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# *ALTERING THE NEAR-MISS EFFECT IN SLOT MACHINE GAMBLERS*

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This study investigated the potential for recreational gamblers to respond as if certain types of losing slot machine outcomes were actually closer to a win than others (termed the *near-miss effect*). Exposure to conditional discrimination training and testing disrupted this effect for 10 of the 16 participants. These 10 participants demonstrated high percentages of conditional discrimination testing performance, and the remaining 6 participants failed the discrimination tests. The implications for a verbally based behavioral explanation of gambling are presented.

DESCRIPTORS: addiction, gambling, near-miss effect, slot machine, stimulus equivalence

A behavior-analytic understanding of pathological gambling is long overdue, and recent attempts have been made to identify variables that are responsible for controlling this maladaptive behavior. Oftentimes such attempts are designed to reconceptualize nonbehavioral assertions of various constructs or intervening variables that appear to underlie the clinical disorder. For example, it has been claimed that pathological gamblers often possess an ''illusion of control'' in which they tend to have a belief of control over a pure-chance event like a dice roll. In attempts to provide an operant account of and demonstrate experimental control over such an operant, Johnson and Dixon (2009a) imposed a response-cost procedure on 2 pathological gamblers who engaged in such irrational choice making. When compared to conditions without response cost, irrelevant choices for activities such as dice rolling or number picking were substantially reduced.

Another common hypothetical construct discussed in the gambling literature is the *near-miss effect*. Here a gambler is presented with a losing outcome of the game, yet tends to believe that such an outcome is closer to winning than other types of losing outcomes. Most frequently the near-miss effect is discussed with respect to the slot machine player who sees two winning symbols on the payoff line and a third winning symbol immediately above or below the payoff line. This ''almost winning'' has been conceptually discussed for years by nonbehavioral researchers (Griffiths, 1991; Reid, 1986) and has been experimentally demonstrated by Dixon and Schreiber (2004) whereby recreational slot machine players have been shown to rate near-miss displays of slot outcomes as closer to wins than non-near-miss displays or total losses. Yet it remains to be seen if such ratings can be altered using behavior-analytic principles that have been successful at altering other types of slot machine gambling.

A recent study by Zlomke and Dixon (2006) produced changes in responding across two identical slot machine simulations that differed only in color after participants' exposure to a series of conditional discrimination training and testing procedures in which the functions of ''more than'' and ''less than'' were derived from various matching-to-sample tasks. These training sessions altered subsequent performance when participants were reexposed to the slot machine tasks even though contingencies remained the same, suggesting a degree of verbal mediation that controlled responding. Replications of concurrent slot machine response allocations have yielded similar effects and conceptual conclusions (Dymond & Whelan, 2007; Hoon, Dymond, Jackson, & Dixon, 2008; Johnson & Dixon, 2009b). Therefore, it

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may be possible that the behavior of rating various slot machine outcomes as near misses and thus better than other outcomes could be verbally maintained, as opposed to the traditional accounts of gambling that posit a flaw in the personality of the gambler. If true, perhaps such verbally controlled responding is modifiable in a similar way. The present paper attempted to explore the degree to which closeness to win ratings of various slot machine outcomes could be altered following the formation of a stimulus equivalence class that resulted in derived relations in contrast to preexperimental conceptualizations of a near-miss slot machine display.

## METHOD

### *Participants and Setting*

Sixteen undergraduate students participated in the study for either course extra credit or a $20 gift card to a local business. All students had no known history of gambling problems, and all had at least minimal experience playing slot machines recreationally. The 1- to 2-hr experiment took place in a university gambling research laboratory setting. This room contained a personal computer equipped with a mouse, a table, a chair, and additional gambling and experimental equipment that was not used in the present study.

### *Apparatus and Experimental Stimuli*

All phases of the current study were conducted on a Dell Dimension PC equipped with a 17-in. monitor and a mouse. All procedures were programmed in Microsoft Visual Basic.NET. Three stimuli, which consisted of graphic images (3.5 cm by 3.5 cm) depicting various outcomes on a slot machine, were used in the pretest and posttest. A ''win'' stimulus consisted of three identical slot reel symbols displayed across a single payout line. A ''near-miss'' stimulus consisted of two identical slot reel symbols displayed in the first two positions across a single payout line, with the third position occupied by a different symbol. A ''total loss'' stimulus consisted of three different slot reel symbols displayed across a single payout line. Stimuli employed during relational training and testing consisted of three abstract images (hereafter referred to as the A1, A2, and A3 stimuli), graphic displays of the text ''win,'' ''loss,'' and ''almost'' (the B1, B2, and B3 stimuli, respectively), and the slot machine outcome images from pretest and posttest, consisting of a ''win,'' ''near-miss,'' and ''loss'' outcome (the C1, C2, and C3 stimuli, respectively).

### *Procedure*

*Initial slot machine outcome ratings (pretest).* In this phase participants were shown a single image depicting a slot machine outcome on the computer screen, and he or she was required to rate how close the image was to a win on a 10-point Likert scale ranging from 1 (*not a win*) to 10 (*win*) by moving a horizontal slider bar with the computer mouse. Once the rating was made, the participant was required to click on a button located beneath the slider bar to record his or her response and advance to the next trial. Prior to the start of this phase, the experimenter gave the participants the following instructions verbally:

> You will be presented with several images depicting outcomes on a slot machine. When an image appears on the screen, please indicate how close you feel the outcome is to a win by giving it a rating of 1–10 with the slider bar you see below the image, with a 1 indicating that the outcome is not a win and a 10 indicating that the outcome is a win. After you select your rating, click on the ''Record Answer'' button to record your response and to advance to the next image. Do you have any questions?

The ''win,'' ''total loss,'' and ''near-miss'' stimuli were presented in random order for a total of 27 slot machine outcomes rated. The pretest terminated once the participant had rated all 27 stimuli.

*Relational training and testing.* Relational training and testing began with each participant completing what was termed A-B training. Training consisted of the presentation of a

sample stimulus (A) at the top middle of the computer screen while three comparison stimuli (B) were presented below the sample. Differential reinforcement for clicking on the appropriate B stimulus given the A stimulus as the sample was provided in the form of auditory feedback consisting of a pleasant auditory sound (short chime) following a correct response or an aversive auditory sound (loud beep identical to that used in Windows to identify an error) following an incorrect response. Correct responses were as follows: Given A1, pick B1 and not B2 or B3; given A2, pick B2 and not B1 or B3; and given A3, pick B3 and not B1 or B2. Participants completed blocks of 18 trials in which a criterion of 16 correct responses was in place to advance to the next phase of training. Failure to make 16 correct responses resulted in the repetition of the 18-trial block.

Once criterion responding was achieved for A-B training, participants were exposed to what was termed A-C training. Once again, a single stimulus (A) was presented as a sample, but now three C stimuli were presented as comparison stimuli. Of these stimuli, C1 was the "win" outcome presented in pretesting, C2 was the near-miss outcome, and C3 was the "loss" outcome. Differential reinforcement and the accuracy criterions for this training phase were identical to those in A-B training. Once criterion responding was achieved for A-C training, participants were exposed to a 36-trial phase of mixed A-B and A-C training. In this phase, differential reinforcement for correct and incorrect responding was identical to the previous training phase, but trials consisted of the randomized presentation of A-B trials and A-C trials. Criterion for passing mixed training consisted of 32 correct responses from a trial block of 36 trials.

Once criterion responding was achieved for mixed training, participants were presented with what was termed symmetry (B-A and C-A) and equivalence (B-C and C-B) testing trials to determine if derived stimulus relations had emerged as a result of the history of trained relations. In total, 36 symmetry and equivalence trials were presented with no programmed consequences (auditory feedback on accuracy of responses) to assess the degree to which participants could derive relations in the absence of reinforcement. No accuracy criterion was in place during this final testing phase, and all responses were made on extinction (i.e., no feedback of any type).

At the onset of relational training and testing, the experimenter verbally presented to the participants the following instructions:

> You will be presented with one image at the top of the computer screen with three images beneath it. Your task is to choose one of the three images located at the bottom of the screen by clicking on it with your mouse. At various points you will be given auditory feedback that will vary depending on the accuracy of your performance, and at other times you will receive no feedback. When you do not receive feedback, still continue to respond as you did before and do your best.

*Final slot machine outcome rating (posttest).* The final phase consisted of reexposure to the same rating task presented in the pretest. Twenty-seven trials of randomly presented outcome stimuli were shown for participants to rate (as in the pretest) with the pictorial stimuli representing "win," "total loss," and "near miss." Following this phase, all participants were debriefed on the purpose and rationale for the study and were given a gift card or were awarded extra credit.

### *Dependent Variables and Reliability*

Two dependent variables were collected during the course of the study. The first variable was the rating of each slot machine outcome's "closeness to a win." The second variable was the percentage of responses within a set of trial blocks of matching-to-sample discrimination training and testing that were correct responses. All responses were recorded by the computer, eliminating the need for a second independent human observer for variable reliability. Prior to conducting each session, the computer performed a debugging sequence that checked to

ensure that data were being captured reliably. No errors were found.

## RESULTS AND DISCUSSION

It was expected that if participants derived the responses of B1-C1, C1-B1, B2-C2, C2-B2, B3-C3, and C3-B3 in the absence of any programmed reinforcement, the word *almost* would acquire some functions of the total loss image, and the word *loss* would acquire some functions of the near-miss slot image. The word *win* was expected to remain unchanged, in that it was to be relationally derived with the winning slot image. Figure 1 displays the resulting data from the pretest and posttest, depicted as mean rating of slot machine outcome stimuli during the initial exposure to the rating task from the pretest and during the subsequent final rating phase from the posttest. In the initial ratings observed in the pretest, 13 of 16 participants displayed mean ratings of ''win'' stimuli higher than either ''total loss'' or ''near-miss'' stimuli. Thirteen of 16 participants displayed mean ratings of ''near-miss'' stimuli that were higher than ''total loss'' stimuli, indicating that they viewed these special types of losses as closer to a win than losses in which all three slot stimuli were different. Participants 771 and 772 displayed ratings during the pretest in which ''total loss'' stimuli were rated as being closer to a win than ''win'' stimuli (Participant 771) or in which both ''total loss'' and ''near-miss'' stimuli were rated as closer to a win than ''win'' stimuli (Participant 772).

All participants successfully completed the relational training and testing. Fourteen participants displayed performance of above 80% correct responding for symmetry, with Participants 115 and 169 displaying poor performance. Ten of 16 participants displayed performance of above 90% correct responding for stimulus equivalence, indicating that they could derive relations between ''win'' outcome stimuli and the word w*in*, between ''near-miss'' outcome stimuli and the word *loss*, and between ''total loss'' outcome stimuli and the word *almost*. Participants 123, 169, 195, 771, 772, and 776 displayed poor performance on these stimulus equivalence trials.

All participants completed the final ratings of the 27 outcome stimuli in Phase 3. After completion of the matching-to-sample task of Phase 2, 15 of 16 participants (the exception was Participant 771) rated ''win'' stimuli as being equivalent to a win, as indicated by the mean ratings for ''win'' stimuli. Ten of 16 participants displayed patterns of mean ratings with ''total loss'' stimuli rated as closer to a win than ''near-miss'' stimuli, representing a reversal in pattern for most participants. Of those participants who failed to display this pattern (Participants 123, 169, 195, 771, 772, and 776), all displayed poor performance on tests of derived stimulus equivalence. Thus, it appears that failure to demonstrate equivalence between the experimental stimuli resulted in a lack of alterations in rating of the slot machine images in the posttest. The total loss/near-miss ratios are presented for all participants, averaged across participants and grouped by failures or passes of the matching-to-sample equivalence test.

The current study supports prior research that the near-miss effect is not inherent in the gambler or a part of the gambler's personality (Dixon & Schriber, 2004) and further suggests that it instead is a verbal relation that can be altered rather easily for many individuals. The logical next step would be to determine how and to what degree the present procedures could be used to alter preference for various slot machines that vary in terms of frequency of near misses. Using a procedure similar to that of Zlomke and Dixon (2006), individuals might initially be presented with choices between two slot machines that vary only in terms of near misses and assess preference (e.g., MacLin, Dixon, Daugherty, & Small, 2007). Afterwards, conditional discrimination training and testing similar to that of the present study could be done and subsequent performances could be

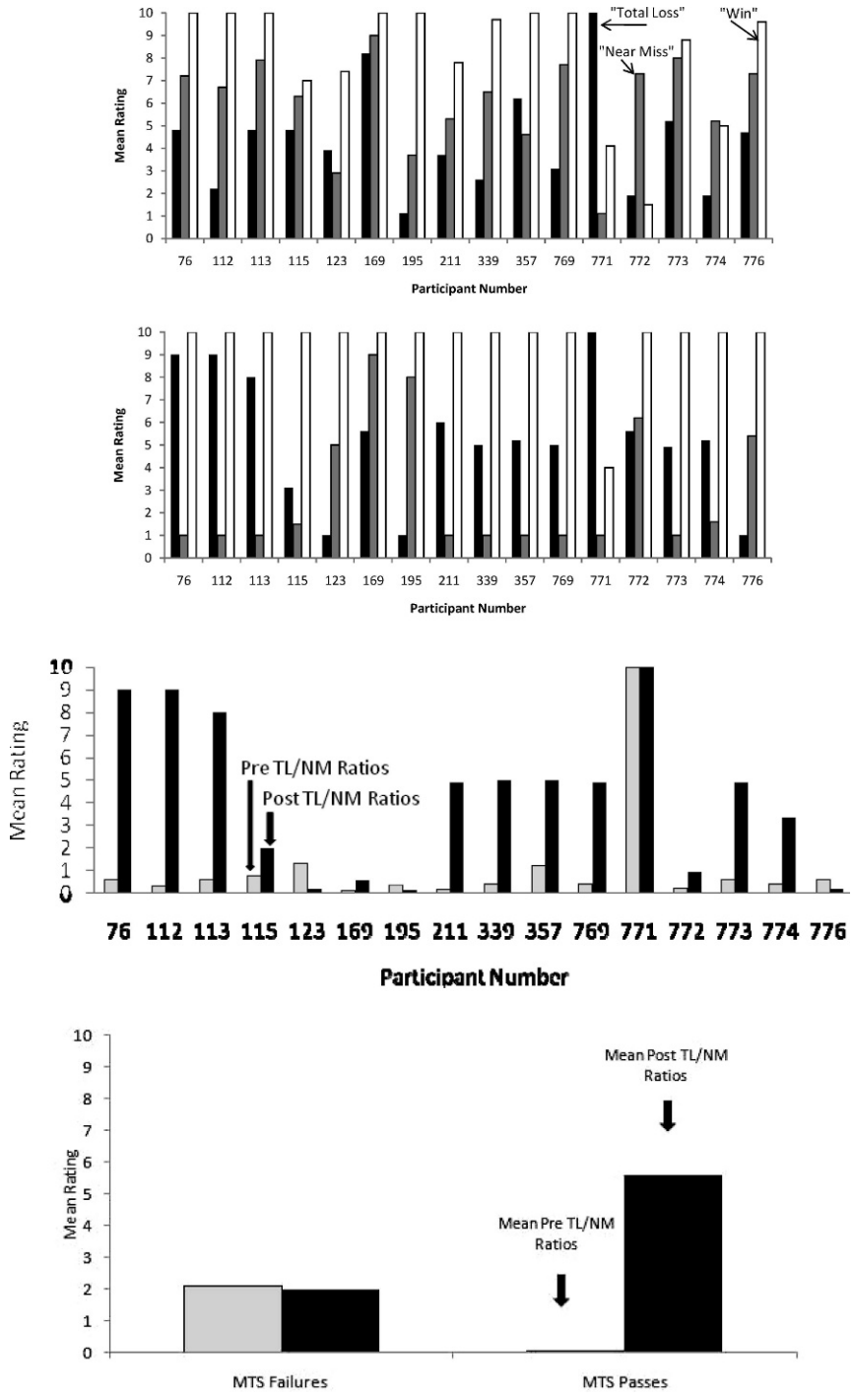


Figure 1. Mean closeness to "win" ratings of "total loss," "near-miss," and "win" slot machine outcomes for each participant during pretests (first panel) and posttests (second panel). The total loss/near-miss ratios (TL/NM) are presented for all participants (third panel) and averaged across participants and grouped by failures or passes of the matching-to-sample (MTS) equivalence test (fourth panel).

evaluated. Additional future research may examine how such verbal processes and the alteration of verbal relations could influence pathological gamblers' actual wagering at various slot machines in a casino.

As we strive to produce an eventual comprehensive behavior-analytic understanding of the variables responsible for controlling gambling behavior and pathological gambling, translational research such as the current study provides the building blocks for eventual effective treatment strategies.

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