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# *MODIFICATION OF SLOT-MACHINE PREFERENCES THROUGH THE USE OF A CONDITIONAL DISCRIMINATION PARADIGM*

KIMBERLY R. ZLOMKE AND MARK R. DIXON

SOUTHERN ILLINOIS UNIVERSITY–CARBONDALE

The present experiment investigated the impact of contextually trained discriminations on gambling behavior. Nine recreational slot-machine players were initially exposed to concurrently available computerized slot machines that were each programmed on random-ratio schedules of reinforcement and differed only in color. All participants distributed responding equally across the two slot machines. A conditional discrimination procedure was then used to teach the contextual cues representing the arbitrary relations of "greater than" and "less than." Following contextual cue training, participants were reexposed to the concurrent slot-machine task. After training of the contextual cues, a higher proportion of responses were made to the slot machine that shared formal properties (i.e., color) with the contextual cue representing "greater than."

DESCRIPTORS: choice, gambling, self-rules, verbal behavior

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During the past 20 years there has been a growth in the number of states that allow legalized gambling (Ghezzi, Lyons, & Dixon, 2000). There has also been an increase from 1% to 5% of the United States population who are classified as problem or pathological gamblers (Harvard Mental Health Letter, 1996). Explanations as to why people develop into problem gamblers include sensation seeking and arousal (Anderson & Brown, 1984), genetic predispositions to gambling (Slutske et al., 2000), and the presence of specific personality disorders (Kroeber, 1992). To date, however, the impact of behavior analysis on understanding the development of gambling behavior has been minimal (see Weatherly, 2004, for a discussion).

Understanding gambling from a behavior-analytic perspective poses a unique challenge because animal models of gambling are nonexistent. Furthermore, there are several legal and ethical issues surrounding optimal research settings and participants. Commercial gaming establishments offer a variety of games (e.g., slot machines, video poker, roulette, blackjack) from which gambling behavior can be evaluated. However, these games are designed and government regulated to be purely probabilistic (i.e., based on an intermittent schedule of reinforcement). As a result, field research in which variables of interest (e.g., reinforcement magnitude, density, delays to reinforcement, or odds of winning) are manipulated and in which participants wager actual currency at a casino game are legally prohibited.

An alternative to studying gambling in commercial gaming establishments might involve the use of controllable and modifiable casino-like games (e.g., MacLin & Dixon, 2004; MacLin, Dixon & Hayes, 1999) in which individuals who gamble recreationally can participate. In one such laboratory investigation, Dixon, Marley, and Jacobs (2003) examined the degree of discounting of delayed consequences by pathological gamblers and matched-control nongamblers. Choices between hypothetically available amounts of money that differed in size (e.g., \$20, \$1,000) and delay (e.g., 1 week, 1 year) were presented. Overall, results showed that gamblers discounted the delayed rewards more quickly in a monotonic fashion than did matched-control participants.

Address correspondence to Mark R. Dixon, Behavior Analysis and Therapy Program, Rehabilitation Institute, Southern Illinois University, Carbondale, Illinois 62901 (e-mail: mdixon@siu.edu).

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One variable of interest in the study of gambling is predicting gamblers' choices among alternatives (e.g., to play one game or another). Such situations may be conceptualized as a concurrent-operants paradigm. Choice on concurrent schedules of reinforcement is rather predictable by understanding the reinforcement rates and magnitudes associated with each response option (Davison & McCarthy, 1988). Such response patterns often occur as the result of extensive exposure to the programmed contingencies, something that rarely happens when a person gambles. By contrast, it is often the case that a gambler may never experience the contingencies of winning the jackpot on a given slot machine, yet they may favor that machine over concurrently available machines with similar programmed contingencies.

Although some choice responding of gamblers may be due to superstitious reinforcement (Skinner, 1953), verbal behavior also appears to have an impact on gamblers' choices, risk levels, and duration of game play. For example, roulette players may choose to wager more chips on specific options (i.e., certain numbers on a roulette board) that have no impact on game outcome if given inaccurate rules stating strategies for winning. Dixon (2000) found that preferences for such game options were reduced via delivery of accurate rules about the game, but for some players even such rules were insufficient to remove "illogical" choice making. Gamblers also tend to play games with poor probabilities of winning for longer periods of time when given inaccurate rules often found in the casino (e.g., "you have to play if you are going to win" and "the best way to win is to keep playing") (Dixon, Hayes, & Aban, 2000). Although these studies illustrate how rules can alter gambling behavior, they do not aid in understanding how gamblers generate such rules.

The concept of a *self-rule* (Skinner, 1972) has been discussed as the product of relational responding to various stimuli and their discriminative functions (Hayes, Barnes-Holmes, & Roche, 2001). This conceptualization of a self-rule suggests that initially neutral or novel stimuli may acquire certain functions through direct training or transfers of functional control in the absence of differential reinforcement. For example, if a verbally competent person is trained by direct reinforcement that A is better than B and B is better than C, the person will be able to derive that C is worse than A in the absence of any direct reinforcement. Furthermore, contextual cues or higher order conditional discriminations may make the functional relations among stimuli transient (i.e., under additional discriminative control; Saunders & Williams, 1998). For example, in a matching-to-sample task, a person might be presented with a sample stimulus of the numeral 5 and given comparison response options of the numerals 8, 2, and 4. Depending on the contextual cue present, differential reinforcement might be provided for selecting the comparison stimulus that is "better than" (selecting 8) or "worse than" (selecting 2).

The purpose of the current study was to develop a set of self-rules that would influence response allocation among concurrently available gambling options. First, we examined the degree to which recreational slot-machine players would match their responses to concurrently available random-ratio (RR) simulated slot machines that differed only by color. We then attempted to alter or enhance initial response allocations through the establishment of "greater than" and "less than" relations that were associated with specific contextual stimuli in a conditional discrimination procedure.

## METHOD

### *Participants*

Nine undergraduate students participated in the experiment. All participants were at least 18 years of age and reported occasionally having played slot machines at regional casinos.

*Apparatus and Setting*

Participation took place at a desk in a small room (3 m by 3.5 m) containing various furniture and equipment. A computer programmed in Microsoft® Visual Basic 6.0 controlled the presentation of stimuli and data collection. Accuracy of data collection by the computer was checked prior to the running of each participant via a program debugger, which evaluated all possible data-collection errors (no errors were found). The IBM-compatible computer ran the Windows XP Professional operating system and featured a full-color 43.2-cm screen, a full-sized keyboard, and two-button computer mouse.

*Procedure*

*Slot-machine task pretest.* The purpose of this task was to acquire baseline data on each participant's response allocation toward two simulated slot machines that were equal in terms of payoff probability and differed only by color. Participation began with the delivery of the following instructions: "Click the mouse on the slot machine you wish to play, and earn as many points as possible." The experimenter answered any questions by repeating the instructions, and then left the room.

The two slot machines were then presented on the screen. One slot machine was primarily yellow, and the other was primarily blue. Each picture covered approximately half the computer screen (see Figure 1). A mouse click on either picture resulted in a new screen being displayed, which allowed the participant to play the slot machine he or she had selected (see Figure 2). Each participant initiated a trial by clicking the mouse pointer on the "continue" button at the bottom of the screen. This resulted in the removal of that button and the presentation of two other buttons that occupied the same portion of the screen (not shown in Figure 2). The left button was a "bet credit" button that, when clicked on, resulted in the right button, a "spin" button, becoming available for clicking and one credit being subtracted from the participant's "cumulative credits" (initially set at 100). When the "spin" button was clicked, the slot machine reels spun for approximately 3 s and displayed either a winning display (three identical symbols on the payoff line) or a losing display (any other type of display of symbols on the payoff line).

Following every winning spin, two credits were added to the participant's "credits won" and "cumulative credits" display windows, and following a losing spin no programmed consequences were delivered except that the one credit the participant initially bet was removed from the "cumulative credits" window. After each spin, the participant was given another choice of which slot machine to play (yellow or blue) as described above. To eliminate any position bias, the different-colored slot machines were randomly positioned on either side of the screen across trials. In addition, an observing response was instated between all trials, in which the participant was required to click on the computer mouse in the middle of the computer screen (between the two pictures) before the next trial (i.e., presentation of the two slot machines) began.

Each of the slot machines was programmed on an RR schedule of reinforcement on which the probability of reinforcement was .5 and the magnitude of reinforcement was held constant (one credit net gain or loss). To control for possible variations in reinforcement density across participants, the RR sequence was generated a priori by a pilot participant, and the resulting identical sequence of trial outcomes was matched to all 9 participants. In addition, regardless of the choice option for a specific slot machine, the outcome of the RR schedule was predetermined for every participant. That is, the program controlled for credits won or lost such that every participant contacted the identical amount of reinforcement obtained despite their individual choices among the two slot-machine options. Thus, given the $p = .5$ contingencies, each participant

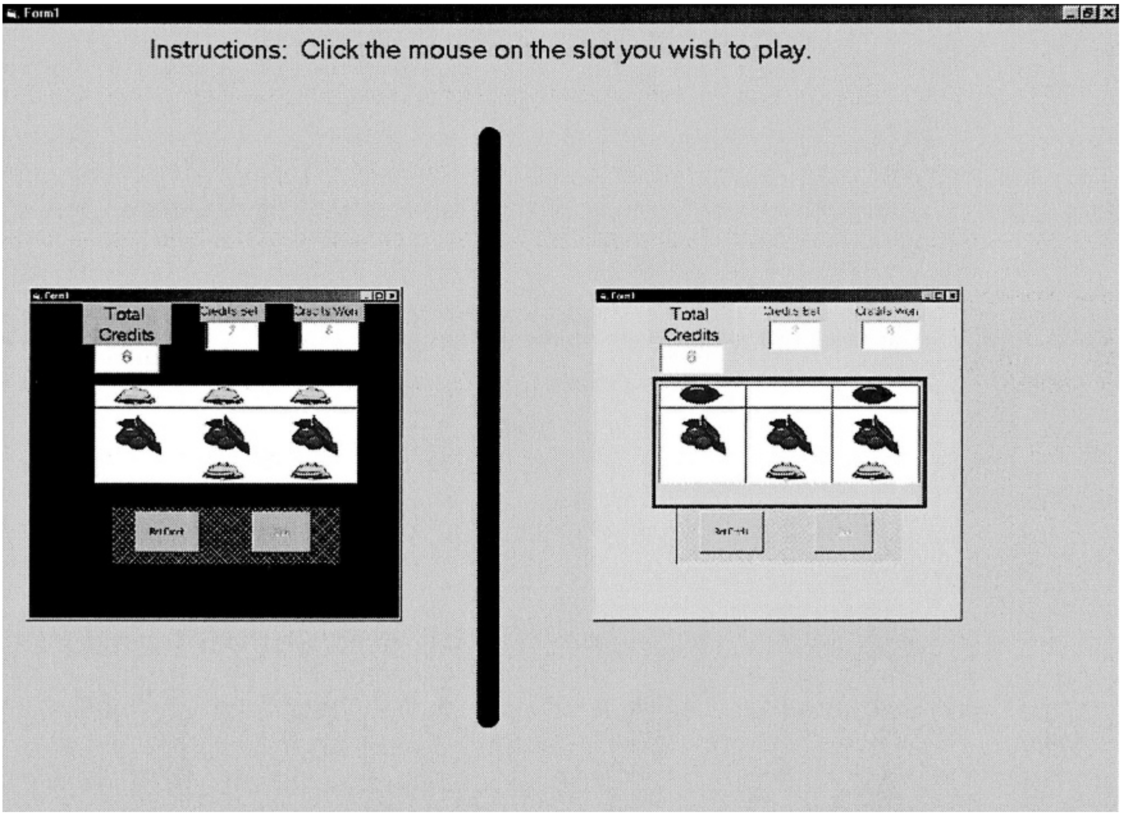


Figure 1. Participants' choice option between the two simulated slot machines.

ended this task with 100 credits. The slot-machine pretest condition continued until 50 trials had been completed.

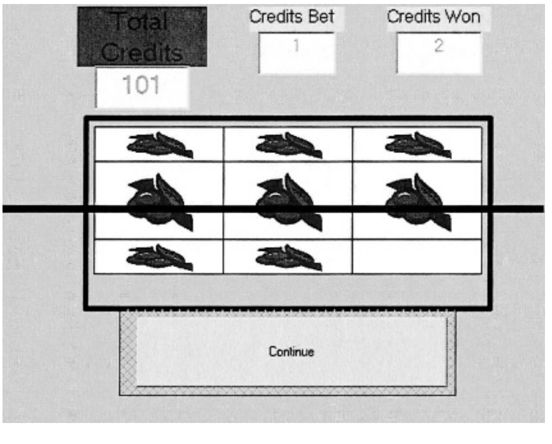


Figure 2. The simulated slot-machine task.

*Conditional Discrimination Training*

Following the slot-machine pretest, conditional discrimination training was conducted to establish the relations of greater than and less than with the colors used in the slot-machine task. During this condition, participants were instructed to match a visual sample stimulus to one of three visual comparison stimuli presented on the computer screen. Six sets of five stimuli and two contextual cues were used during this procedure. The six sets of stimuli included five images or words that represented a continuum from least to most, each approximately 8 cm by 8 cm. Stimulus sets incorporated gambling stimuli (playing cards), monetary values (dollar bills and coins), and nonmonetary or gambling stimuli (letter grades used in American universities, placement in a competition). Thus, the stimuli could be

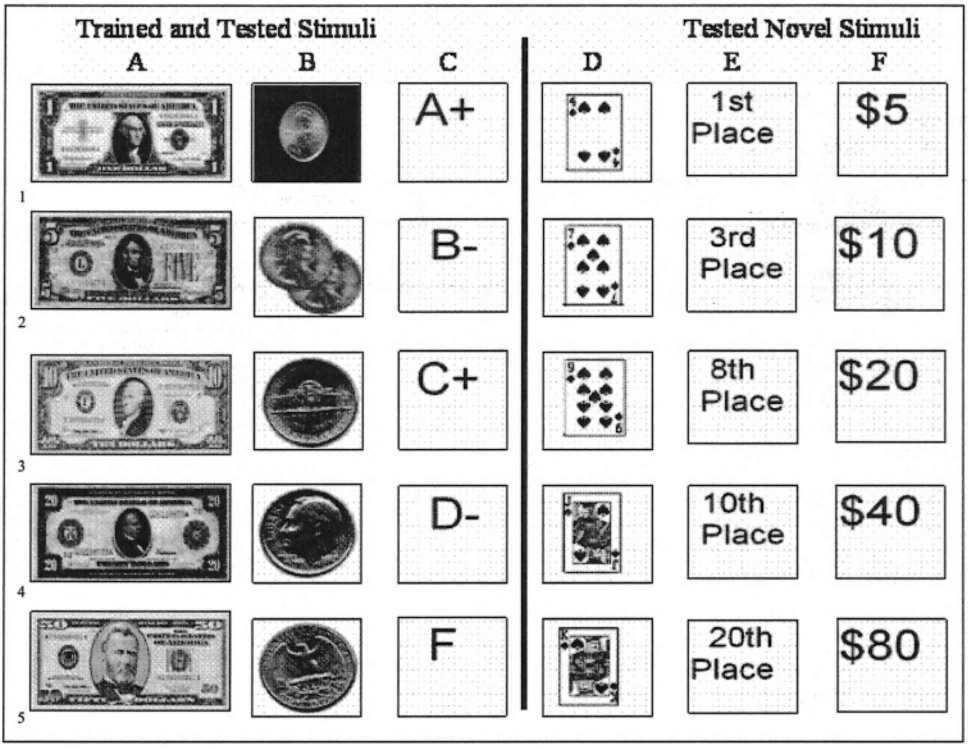


Figure 3. Stimulus sets that were used during the conditional discrimination training procedure.

considered to be related to different concepts (e.g., ranking, value, size); however, they represented a difference in categorization along a continuum (greater than to less than). For example,

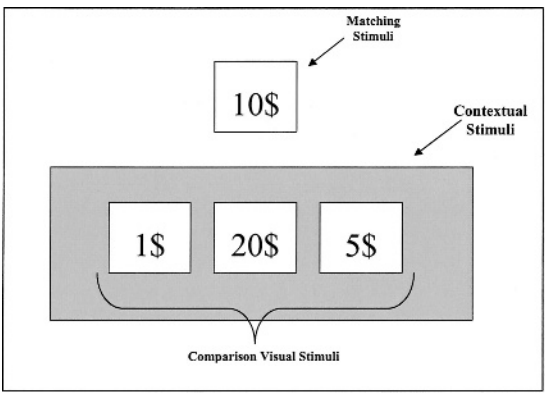


Figure 4. The discrimination training and testing task. The top image represents the sample stimulus, the lower three images represent the comparison stimuli, and the larger shaded rectangle represents the contextual stimulus.

Set B included pictures of a penny, two pennies, a nickel, a dime, and a quarter (see Figure 3).

In addition to the six sets of comparison stimuli, two contextual cues were presented in this condition. The contextual cues were two colored rectangles (yellow or blue) approximately 40 cm by 12 cm. The contextual cues were presented as a rectangle behind the comparison stimuli images (see Figure 4).

At the beginning of the conditional discrimination training condition, the following instructions were presented on the screen:

> You are going to see five images presented on your screen: one image on top, three on the bottom, and one larger image surrounding the three on the bottom. Your job is to choose one of the three images on the bottom of the screen by clicking on it with the mouse. When you are correct you will receive one point. Incorrect responses will not result in awarded points. Please try to earn as many points as you can. The more points you earn, the quicker you will finish. There will be parts of the experiment

where feedback is not given. The computer is still keeping track of your responses so continue to do your best. Do you have any questions?

The experimenter answered additional questions by repeating relevant sections of the instructions. After addressing questions, the experimenter left the room.

All trials of conditional discrimination training involved the same stimulus presentation format throughout. A single sample stimulus was visible in the middle of the screen, and a colored contextual cue (yellow or blue) was presented as a rectangle behind the three comparison stimuli at the bottom of the screen. Participants responded by clicking on one of the three bottom images with the mouse.

During the training phases, a point counter was visible. The counter displayed the cumulative points earned and feedback regarding the correctness of the response (i.e., "good job" or "wrong"). Following a correct response, a 1-s chime sounded, the phrase "good job" was displayed, and one point was added to the cumulative point counter visible at the top of the computer screen. Incorrect responses resulted in a 1-s chord sounding and display of the word "wrong." Following feedback, a 1-s intertrial interval elapsed before the next trial began with the presentation of the relevant sample and comparison stimuli. The relations of greater than and less than were trained in three separate phases using three sets of stimuli.

*Phase 1: Less than.* During this phase the blue contextual cue was presented surrounding the comparison stimuli to train the relation of less than. That is, when the blue cue was presented, a response on the comparison that was less than the sample resulted in programmed positive consequences (e.g., point delivery). Using Set A as an example, if the $5 bill was presented as a sample and the comparisons were $1, $10, or $20, a correct response would be selection of the $1 bill. Stimuli from Sets A, B, and C were randomly presented six times each in an 18-trial block that required the participant to correctly respond to the presented stimuli and contextual cue at 89% accuracy or better to advance to the next phase. If less than 89% accuracy occurred within the block of 18 trials, the participant was presented with another block of 18 trials. Sample stimuli during subsequent less than phases included the $5 bill, two pennies, the grade of B−, the $10 bill, a nickel, and the grade of C+. Comparison stimuli included various arrangements of all remaining 15 stimuli.

*Phase 2: Greater than.* During this phase, the yellow contextual cue was presented surrounding the comparison stimuli to train the relation of greater than. When the yellow cue was presented, a response on the comparison that was greater than the sample resulted in the programmed positive consequences. For example, if the $10 bill was presented as a sample, the correct response would be selection of the $20 bill over $1 and $5 options. All other stimuli and the performance criteria (i.e., 89% accuracy or better) were identical to those used in the less than phase. Sample stimuli during this phase included the $20 bill, a dime, the grade of D−, the $10 bill, a nickel, and the grade of C+. Comparison stimuli included various arrangements of all remaining 15 stimuli.

*Phase 3: Mixed less than and greater than.* During this phase, mixed training between the Phase 1 and Phase 2 contingencies occurred. Stimuli from Sets A, B, and C were randomly presented 12 times each in a 36-trial block, and each contextual cue (blue or yellow) was presented 18 times each. As before, the participant was required to score 89% or better to advance to the next phase. If the 89% criterion was not met, the participant was presented with another bock of 36 trials, after which performance was again evaluated for meeting the 89% accuracy criterion. All sample and comparison stimuli arrangements were identical to those of Phases 1 and 2 and were presented in a randomized order.

*Phase 4: Test.* During this phase, a 54-trial relational test was administered. The stimuli used in the posttest included the three sets of images used during training (left side of Figure 3) as well as three sets of novel pictures (right side of Figure 3) to assess any transfer of function of the greater than and less than contextual cues to novel stimuli. The test contained 30 trials that used the sets of trained stimuli (A, B, and C) and 24 trials that used the sets of novel stimuli (D, E, and F). No feedback or points were provided at any time during this phase. Prior to the first trial of the test, the participant viewed the following instructions: "You will no longer receive feedback following your responses. Continue to do the best you can. The computer is recording your score."

The criterion for completion of this phase was correct responding in the presence of the different stimuli and the relevant contextual cues at 85% accuracy or better (i.e., 46 of 54 trials). If less than 85% correct performance occurred, the participant was reexposed to the mixed training contingencies of Phase 3. Following completion of Phase 3, another exposure to Phase 4 occurred.

### *Slot-Machine Task Posttest*

The purpose of this task was to determine whether the participants exhibited any change in preference between the two simulated slot machines following conditional discrimination training. Participants were reexposed to the exact simulated slot-machine task used during the slot-machine task pretest condition. During this condition, an additional 50 trials were conducted so that direct comparisons could be made with the pretest condition. The same programmed RR schedules (50% probability of reinforcement) from the pretest remained in place for all participants.

## RESULTS

Figure 5 displays each participant's response allocation across the two slot machines during initial exposure to the task. For most participants, responding was relatively equally distributed. No participant showed more than a 20% (10-trial) preference for either option. Across all participants, 49% of responses were allocated to the yellow machine and 51% were allocated to the blue.

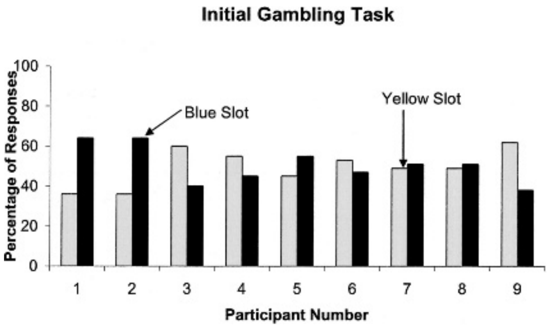


Figure 5. Response allocations across the concurrently available slot machines during initial exposure to the gambling task.

All participants reached criterion responding in the conditional discrimination training and subsequently progressed to the relational test. The number of blocks required to meet criteria during Phase 1 (less than) and Phase 2 (greater than) varied from 10 blocks to one block, with the average being approximately five blocks for less than training and two blocks for greater than training. The number of training blocks required to meet criteria in the mixed training phase varied from five to one, with an average of two training blocks.

Seven of the 9 participants performed at 89% accuracy or better during exposure to the relational test. Two participants required reexposure to the mixed less than and greater than training phase (Participants 2 and 8). Both participants reached mastery criterion with 97% correct during this reexposure in one block of 36 trials. It should be noted that Participant 2 subsequently passed the relational test, whereas Participant 8 scored 70% on the mixed less than and greater than test. Figure 6 displays performance on trained, novel, and combined (i.e.,

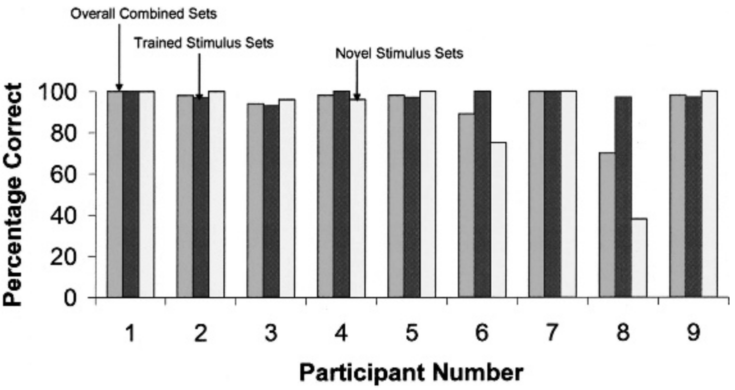


Figure 6. Percentage of correct responses made during conditional discrimination testing conditions for each participant. Overall test performance is displayed in the first of the three bars for each participant, trained stimulus sets in the middle, and novel stimulus sets in the right.

trained and novel) stimulus sets across participants.

A comparison of responding on the slot-machine task pretest and final slot-machine task posttest is displayed in Figure 7. Eight of the 9 participants (the exception was Participant 8) allocated a majority of their responses to the yellow machine during the posttest condition. Together, the participants allocated 81% of their responses to the yellow machine and 19% to the blue machine. A notable exception to this trend occurred with Participant 8. During the initial exposure to the gambling task, Participant 8 allocated 49% of his responses to the yellow slot machine and 51% to the blue machine, thus demonstrating almost exact matching performance. As noted above, this participant required a second exposure to the mixed training phase after failing the discrimination test. Following reexposure to the mixed training and meeting of the criteria, Participant 8 again did not pass the discrimination test. Thus, the only participant who did not show a shift in response allocation on the second slot-machine task was the 1 participant who failed the relational responding test; all other participants allocated their responding to the yellow slot machine.

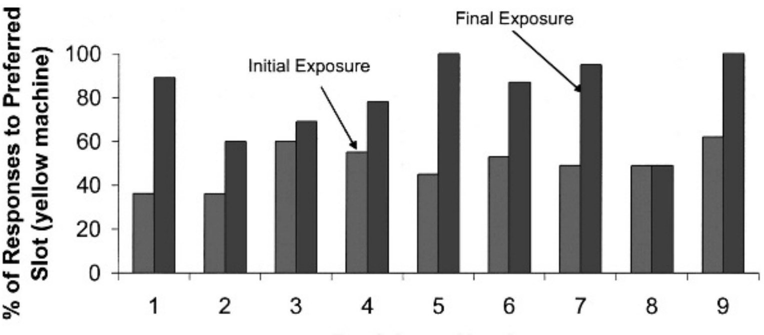


Figure 7. Response allocations to the preferred slot (yellow machine) during initial and final exposure to the slot-machine task.

## DISCUSSION

The current study provided a means of initially assessing response preference for slot machines that had an equal (50%) probability of reinforcement on any given spin. These two response options differed only in color, which allowed a baseline response preference to be established. No participant had a clear preference for one option over the other. During conditional discrimination training, all participants were provided with differential reinforcement for matching a sample stimulus to one of three comparison stimuli that were either greater than or less than the sample, depending on the contextual cue present. After reexposure to the same concurrent schedule consisting of two simulated slot machines, 8 of 9 participants demonstrated a higher preference for one option (the yellow slot machine) than another (the blue slot machine), thus suggesting a transformation of the stimulus functions of greater than (associated with the yellow slot machine) and less than (associated with the blue slot machine). These results are similar to previous investigations in which responding on a novel tasks was altered by training arbitrary relations of more than and less than (Dymond & Barnes, 1995).

The development and transfer of stimulus functions have been shown across a variety of functions, including elicitation of fear (Dougher, 1998), interresponse times and temporal control (Rehfeldt & Hayes, 1998), contextual control (Kohlenberg, Hayes, & Hayes, 1991), as well as other discriminative stimulus functions (Barnes & Keenan, 1993; DeGrandpre, Bickel, & Higgins, 1992). Future research might expand on the present study to examine other transfers of function within a gambling environment. For example, a function could be attached to arbitrary stimuli so that Context X comes to represent "fast" and Context Y comes to represent "slow." Presumably, such an arrangement could be used to differentially reinforce decreases in the frequency of gambling responses among pathological gamblers.

The current results suggest that recreational gamblers may allocate their responding almost equally across concurrently available slot machines of equal probability. It should be noted that our participants were exposed to the slot-machine task for only 50 trials; this may have not been sufficient exposure to generate steady-state responding. That is, the current participants may have been merely sampling both response options during these trials rather than showing a bias in responding toward either option. However, changes in response allocation following training suggest that a clear preference for the yellow (greater than) option developed posttraining. It is also important to note that the current participants were recreational gamblers. It is unknown if similar results would have been obtained with pathological gamblers.

Although the pretest–posttest design used in the present experiment is methodologically limited, it provided an initial foundation for evaluating the possible emergence of self-rules. Nevertheless, the design should be modified in future investigations. For example, the present methodology could be modified to incorporate a multiple baseline across subjects design in which each participant is exposed to varying numbers of pretest (baseline) choices between slot machines before progressing to conditional discrimination training and testing. Other procedural modifications could include alterations in the probabilities of reinforcement on the two simulated slot machines without informing the participant, to assess the resulting potential for insensitivity to subsequent changes in reinforcement probability. Additional manipulations might include examining the effects of significant losing streaks or winning streaks on individual participants (see Rachlin, 1990) along with temporal response patterns such as latency and engagement (Dixon & Schreiber, 2002). Also, future research might assess response allocation immediately following the pretest, such that if a preference for yellow was shown, the computer program would subsequently arrange stimuli such that blue represented greater than and vice versa. The programming structure of our experiment did not permit such changes to be made.

In summary, the present study provided an empirical foundation for the study of gambling behavior among recreational slot-machine players on concurrently available slot machines. Although a translational approach to the study of gambling may limit the implications that can be drawn from the present data, these results suggest that a preference for one type of machine over another can be empirically created through transfers of stimulus functions. Specifically, the current study led to the development of a self-rule through initially neutral or novel stimuli acquiring specific relations without direct training. Nevertheless, additional research on the development of self-rule formation is required. Although we anecdotally deduced that self-rules about which slot machine was greater than or less than were formed, this hypothesis was not directly assessed. Thus, future research might consider incorporating a variety of supplemental measures to examine rule generation. These might include think-aloud procedures in which participants speak aloud during the experiment and resulting verbal behavior is examined for relevant content, a postexperimental questionnaire as to why participants responded a certain way, or intermittently pausing the experiment and asking participants to state why they were responding one way over another.

## REFERENCES

Anderson, G., & Brown, R. I. F. (1984). Real and laboratory gambling, sensation-seeking and arousal. *British Journal of Psychology*, *75*, 401–410.

Barnes, D., & Keenan, M. (1993). A transfer of functions through derived arbitrary and nonarbitrary stimulus relations. *Journal of the Experimental Analysis of Behavior*, *59*, 61–81.

Davison, M., & McCarthy, J. (1988). *The matching law.* Hillsdale, NJ: Erlbaum.

DeGrandpre, R. J., Bickel, W. K., & Higgins, S. T. (1992). Emergent equivalence relations between interoceptive (drug) and exteroceptive (visual) stimuli. *Journal of the Experimental Analysis of Behavior*, *58*, 9–18.

Dixon, M. R. (2000). Manipulating the "illusion of control": Variations in risk-taking as a function of perceived control over chance outcomes. *The Psychological Record*, *50*, 705–720.

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

Dixon, M. R., Marley, J., & Jacobs, E. (2003). Delay discounting of pathological gamblers. *Journal of Applied Behavior Analysis*, *36*, 449–458.

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

Dougher, M. J. (1998). Stimulus equivalence and the untrained acquisition of stimulus functions. *Behavior Therapy*, *29*, 577–591.

Dymond, S., & Barnes, D. (1995). A transformation of self-discrimination response functions in accordance with the arbitrarily applicable relations of sameness, more than, and less than. *Journal of the Experimental Analysis of Behavior*, *64*, 163–184.

Ghezzi, P., Lyons, C., & Dixon, M. R. (2000). Gambling from a socioeconomic perspective. In W. K. Bickel & R. E. Vuchinich (Eds.), *Reframing health behavior change with behavioral economics* (pp. 313–338). New York: Erlbaum.

Harvard Mental Health Letter. (1996). *Pathological gambling.* Retrieved September 13, 2001, from http://firstsearch.oclc.org/FETCH:…ml/fsfull-text.htm%22:/fstx23.htm

Hayes, S. C., Barnes-Holmes, D., & Roche, B. (2001). *Relational frame theory: A post-Skinnerian account of human language and cognition.* New York: Kluwer Academic.

Kohlenberg, B. S., Hayes, S. C., & Hayes, L. J. (1991). The transfer of contextual control over equivalence classes through equivalence classes: A possible model of social stereotyping. *Journal of the Experimental Analysis of Behavior*, *56*, 505–518.

Kroeber, H. L. (1992). Roulette gamblers and gamblers at electronic game machines: Where are the differences? *Journal of Gambling Studies*, *8*, 79–92.

MacLin, O. H., & Dixon, M. R. (2004). A computerized roulette simulation to investigate the variables involved in gambling behavior. *Behavior Research Methods, Instruments, and Computers*, *36*, 96–100.

MacLin, O. H., Dixon, M. R., & Hayes, L. J. (1999). A computerized slot machine simulation to investigate the variables involved in gambling behavior. *Behavior Research Methods, Instruments, and Computers*, *31*, 731–735.

Rachlin, H. (1990). Why do people gamble and keep gambling despite heavy losses. *Psychological Science*, *1*, 294–297.

Rehfeldt, R. A., & Hayes, L. J. (1998). Untrained temporal differentiation and equivalence class formation. *The Psychological Record*, *48*, 481–510.

Saunders, K., & Williams, D. (1998). Stimulus equivalence. In K. A. Lattal & M. Perone (Eds.), *Handbook of research methods in human operant behavior* (pp. 193–228). New York: Plenum.

Skinner, B. F. (1953). *Science and human behavior*. New York: Appleton-Century-Crofts.

Skinner, B. F. (1972). *About behaviorism*. New York: Knopf.

Slutske, W. S., Eisen, S., True, W. R., Lyons, M. J., Goldberg, J., & Tsuang, M. (2000). Common genetic vulnerability for pathological gambling and alcohol dependence in men. *Archives of General Psychiatry*, *57*, 666–673.

Weatherly, J. N. (2004). The best we have: A critique of Ladouceur, Sylvain, Boutin, and Doucet's *Understanding and Treating the Pathological Gambler*. *The Behavior Analyst*, *27*, 119–124.

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