Analysis of Gambling Behavior

Volume 4 | Issue 1 Article 3

2010

The Effect of Relational Training on the Near-Miss Effect in Slot Machine Platers

Becky L. Nastally
Southern Illinois University, bnastall@siu.edu

Mark R. Dixon
Southern Illinois University, mdixon@siu.edu

Analysis of Gambling Behavior 2010, 4, 16–26 Number 1 (Summer2010)

The Effect of Relational Training on the Near-Miss Effect in Slot Machine Players

Becky L. Nastally & Mark R. Dixon
Southern Illinois University

In the current study, six slot machine players were exposed to two concurrently available computer simulated slot machines (one yellow and one blue). The blue slot machine produced a high frequency of near-miss outcomes and the yellow slot produced no such outcomes. Both machines produced reinforcement on a random-ratio 10 schedule and response options were presented in a free operant paradigm. After a 50-trial exposure, participants completed multiple exemplar training and testing as well as a stimulus-sort task to form a relation between the color blue and 'worse-than' and then were re-exposed to the slot machine task for another 50 trials. Results indicated that four of six participants initially showed a preference for the near-miss slot machine. However following training and testing phases, four of six participants' response allocation toward this slot decreased. The results are discussed in terms of the formal and functional properties of what is termed as the 'near-miss' effect.

Keywords: Near-miss effect, Gambling, Preference, Verbal behavior

----

The near-miss effect is a widely investigated concept in the gambling literature. It serves as a prime example of a variable other than winning that may work to maintain gambling behavior. Although it is primarily referred to as a 'near miss', it may be more clearly conceptualized as 'almost winning' or 'very close to winning' as previous research has shown (Dixon & Schreiber, 2004). On a slot machine, for example, a near miss is often defined as two of three slot machine reels stopping on identical symbols while the third or last reel stops on a different symbol, suggesting a win is just out of reach, even though this is not the case. This effect is not exclusive to slot machines, as recent research has shown parallels of almost winning in the game of blackjack (Dixon, Nastally, Hahs, Horner-King & Jackson, 2009) and roulette (Hahs & Dixon, manuscript in preparation).

Explanations of this observed effect have been offered both outside and within the field of behavior analysis. Those from the cognitive perspective have described the near miss as a cognitive fallacy (Griffiths, 1991) and speculated that this outcome can strengthen particular strategies and increase beliefs about a future success (Reid, 1986). Behavior-analytic interpretations have pointed to the effects of conditioned reinforcement through stimulus generalization (Skinner, 1957) and research has provided evidence of the role of verbal behavior (Dixon, Nastally, Jackson, & Habib, 2009). Additionally, recent research has attempted to analyze this effect at the physiological level and it seems there are neurological differences in how pathological and non-pathological gamblers respond to near misses (Habib & Dixon, in press).

A study conducted by Kassinove and Schare (2001) investigated the effect of different rates of exposure to near-miss slot-machine outcomes (15%, 30%, and 45%) on gambling persistence in 180 undergraduate

Address all correspondence to:
Mark R. Dixon
Behavior Analysis and Therapy Program
Rehabilitation Institute
Southern Illinois University
Carbondale, IL 62901
Email:mdixon@siu.edu

participants. Statistical analyses showed that there was a significant relationship between persistence and rate of near misses, the strongest occurring during the 30% near-miss exposure. Another study examined these same rates of near-miss exposure, but all three response options were presented concurrently (MacLin, Dixon, Daugherty, & Small, 2007). These results showed that both prior to and during extinction, participant response allocation to the different slot machines was linearly related to the amount of near-miss frequency (i.e., participants allocated the majority of their responses toward the slot that produced near-misses 45% of the time).

Dixon et al. (2009) recently investigated the effect of the formation of verbal relations on changes in the near-miss effect as measured by subjective ratings. Using a simple procedure, participants were first exposed to various pictures of slot machine outcomes (wins, near-misses, and total losses) and asked to rate them in terms of their closeness to winning. As was expected, most participants rated near-miss outcomes substantially higher than total losses but not as high as wins. Upon conditional discrimination training, wherein a relation between the word “Loss” and a picture of a near-miss outcome was formed, 10 of 16 participants (specifically those who met criterion in the relational-training portion of the experiment) decreased their closeness to win ratings when they were again presented with the picture.

There is evidence to suggest that conditional discrimination procedures similar to the one utilized above can also have an effect on response allocation to concurrently available gambling options (Hoon, Dymond, Dixon, & Jackson, 2008; Nastally, Dixon, & Jackson, 2009; Zlomke & Dixon, 2006). For example, Zlomke and Dixon (2006) demonstrated that a yellow slot machine was preferred over a concurrently available blue slot machine producing the same win rate following a training procedure that resulted in the formation of a rule between the color yellow and ‘greater-than’. As the two response options produced equal exposure to wins and losses in this study, it is unknown whether the verbal rule formation would override differing programmed contingencies produced by the concurrently available response options.

The purpose of the current experiment was to extend previous findings on the near-miss effect and verbal rule adherence as it relates to gambling. Specifically, we sought to evaluate the influence of non-arbitrary multiple exemplar training on response allocation toward two concurrently available simulated slot machines, one of which produced a high frequency of near-miss outcomes while the other produced no such outcomes.

METHOD

Participants and Setting

Six graduate students (aged 22-42; 5 F, 1 M) were recruited to participate in the study for course extra credit. The participants were enrolled in a behavior analysis program, but they all reported being unfamiliar with the behavior-analytic literature on gambling. Participants were screened for potential gambling pathology using the South Oaks Gambling Screen (SOGS) (Lesieur & Blume, 1987). The entire experiment took approximately one hour to complete and took place in a university human operant laboratory. The specific room used was approximately 4 ft. by 6 ft that contained a computer, desk, and chair.

Apparatus and Experimental Stimuli

All phases of the current study were conducted on a Dell Precision 690 PC equipped with a 22” monitor and a mouse.

All experimental procedures were programmed using Microsoft Visual Basic .NET. Phase 2, or multiple exemplar training with non-arbitrary stimuli, involved the use of 10 different word pairs and two color stimuli (blue and yellow) that were incorporated to train multiple exemplars of better- or worse-than relations. All stimuli were presented as 2 in. by 2 in. graphical images containing one word or color. The textual stimuli included both word pairs that were associated with gambling and were not necessarily associated with gambling. These word pairs were "alive-dead", "rich-poor", "healthy-sick", "winner-loser", "successful-failure", "attractive-ugly", "intelligent-stupid", "interesting-boring", "happy-depressed", and "strong-weak". The rest of the stimuli used in Phase 2 were two colors: blue and yellow. Stimuli used during Phase 3 (the stimulus sort task) consisted of 14 2-in. by 3-in. pictures (one blue slot, one yellow slot, and 12 words). This phase was a table top procedure so that pictures were printed out and cut to be uniform in size.

Experimental Design and Procedure

The study utilized a within-subjects pre/post-test design. Upon beginning the experiment, participants signed the consent form. Next, the experimenter led the participant into the room in which the experiment took place and the participant completed a computerized version of the SOGS (Lesieur & Blume, 1987). Upon completing this questionnaire, Phase 1 began.

Phase 1: Slot Machine Exposure.

In Phase 1, the following instructions were first read to the participant:

> "Today you have the opportunity to play these two computerized slot machines and switch back and forth between them as you so choose. You may choose by clicking the mouse on the picture of the slot machine on which you would like to play (prompt the participant to make their first choice.) Each time you will bet by pressing the 'bet one credit' button. Upon clicking on the betting button, the spin button will be activated. After each spin, your credits will be cashed out and you will again return to the choice screen and can choose freely each time which machine you would like to play on. In addition to earning your extra credit today, there are some additional contingencies in place for playing. For example for every time that you win on the cherries on up through the double bars, we will enter your name into a drawing for a $25 gift certificate. The 3 'Exit Signs' are our jackpot today. Upon getting this win you will not only receive extra credit, but you'll get to leave the study immediately and we will give you the $25 gift certificate. When you are ready to begin click on the BEGIN button."

During this phase, participants were given the opportunity to play "Slot Machine 1" or "Slot Machine 2" which were identical except for their base color. The background of Slot Machine 1 was blue and the background of Slot Machine 2 was yellow. Both machines were represented on a choice screen with the question "You may play on either Slot Machine 1 or Slot Machine 2. Which slot machine would you like to play on?" The position of the slot machines on this screen was randomized in order to control for position bias.

Upon clicking on one of the slot machines, participants were exposed to a screen containing that slot machine in the center of the screen. When this screen appeared, 200 credits were transferred to the 'total credit' window and the 'bet one' and 'bet max' buttons were highlighted. The participant was only able to bet one credit on each trial. Upon clicking on this button, the 'spin' button lit up and after it was clicked the three reels of the slot machine spun for approximately three seconds. After the reels stopped, depending on the outcome, one credit was either added or deducted from the 'total credit' window (reinforcement magnitude was held constant at one credit gain or loss on each trial). Then a prompt appeared on the screen in the form of an arrow pointing at the 'cash out' button that read "Click on the Cash Out button to continue". Upon clicking on the cash-out button, participants were exposed to a screen that informed them of the amount of total credits they had. An observing response was required (clicking on a button that read "Click Here") in order to return to the choice screen. This observing response was instated to reinforce attending to the stimuli on the screen.

Phase 1 consisted of 50 trials. During this phase, wins were programmed on a random-ratio (RR) 10 schedule on each of the two slot machines (i.e. each slot machine produced wins according to this schedule independently of the other machine) and near-miss outcomes were programmed on a RR 40 on the blue slot machine. As with real slot machines, the outcome of each trial (win or various loss types) occurred independently of past or future trials. In an attempt to increase the value of 'winning' and thus the value of a near-miss outcome, participants were told that each time they won on the first nine possible winning combinations (cherries through double bars), their name would be entered into a drawing for a $25 gift certificate. A 'jackpot' was also created in that participants were told that obtaining three identical 'EXIT' signs would result in getting to leave the experiment immediately and receiving the $25 gift certificate directly. The jackpot winning combination was programmed never to occur, so participants never actually contacted this contingency. In addition to these contingencies, Slot Machine 1 (i.e., the blue slot machine) was programmed to produce near-miss outcomes 40% of the time while Slot Machine 2 (i.e., the yellow slot machine) produced zero near-miss outcomes. A near miss was defined as two identical symbols appearing on the payout line in either the first and second, first and third, or second and third position with a different symbol appearing in the remaining position.

Following 50 trials of simulated-slot-machine play, the experimenter asked participants to answer two questions. First, to estimate how many times they won on both the yellow and blue slots and second, if they were given the opportunity to play on only one of the slot machines for the next 100 trials, which one would they prefer.

Phase 2: Multiple Exemplar Training with Non-Arbitrary Stimuli.

In Phase 2, a non-arbitrary relational training procedure was presented to participants (see Dixon, Bihler, & Nastally, in press; Reilly, Whelan, & Barnes-Holmes, 2005) to establish relations of 'better-than' and 'worse-than' in the presence of the colors yellow and blue. In the training, there were five pairs of textual stimuli, or written words, the first of which represented the 'better-than' relation and the second represented the 'worse-than' relation. These stimuli consisted of the following pairs: "alive-dead", "rich-poor", "healthy-sick", "winner-loser", and "successful-failure". Because each pair appeared in the presence of both colors, there were 10 different trial type combinations.

During a trial, either of the two colors first appeared toward the top of the screen (as the sample stimulus) followed by two words underneath the figure side by side (the comparison stimuli). Differential reinforcement for clicking on the appropriate comparison stimulus given the sample was provided in the form of auditory feedback consisting of a pleasant auditory sound (short tada .wav file) following a correct response or a neutral auditory sound (tone .wav file) following an incorrect response. The presence of the colors determined which selection of the two comparison stimuli was reinforced. For example, in the presence of yellow, selecting the stimulus representing the relation 'better-than' (i.e. "alive", "rich", "healthy", "winner", "successful") was reinforced. In the presence of blue, selecting the stimulus representing the relation 'worse-than' (i.e. "dead", "poor", "sick", "loser", "failure") was reinforced.

There were a total of 40 trials and participants needed to reach a criterion of 90% correct responding (36 out of 40 trials). If a participant did not reach criterion responding, exposure to the training blocks continued. If a participant did not meet criterion after exposure to five successive trial blocks following initial exposure, he or she was thanked for participating, provided course extra credit, and excused from the experiment.

Once participants met criterion in the training portion, they immediately moved into a testing phase which was the same as the training phase including stimuli presented, number of trials and correct responding criterion in order to advance to the next phase. The only difference was the trials were presented in the absence of any feedback and the following novel word sets were used: "attractive-ugly", "intelligent-stupid", "interesting-boring", "happy-depressed", and "strong-weak". Following Phase 2, participants immediately proceeded to Phase 3.

Phase 3: Stimulus Sort Task.

Upon successful completion of the multiple exemplar training/testing phase, to verify that the proper relations were formed participants were exposed to a stimulus sort task that incorporated three word-sets randomly selected from the training phase (alive-dead, attractive-ugly, happy-sad) and three novel word sets related to gambling (good-bad, gamble-save, jackpot-bankrupt). The selection of stimuli for the sort task was based on prior research on transfer of function in a gambling context (Hoon et al., 2008; Zlomke & Dixon, 2006). The sort task was a table-top procedure in which two 2-in. by 3-in. pictures of the slot machines (exactly as they appeared in the visual basic program) were presented in front of the participant. The participant was then given 2-in. by 3-in. cut-out cards with the individual words from each set typed in bold font and asked to place the card underneath the picture of the slot machine it went with. The experimenter informed the participant that no feedback would be delivered during this phase.

In all, there were 12 individual words presented a total of three times each making the phase consist of 36 trials. The order in which the words were presented was determined randomly.

Phase 4: Slot Machine Re-exposure.

After completing Phase 3, participants were re-exposed to the slot-machine task as described above. In addition to the two questions asked of participants during Phase 1, the experimenter also asked them "Overall, in deciding whether to play on the yellow or blue slot machine, what were you attending to more, the color of the slot machine or the number of times it was winning?"

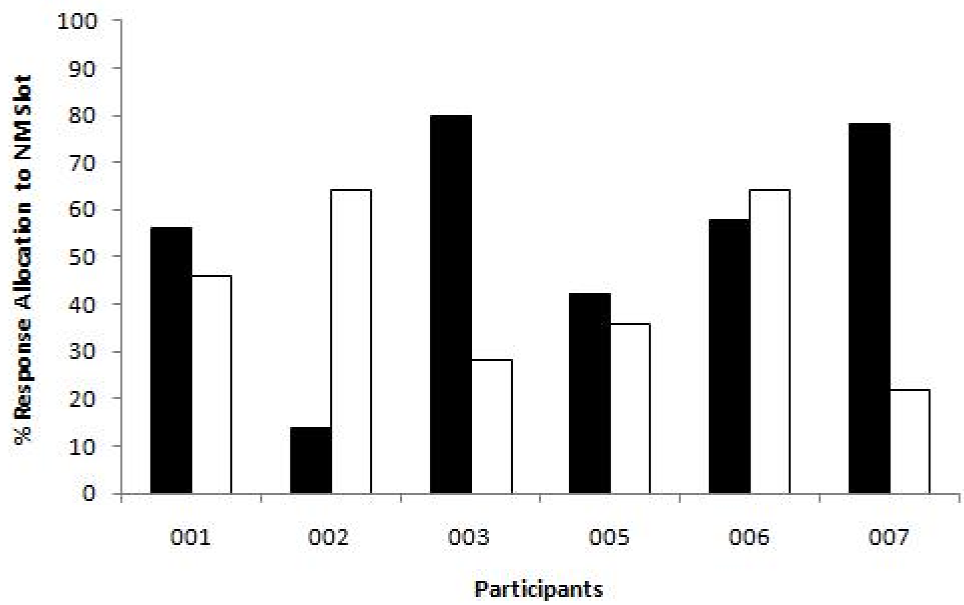
Dependent Measures and Reliability

Three response measures were of interest in the current study. First, response allocation to the slot machine producing a higher proportion of near-miss outcomes (the blue slot machine – Slot Machine 1) before and after the multiple exemplar training indicated whether the verbal relations that emerged affected overt responding. Second, the percentage of correct responses within a set of test-trial blocks during multiple exemplar training

(Phase 2) indicated whether the functions of 'better-than' and 'worse-than' transferred to the colors. And third, the number of correct responses during the stimulus sort task was measured as another indicator of the strength of the relation.

To ensure reliability of response measurement, a second observer reviewed 50% of the total output files that contain permanent records of responding produced by the programming software and IOA was calculated as 100%. An independent observer also scored 50% of the table-top stimulus sort task sessions and IOA for this measure was 91%.

Figure 1. Response allocation to the near-miss slot during Phase 1 (black) and Phase 4 (white).



RESULTS

The SOGS scores of Participants 001, 002, 003, 005, 006 and 007 were 0, 3, 0, 0, 0, and 0 respectively. Percent response allocation toward the blue (or near miss; NM) slot machine for each participant during the initial and final slot machine exposure are presented in Figure 1. During Phase 1, the initial slot machine exposure, Participants 001, 003, 006, and 007 (four out of six) showed a preference for the slot machine that was producing near-miss outcomes at a rate of 40% as opposed to the other slot which was producing no near-miss outcomes. Preference was defined as percent response allocation (of a total of 50 trials) exceeding 55%. The other two participants (002 and 005) emitted response allocation to the blue slot machine 14 and 42% of the time respectively. Overall, the median percentage of responses allocated to the NM slot machine across all participants during Phase 1 was 61% .

The next phases of the experiment were multiple exemplar training and the stimulus sort task. Trial blocks to criteria during multiple exemplar training for Participants 001, 002, 003, 005, 006 and 007 were 1, 4, 1, 1, 1, and 1 respectively. Performance during the stimulus sort task was 92, 92, 100, 92, 11, and 83% correct for Participants 001 through 007 respectively.

Following the stimulus sort task, participants were re-exposed to the simulated slot machines for another 50 trials. Of the participants who showed an initial preference for the blue slot machine (001, 003, 006, and 007), all except Participant 006 showed a decrease in response allocation toward the same machine following training and stimulus sort task phases (see Figure 1). Participant 006 actually showed a 6% increase toward the blue slot machine. Interestingly, even though Participants 002 and 005 did not show an initial preference for the blue slot, Participant 002's response allocation toward this slot increased substantially following the training and sorting phases (specifically by 50%). Participant 005's response allocation toward the blue slot, however, started out low and decreased slightly during re-exposure. Total median response allocation toward the blue slot machine during Phase 1 (pre) and Phase 4 (post) was 61% and 32% respectively.

In regard to the measures of verbal behavior across participants following Phases 1 and 4, participants were fairly accurate in estimating how many times they won on each of the two slot machines. The greatest discrepancy between actual and reported win frequencies never exceeded three instances. The question of which slot machine they would play on for the next 100 trials, given the opportunity, sought to gain a measure of subjective preference. Interestingly, during the initial slot-machine exposure, there was no discrepancy between which slot participants reported preferring and to which slot they allocated a greater proportion of responses. However, during the final exposure, differences were observed. For example, Participants 001 and 007 both reported preferring the blue slot, but allocated a greater percentage of responding toward the yellow slot machine. Lastly, five of six participants reported attending to the win rate of slot machines to a greater degree than their color when choosing to play on either the blue or yellow one.

Because each slot machine in the current study produced reinforcement on a true RR schedule, a contingency table summarizing the exact magnitude of reinforcement produced by both the yellow (Y) and blue (B) slot machines for each participant is presented in Table 1. Also found in this table are the total losses during Phase 1, or pre-test (Pr), and Phase 4, or post-test (Po), produced by both machines for each participant. The total number of near-miss outcomes produced by the blue slot only and how many times the two identical symbols appeared in the first two (NMright), first and third (NMmid), or second and third reel positions (NMleft) are also depicted here.

DISCUSSION

The results of the current study showed that the majority of participants initially preferred a simulated slot machine that produced a fairly high frequency of near-miss outcomes (40%) over one that produced no near-miss outcomes at all. The results of Phase 1 by itself extend the findings of previous studies on the near-miss effect in that preference was measured as response allocation to two concurrently available slot machines, one of which was producing a higher rate of near-miss outcomes. Most studies on the near-miss using objective measures have manipulated this variable in the context of prolonged play on one available slot machine using group design methodology (Cote et al., 2003; Daugherty & MacLin, 2007; Ghezzi et al., 2006; Kassinove & Schare, 2001) and we are aware of only one other study that has examined it in a concurrent operant paradigm (MacLin et al., 2007). If the near-miss effect is defined in terms of conditioned reinforcement, it would be expected that it would not only produce gambling persistence but also greater responding in the context of choice.

In addition, the results observed in Phase 1 extend the findings of studies that have utilized verbal behavior as the primary measure of preference for near-miss outcomes (Dixon & Schreiber, 2004; Dixon, et al., 2009). Specifically, they provide evidence of a correspondence between what participants said they prefer and the overt choices they made related to gambling response options. Such a correspondence is essential if valid assumptions are to be made solely based on verbal behavior as a dependent variable and further replication of this correspondence is needed to strengthen the validity of self-report measures in general. In essence, there is a need to increase investigation of whether people 'do as they say they do' as it were.

The results of the multiple exemplar training and stimulus-sort task, as well as the participants' SOGS scores, as they relate to the overt responding in Phases 1 and 4 are note-worthy for two reasons. First, all participants, except for 002 who required four training blocks, met correction criterion during the multiple exemplar training within one trial block. Participant 002 also had the highest SOGS score. Even though she did not score in the range of a potential pathological gambler, a score of 3 does indicate some evidence of a potential gambling problem (Lesieur & Blume, 1987). It could be that, as other studies on gambling have speculated (Nastally et al., 2009), individuals with a history of problem gambling adhere to self-rules to a greater degree than do individuals with no evidence of pathology and because of this adherence it was more difficult for her to learn the rule provided by the training. This hypothesis seems to be supported by the fact that even though the relations were eventually derived, she did not respond in accordance with them as demonstrated by the

Table 1

Contingency Summary Across Trial Types for Each Participant

	Total Loss				Total Wins				Total NM		NMright		NMmid		NMleft	
Part #	Pr		Po		Pr		Po		Pr	Po	Pr	Po	Pr	Po	Pr	Po
	Y	B	Y	B	Y	B	Y	B	B	B	B	B	B	B	B	B
001	21	18	23	16	1	1	2	4	7	5	5	4	2	1	0	0
002	37	5	18	16	6	1	0	3	1	12	1	9	0	1	0	2
003	18	18	33	9	2	3	3	0	9	5	7	5	0	0	2	0
005	28	11	30	9	0	3	2	1	7	8	7	5	0	2	0	0
006	16	16	19	21	5	3	0	1	10	9	9	9	0	0	1	0
007	9	18	19	14	2	6	6	2	15	9	12	6	1	1	2	2

subsequent increase in her responding toward the near-miss slot.

Second, an interesting finding comes from the results of the stimulus-sort task. For example, Participant 006 responded correctly on only 11% of the sort task trials, but reached criterion responding in only one trial during multiple exemplar training. It appears that she was responding in accordance with a rule involving the exact opposite contingencies between the multiple exemplar training and the sort task. This participant showed an initial preference for the near-miss slot, which increased slightly during re-exposure suggesting the rule derived during the sort-task had greater control over her responding. However, it is difficult to attribute such an influence of the sort-task by itself when Participant 007 produced the next lowest score (83%) and subsequently reduced responding toward the blue slot substantially.

As stated in the results, of the four participants who demonstrated an initial preference for the blue slot, three of them showed a decrease in preference following the training and sort tasks. Although Participant 005 did not show an initial preference for the blue slot, her response allocation also decreased following the training phases. These findings extend those of prior studies on transfer of function in a gambling context (Hoon et al., 2008, Nastally et al., 2009; Zlomke & Dixon, 2006) in that the slot machines in the current experiment differed in both color and loss type frequency. The finding that initial differences in responding can be predicted based on loss type (a greater frequency of near-miss as opposed to total loss outcomes), and those differences can be reversed as a result of reinforced rule following is a meaningful contribution to this particular body of research.

At the same time, although it can be said that four of six participants constituted a majority in the present experiment, it is worth noting that these outcomes are not vastly greater than those that would be expected based on chance alone. Other investigations of the near-miss effect using a concurrent operant set-up have produced similarly less-than-extreme demonstrations of preference (MacLin et al., 2007) and there have also been instances of no near-miss effect being observed whatsoever (Ghezzi et al., 2006; Whitton & Weatherly, 2009). Given this fluctuation in pronouncement of the near miss-effect and the range of methodology designed to study it, it is possible that procedural variations (e.g. availability of one or more response options, schedule of reinforcement, forced trials vs. free operants, etc.) contribute at least in part to its occurrence.

In terms of ways this experiment differs from and extends the conclusions that can be drawn from previous gambling studies on transfer of function (Hoon et al., 2008, Nastally et al., 2009; Zlomke & Dixon, 2006), the role of reinforcement in the current study is also worth comment. While these former studies have incorporated a matched schedule of reinforcement for each of the concurrently available slot machines, the current set of slot machines produced reinforcement on a true RR schedule of reinforcement. As a consequence, it is impossible to completely rule out reinforcement as a potential determiner of participant response allocation. At the same time, however, it lends greater external validity to the current methodology. Additionally, as shown by the data in Table 1, the magnitude of reinforcement produced by the two machines did not differ substantially and this difference must be considered in terms of the actual percentage of response allocation that allowed the participant to experience such reinforcement.

The current experiment is not without limitations. For example, pre-existing histories associated with the specific colors of the slot machines cannot be accounted for in the current study because the color slot producing the greater frequency of near-miss outcomes was not counterbalanced across participants. However, if history did in fact play a role, one would expect more exclusive preference for either the yellow or blue slot across participants during pre-test. Still, future studies incorporating similar methodology should control for this factor. Likewise, the pre-test/post-test design methodology does not rule out all confounding variables (e.g. reinforcement). However, the present experiment should be viewed as preliminary as it is one of the first to attempt this type of investigation of the near-miss effect, and subsequent studies should employ more conservative design methodology to support the present findings.

The present study addressed the roles of both verbal rule adherence and what has been termed the near-miss effect in influencing the choice making of gamblers. Within both of these areas there are a number of potential research questions to pursue. For example, to further illustrate the role of verbal behavior in gambling, future studies should continue to pit derived or directly introduced rules against a variety programmed contingencies within the context of choice making. Varying the loss type in the present analysis was one example, but several variations of mixed schedules of reinforcement produced by each response option could also be utilized. In terms of the near-miss effect, future studies could attempt to treat such maladaptive rule following in individuals with a history of problem gambling using a brief clinical intervention such as providing accurate information about near-miss outcomes. There is increasing support for reducing gambling behavior in non-pathological gamblers through such interventions (Mui & Dixon, under review; Weatherly & Meier, 2008) and it would seem to follow that such treatment strategies could also be effective in reducing the rule-governed behavior of real gamblers.

In summary, the near-miss effect represents an important area of gambling research. Although it has been conceptualized in a number of ways within the gambling literature, most researchers are in agreement about its harmful effect on the problem gambler. Evidence of this effect on both cognition and behavior is well documented. This effect represents just one of the strategies that are used by the gambling industry to perpetuate gambling behavior and more research is necessary to identify the most effective way to counteract these efforts.

REFERENCES

Daugherty, D., & MacLin, O. H. (2007). Perceptions of luck: Near wins and near loss experiences. *Analysis of Gambling Behavior, 1,* 123-133.

Dixon, M. R., Bihler, H., & Nastally, B. L. (in press). Slot machine preferences of pathological and recreational gamblers are verbally constructed. *The Psychological Record.*

Dixon, M. R. Nastally, B. L., Hahs, A. D., Horner-King, M., & Jackson, J. W. (2009). Black-jack players demonstrate the near-miss effect. *Analysis of Gambling Behavior*, 3, 56-61.

Dixon, M. R., Nastally, B. L., Jackson, J. W., & Habib, R. (2009). Altering the "near-miss effect" in slot machine gamblers. *Journal of Applied Behavior Analysis, 42,* 913-918. doi:10.1901/jaba.2009.42-913

Dixon, M.R., & Schreiber, J.E. (2004). Near-miss effects on response latencies and win estimations of slot machine players. *The Psychological Record, 53*, 335-348.

Ghezzi, P.M., Wilson, G.R., & Porter, J.C.K. (2006). The near-miss effect in simulated slot machine play. In P.M. Ghezzi, C.A. Lyons, M.R. Dixon, & G.R. Wilson (Eds.) *Gambling: Behavior Theory, Research, and Application* (pp. 155-189). Reno: Context Press.

Griffiths, M. (1991). Psychobiology of the near-miss in fruit machine gambling. *The Journal of Psychology, 125*, 347-357.

Hahs, A. D., & Dixon, M. R. (manuscript in preparation). Investigating the near-miss effect in the game of roulette.

Hoon, A., Dymond, S., Dixon, M.R., & Jackson, J.W. (2008). Contextual control of slot machine gambling: Replication and extension. *Journal of Applied Behavior Analysis, 41*(3), 467-470. doi:10.1901/jaba.2008.41-467

Kassinove, J.I., & Schare, M.L. (2001). Effects of the “near miss” and the “big win” on persistence at slot machine gambling. *Psychology of Addictive Behaviors, 15*, 155-158.

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*(9), 1184-1188.

MacLin, O. H., Dixon, M. R., Daugherty, D., & Small, S. L. (2007). Using a computer simulation of three slot machines to investigate a gambler’s preference among varying densities of near-miss alternatives. *Behavior Research Methods, 39,* 237-241.

Mui, N., & Dixon, M. R. (under review). Examining effects of different types of information on slot machine play. *Analysis of Gambling Behavior.*

Nastally, B. L., Dixon, M. R., & Jackson, J. W. (2010). Manipulating slot machine preference in problem gamblers through contextual control. *Journal of Applied Behavior Analysis, 43,* 125-129. doi:10.1901/jaba.2010.43-125

Reid, R.L. (1986). The psychology of the near miss. *Journal of Gambling Behavior, 2*, 32–39.

Reilly, T., Whelan, R., & Barnes-Holmes, D. (2005). The effect of training structure on the latency of responses to a five-term linear chain. The Psychological Record, 55, 233-249.

Skinner, B. F. (1957) *Verbal Behavior*. Cambridge: Prentice-Hall.

Weatherly, J. N., & Meier, E. (2008). Does providing accurate information about slot machines alter how participants play them? *Analysis of Gambling Behavior, 2,* 2-12.

Whitton, M., & Weatherly, J. N. (2009). The effect of near-miss rate and card control when American Indians and non-Indians gamble in a laboratory situation: The influence of alcohol. *American Indian and Alaska Native Mental Health Research, 16,* 28-42.

Zlomke, K.R., & Dixon, M.R. (2006). Modification of slot-machine preferences through the use of a conditional discrimination paradigm. *Journal of Applied Behavior Analysis, 39*,351-361. doi:10.1901/jaba.2006.109-04

Action Editor: *Jeffrey N. Weatherly*