into rank scores.

Results

Manipulation Check

Galvanic Skin Response (GSR) was used as a manipulation check for arousal differences between the crocodile condition and the control. Measurements were computed for the 30 s prior to the start of the EGM task and the 30 s after the beginning of wagering. As predicted, there was a significantly greater increase in GSR for the Crocodile condition ($M = 11.1 \mu\text{m}$) than for the control condition ($M = 0.62 \mu\text{m}$), $t(97) = 2.18$, $P = .03$.

Average Bet-size

The effects of Negative-Affect Level (PANAS), Condition, and Problem-gambling Status (PGSI) on Average Bet-size ($M = 60.24$ cents, $SD = 24.12$) were analyzed using a

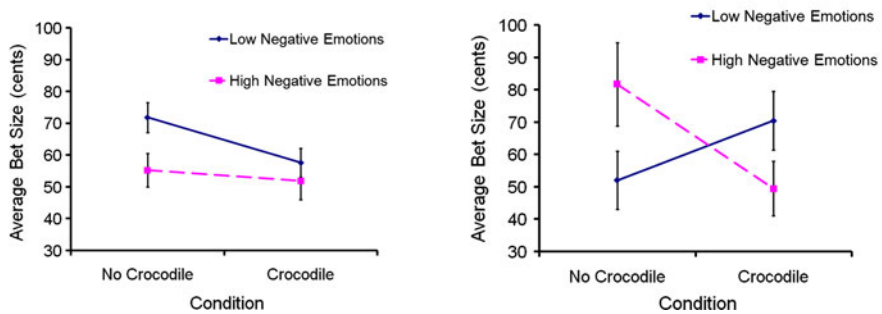
Panel A: No Gambling Problems, PGSI = 0 Panel B: Some Gambling Problems, PGSI ≥ 1 

Fig. 1 Bet-size by problem gambling status, condition and negative affect level

$2 \times 2 \times 2$ ANCOVA, with Age and Gender as covariates. The Gender covariate proved significant in this model, with Male participants ($M = 66.45$ cents) placing higher average bets than Female participants ($M = 50.84$ cents), $F(1,93) = 15.66$, $\eta_p^2 = .14$, $P < .001$. In addition, the model revealed a significant 3-way interaction between Negative-affect Level, Condition and Problem-gambling Status on the outcome of Average Bet-size, $F(1,93) = 7.54$, $\eta_p^2 = .08$, $P < .01$. Figure 1 (panel A) shows that for the subset of persons with no identifiable gambling problems (PGSI = 0), there was a reduction in bet-size in the Crocodile condition when compared to the control, regardless of negative affect level.

In contrast, Fig. 1 (panel B) shows that for the subset of persons with 1 or more PGSI gambling problems (the at-risk group), the effect of condition was dependent on the level of negative affect. Persons who were high in negative affect showed a pattern of results similar to people with no gambling problems, whereby subjects in the crocodile condition had lower average bet-sizes when compared to the control. However, at-risk persons who were low in negative affect showed the predicted pattern of more intense gambling, as measured by bet-size, in the crocodile condition when compared to the control.

Final Payouts

The effects of Negative-affect Level (PANAS), Condition, and Problem-gambling Status (PGSI) on *Final Payouts* ($M = \$24.62$, $SD = 13.03$) were analyzed using a $2 \times 2 \times 2$ ANCOVA, with Age and Gender as covariates. Using rank scores, there were no significant main effects or interactions in the model.

Speed of Betting

The effect of Negative-affect Level (PANAS), Condition, and Problem-gambling Status (PGSI) on *Speed of Betting* (Bets per minute; $M = 4.43$, $SD = 1.11$) was analyzed using a $2 \times 2 \times 2$ ANCOVA, with Age and Gender as covariates. Age ($\beta = -0.03$, $\eta_p^2 = .18$, $P < .001$) and Gender ($\beta = -0.47$, $\eta_p^2 = .05$, $P = .03$) proved to be significant covariates, with both Male and relatively young participants betting faster than Female and older participants, respectively. Main effects also revealed that participants with gambling problems bet faster ($M = 5.00$ bets per minute) than those with no problems ($M = 4.28$ bets per minute), $F(1,93) = 8.60$, $\eta_p^2 = .09$, $P < .01$. However, there were no significance

effects for the Negative-affect factor on speed of betting, and likewise no interactions proved significant.

Total Trials

The effects of Negative-Affect Level (PANAS), Condition, and Problem-gambling Status (PGSI) on *Total Trials Played* ($M = 37.46$, $SD = 21.75$) were analyzed using a $2 \times 2 \times 2$ ANCOVA, with Age and Gender as covariates. A significant main-effect was found for problem-gambling status, $F(1,93) = 6.17$, $\eta_p^2 = .06$, $P = .02$, such that participants with at-risk gambling problems placed more bets ($M = 46.86$ trials) than persons with no gambling problems ($M = 34.90$ trials). In addition, participants in the high-arousal Crocodile condition placed fewer bets ($M = 32.37$) than the no-crocodile control ($M = 42.65$), $F(1,93) = 6.25$, $\eta_p^2 = .06$, $P = .01$. This model showed no significant effects for the Negative-affect factor on the number of trials played. Lastly, none of the covariates or interactions in the model proved significant.

Discussion

In conformity with initial predictions (cf., Rockloff et al. 2007), manipulated high-arousal that was interpreted as a negative mood state (an “unlucky” feeling) had a moderating effect on average bet size for both non problem and at-risk gamblers. Conversely, high-arousal which was *not* interpreted as a negative mood state, but rather a “lucky” feeling, had the predicted effect of increasing bet sizes for at-risk gamblers (although not reliably for non problem gamblers). The results of the study, therefore, provided partial support for the predictions regarding the Average Bet-size measure of gambling intensity.

The Low Arousal “Control” Condition

Among at-risk gamblers, the combination of low arousal and negative affect produced the most intense betting observed (see Fig. 1, panel B). This finding is consistent with the view that negative moods, and particularly low-arousal states such as boredom or mild anxiety, may motivate problem gambling involvement (Dickerson et al. 1991). In contrast, the combination of low arousal and lack of negative moods showed restrained gambling intensity among at-risk gamblers, particularly when compared with the betting of non-problem gamblers (see Fig. 1, and compare panels B and A). Taken together, these results indicate that at-risk gamblers are not always lacking in caution, but may be motivated to make large bets by low intensity negative emotions, such as boredom or mild anxiety.

The High Arousal Crocodile “Test” Condition

The elevated state of arousal produced by cradling the crocodile; verified through a manipulation check; produced reliable and strong influences on average bet sizes. Non-problem gamblers moderated their bets in the high arousal condition compared to the control (see Fig. 1, panel A). A climate of caution appeared to carryover from holding the crocodile, regardless of the reported emotional state of the participants. Thus, contrary to prediction, non problem gamblers were *not* disposed to equate their high-arousal as indicators of future gambling success.

In contrast, at-risk gamblers (see Fig. 1, panel B) were prone to misattribute high arousal as an indicator of future gambling success, as demonstrated by relatively large average bet sizes in the absence of negative moods. Also consistent with predictions, at-risk gamblers in the high arousal condition who experienced negative moods were differentially more pessimistic, as demonstrated by their sharply lower average bet size (cf., Rockloff et al. 2007).

In sum, low intensity negative moods such as boredom or mild anxiety contribute to large bets among at-risk players, whereas high autonomic arousal without negative moods also produces relatively large wagers. Taken together, the results suggest that betting among at-risk players may be motivated both by attempts to alleviate low-arousal dysphoric moods, and by high-arousal induced positive expectations of winning money.

Emotion Theory

Schachter and Singer's (1962) Two Factor Theory of Emotion asserts that the influence of autonomic arousal on behavior is moderated by the cognitive interpretation of that state of arousal. For at-risk gamblers, high arousal coupled with low negative emotions is consonant with a cognitive interpretation suggesting future gambling success. Thus, at-risk gamblers experience arousal from the crocodile, but their attention is misdirected to the more immediate EGM gambling experience as a source for them to interpret the reason for their mood state. High arousal that lacks negative emotion becomes a reasonable set of circumstances to accept their emotional state as indicative of a "winning" or "lucky" feeling. Gamblers in this circumstance logically seek to capitalize on these positive expectations in the form of higher average bet sizes.

At-risk gamblers who have negative emotions coupled with high arousal also seek the immediate environment for an interpretation of their feeling state. Negative emotions which are attributed to the gambling experience are a reasonable circumstance to accept emotions as a "losing" or "unlucky" feeling. Gamblers in this situation are apt to act on this interpretation by reducing bet sizes and thereby limit losses.

Other Measures of Gambling Intensity

Other measures of gambling-intensity explored in this study included Final Payouts, Speed of Betting and Total Trials Played. No significant effects on Final Payouts were found. Speed of betting was generally faster for participants who were male, young and had some gambling problems; but the experimental "arousal" manipulation showed no reliable effects. The Total Trials Played was higher for subjects with gambling problems, and conversely lower for those in the high arousal crocodile condition. Lastly, negative affect did not significantly impact on any of these other measures of gambling-intensity, perhaps due to the greater amount of between-subjects variability for these outcomes.

In short, "other" measures of gambling intensity, apart from Bet Size, failed to show the expected effects from the arousal manipulation. One explanation for these null results may be low statistical power as a consequence of too few subjects and/or a weak manipulation. Another explanation for these null findings may be that high arousal alters bet sizes, but not "other" markers of gambling intensity. A more comprehensive understanding of the components of gambling behavior; including bet-size, speed and persistence; may yet emerge from future investigations.

Limitations

By design, participants in the Crocodile test condition gambled almost immediately after having held the crocodile in order to maintain their arousal level into the EGM task. This precluded a baseline measure of affect. Instead, the PANAS measure of affect (Watson et al. 1988) was given after the gambling task, and therefore could potentially be a result of the gambling outcomes (either favorable or unfavorable) rather than a motivating factor driving behavior. The lack of any discernible difference in Final Payouts between players with high and low negative affect, however, made the presumed motivational explanation of affect more compelling. Furthermore, the interpretation of emotions contributing to “lucky” or “unlucky” feelings is only an arguable conjecture in this study. Future studies might use some dynamic measure of lucky feelings as they develop over time. Simple static feelings of luck after a gambling session has finished (e.g., a paper-and-pencil scale) are likely to be influenced and potentially distorted in memory by the final payout received. Larger payouts would be perceived as “lucky” regardless of feelings during play.

The sample in this study was drawn from visitors to a popular local tourist attraction. The crocodile park drew many (50%+) overseas visitors, and attendees are not representative of the local population. The study relies on a tradition of experimental realism, whereby the manipulation—although far removed from everyday experience—acts on psychological mechanisms that are presumed to be human universals. Future research must verify if the arousal manipulation is ecologically valid in more naturalistic gambling settings.

Another important limitation is that the study included relatively few subjects with high-risk gambling problems, and thus the conclusions drawn above may not extend to clinical populations. The analysis necessarily grouped persons with only one gambling problem with others having more problems, and there may not be a continuity of behavior among these respondents. Lastly, the participation rate in the research was 33%, likely due to the fact that most attendees came as part of a group and were reluctant to be separated from their companions. This participation rate is reasonable for recruitment at a tourist destination, but some unknown bias may have been introduced by self-selection into the study. Future research should address these limitations.

Summary

The results of this study provide further evidence that physiological arousal has an influence on EGM gambling behavior (cf., Rockloff et al. 2007). The influence of arousal on gambling behavior, however, is dependent on the cognitive interpretation of that feeling-state. For reasons that are not entirely clear, some participants had a negative feeling potentially emanating from their interaction with the crocodile, whereas others did not experience this negative affective reaction. It is possible, of course, that some people are simply more fearful of crocodiles than others, and naturally carry forward this caution to their gambling.

Regardless of affective state, participants with no gambling problems reduced their bet sizes in the crocodile condition when compared with the control. This *cautious shift* shows a misattribution of arousal from the crocodile that led participants to believe they were going to experience relatively *less* gambling success. Gamblers with some problems and a negative affective state also exhibited the cautious shift. Importantly, at-risk gamblers in the low-arousal control condition bet larger amounts when experiencing negative

emotions, suggesting that low intensity emotions—such as boredom and mild anxiety—may motivate gambling as a potential release from an aversive mood state. Lastly, however, gamblers with some problems but lacking a negative affective-state demonstrated a *risky-shift* in response to the crocodile condition in accord with expectations. In short, at least some at-risk gamblers are prone to attribute their physiological arousal during play as an indicator of a “winning” feeling, and attempt to capitalize on these erroneous expectations of success by gambling larger amounts.

Acknowledgment This research was supported by a grant from the Queensland Treasury Department, Australia.

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