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CHOICE BEHAVIOR OF NONPATHOLOGICAL WOMEN PLAYING CONCURRENTLY AVAILABLE SLOT MACHINES: EFFECT OF CHANGES IN PAYBACK PERCENTAGES

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In a simulated casino environment, 6 nonpathological women played concurrently available commercial slot machines programmed to pay out at different rates. Participants did not always demonstrate preferences for the higher paying machine. The data suggest that factors other than programmed or obtained rate of reinforcement may control gambling behavior, which should encourage behavior analysts to look beyond direct, contingency-driven explanations of gambling.

DESCRIPTORS: choice, concurrent schedules, gambling, nonpathological gamblers, rate of reinforcement

Gambling is both a serious societal problem and a popular pastime (see Petry, 2005). The literature on gambling is vast, but little of it is experimental or behavior analytic (see Weatherly & Phelps, 2006), which is unfortunate given the potential contributions of behavior analysis to the study of gambling (Dixon & Holton, 2009; Weatherly & Dixon, 2007). Basic research shows that organisms are generally (e.g., Herrnstein, 1961), but not perfectly (e.g., Baum, 1974), sensitive to relative rates of reinforcement. However, several studies from our laboratory have failed to find such sensitivity when participants gamble (Gillis, McDonald, & Weatherly, 2008; Weatherly & Brandt, 2004). These studies assessed sensitivity across conditions or sessions rather than when the options were presented concurrently, which may have hindered discrimination (e.g., Shah, Bradshaw, & Szabadi, 1989).

The present study attempted to determine whether individuals given multiple opportunities to play concurrently available slot machines in a simulated casino environment would demonstrate sensitivity to reinforcement by choosing to play the higher paying machine. The primary focus was not whether players could ever display such sensitivity, but rather if they would do so under conditions that mimicked those faced in actual casinos.

METHOD

Participants. Six women who scored less than 5 on the South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987) participated. Women were recruited because women, as opposed to men, tend to prefer gambling on slot machines (e.g., Mok & Hraba, 1991). All 6 were Caucasian. Jan, April, May, June, Juli, and Nova were 45, 47, 40, 44, 41, and 24 years of age, respectively. Four were married; two were single. One had an annual income of below $10,000, 2 earned between $25,000 and $34,999, and 3 earned more than $35,000.

Materials and apparatus. Participants provided informed consent and then completed the SOGS, a demographic questionnaire, and the

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Gambling Functional Assessment (GFA; Dixon & Johnson, 2007) prior to gambling. They completed the SOGS again following the final gambling session to assess potential negative effects of the procedure.

The demographic questionnaire asked participants' sex, age, marital status, race or ethnicity, and annual income. This information was requested because each is related to a known risk factor for pathological gambling (Petry, 2005). The SOGS is a 20-item self-report questionnaire designed to measure participants' gambling history. It is the most widely used screen for the potential presence of pathological gambling (Petry). Scores of 5 or more on the SOGS suggest the possible presence of pathology. Participants had to score below 5 on the initial administration of the SOGS to participate. Jan, April, May, June, Juli, and Nova scored 0, 0, 1, 3, 1, and 0, respectively.

The GFA is a 20-item self-report questionnaire designed to identify the consequences that maintain respondents' gambling. The four possible consequences are sensory experience, escape, attention, and tangible rewards. The top score in any category is 30, with the highest score indicating the primary reinforcing consequence.

Three slot machines were used: a ''Triple Diamond'' that allowed the player to bet one to two coins per play, a ''Red, White, and Blue'' (wild) that allowed the player to bet one to three coins per play, and a ''Sizzlin 7's'' that allowed the player to bet one to three coins per play. The overall payback percentage for each machine could be altered by changing a computer chip on the internal control panel (between sessions). Each machine took tokens worth $0.05 each and was equipped with an internal counter that recorded the number of coins put into the machine and the number of coins dispensed. All wins were dispensed in tokens rather than accumulated as credits on the machine so that the number of coins won could be tracked. The number of trials played was recorded by hand.

Procedure. Participants were observed individually. Before the first session, the participant completed the informed consent process and the questionnaires. In the first session, the researcher gave each participant the identical instructions: She would be staked with 100 tokens ($5 total) for each session; she could play two of the slot machines, which were identified to her each session; she could freely switch between the two slots during the session. Sessions ended when the participant decided to quit or 20 min had elapsed. Participants were informed that they would be paid in cash at the end of the study for all the tokens they accumulated across the sessions. Participants were allowed to withdraw tokens from their accumulated amount for additional play if they lost all 100 tokens in a session.

The researcher remained in the room to record the number of plays on each machine (i.e., a lever pull or button press that made the reels spin) and whether the participant always bet the same number of tokens per play, but did not record the bet size for every individual play. Agreement was assessed by comparing the coins played (as registered by the counter on the machine) to the number of plays recorded by the researcher for sessions in which the participant always bet the same number of tokens per play. A constant bet size was noted in 72 of the 117 sessions (and thus the number of trials played multiplied by the constant bet per trial should equal the number of tokens played according to the machine's counter). The hand-recorded data perfectly corresponded to the coins played in 67 of those 72 sessions (93%).

Participants played each pair of machines at certain payback percentages. Once the participant met the criterion for stability (exclusive or near-exclusive preference for one machine across two or more sessions based on visual inspection of the data), the researcher changed the payback percentage on one or both machines. The

exception to this rule was for Juli in the first condition, in which she displayed a reliable pattern of switching preference between machines. For Juli, the researcher changed conditions after she had displayed seven consecutive sessions with a shift in machine preference. Although the difference in payback percentages was small, they were chosen because they are those used in casino slot machines (as were the overall payback percentages used in the study). All three machines were used, so changing conditions sometimes entailed changing machines. This practice helped prevent bias for a particular machine but confounded changes in payback percentage with a change in other factors (e.g., maximum bet per play, the visual and auditory stimuli that occurred during play). Again, however, this procedure mimicked an actual casino environment, which presents players with a variety of machines.

The number of conditions, number of sessions per condition, and the payback percentages on the slots for each participant in each condition are shown in Figure 1. Payback percentage refers to the percentage of the original bet that would be expected to be returned, on average, over an indefinite period of play. Anything below 100% represents a contingency in which the player will lose over time, perhaps slowly (e.g., 98% payback) or quickly (e.g., 85%). Because of the probabilistic nature of a slot machine, coupled with the fact that participants did not play over an indefinite period of time, it was possible for obtained payback percentages to differ from programmed percentages. Condition length differed depending on participants' schedules and the stability of their data. After the final session, participants completed the SOGS a second time, answered two questions on how they had gambled, were paid, debriefed, and dismissed.

RESULTS AND DISCUSSION

GFA scores suggested most participants gambled for similar reasons. Jan had never gambled and scored 0 in each category. The other participants had scores in at least one GFA category (April: sensory = 6, tangible = 4; May: tangible = 5; June: sensory = 4, tangible = 4; Juli: sensory = 6; Nova: sensory = 7, escape = 3, tangible = 7). Mean number of trials (mean bet per trial) were 99.8 (1), 65 (2.9), 36.4 (2.2), 44.6 (2.1), 48.4 (2.3), and 64 (1.3) for Jan, April, May, June, Juli, and Nova, respectively. They experienced overall payback percentages of 97.9%, 90.3%, 78.4%, 91.8%, 75.2%, and 139.9%, respectively.

Figure 1 presents the percentage of the total coins played by each participant in each session on the slot that was programmed to provide the highest payback percentage. With the exception of Juli, participants rarely switched machines in a session. In only 19 of the 117 total sessions were both machines played in the same session. The same was true within conditions; across the 25 total conditions, participants played one machine exclusively in a particular condition in 13 conditions.

Figure 1 provides little evidence that programmed payback percentage governed behavior. Jan, April, and May frequently played exclusively on the machine with the highest programmed payback percentage, but did so fortuitously. That is, they never played the other machine, so one cannot conclude that their play was the outcome of stimulus control by the programmed contingencies. In fact, had they played the other machine, it is possible that a higher obtained payback percentage would have been experienced on the machine with the lower programmed payback percentage, an outcome that was observed in several conditions for several participants (asterisk in Figure 1). Further, there were several discrepancies between gambling behavior and both the programmed and obtained payback percentages. In only 5 of the 25 possible conditions did participants play both slot machines and then come to display exclusive preference for the slot machine that paid out at the higher rate.

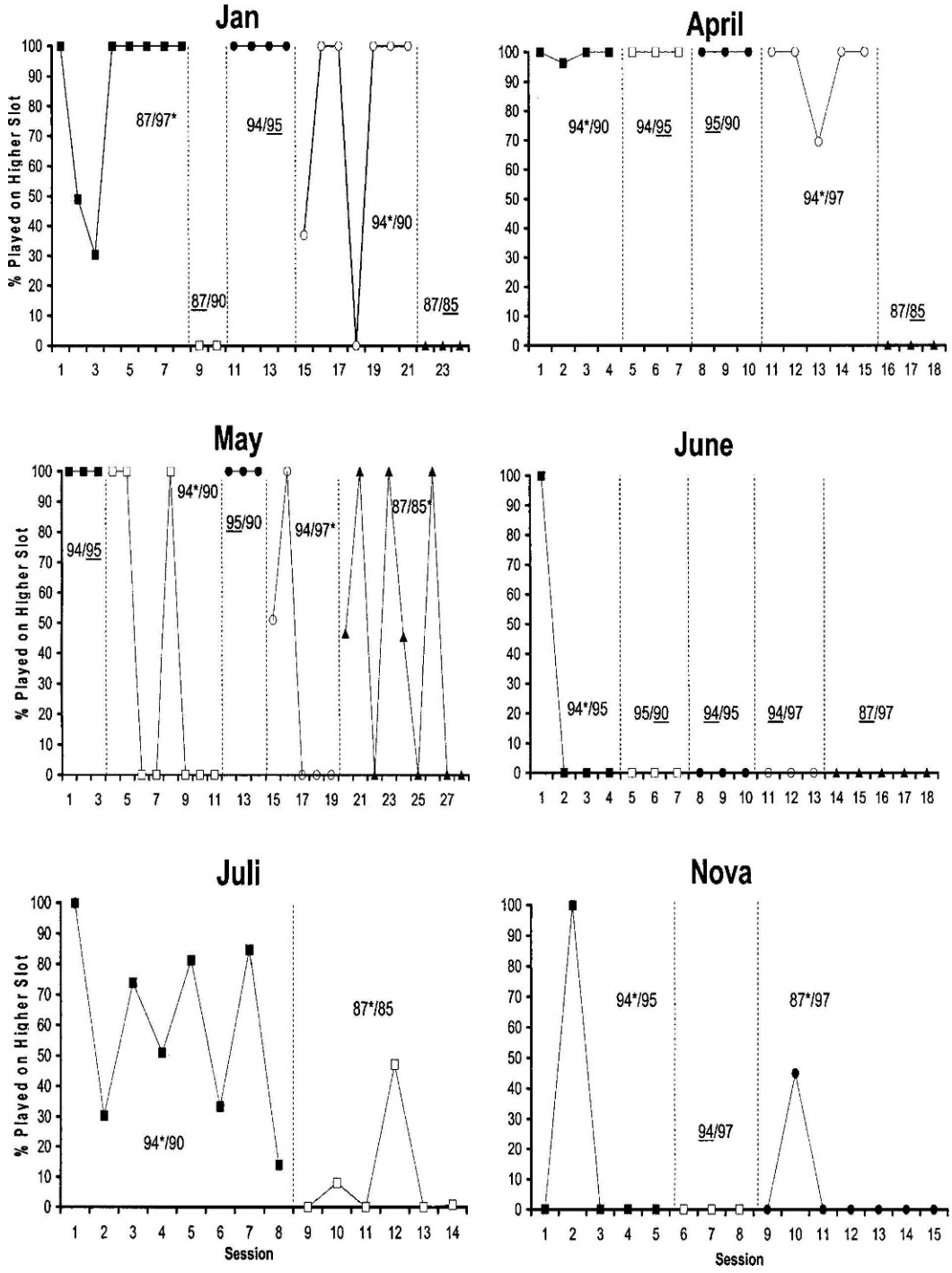

Figure 1. The percentage of the coins played on the slot machine that had the highest programmed rate of payback in each session for each participant. The ratios displayed in each panel represent the different probabilities programmed on the two different slot machines. The asterisk represents the slot machine that had the highest obtained (vs. programmed) payback percentage in conditions in which both machines were played. The underscore indicates that the participant displayed exclusive choice of that particular machine; the other machine was not played during that condition.

The researcher asked each participant ''What strategy did you use when playing?'' and ''How did you choose between machines?'' Although anecdotal and not open to experimental analysis, in no case did any participant indicate that overall payback rate was governing her behavior.

The present results have limitations. Participants were faced with choosing between slots that differed in multiple ways, not just by payback percentage. This procedure maximized external validity by mimicking the conditions gamblers face in actual casinos. The present results may not apply to men or to certain groups of women. One could also argue that sensitivity to payback percentages and to differences in payback percentages would have emerged had the current participants been given further opportunities to gamble. Finally, participants did not gamble with their own money. Ethical considerations dictated staking money, but research suggests that individuals take steps to avoid the loss of staked money (see Kahneman, Knetsch, & Thaler, 1990) and that participants gamble more conservatively with even small amounts of staked money than for credits with no monetary value (Weatherly & Brandt, 2004; Weatherly & Meier, 2007).

The current data are consistent with the idea that participants' gambling was rule governed. Jan nearly always played only 100 tokens and bet only one token at a time. June and Nova reliably displayed exclusive preference for a particular slot, despite extended experience with a poor payback percentage. Verbal responses suggest that preferences for a machine emerged for reasons other than payback rates, consistent with recent research (e.g., Zlomke & Dixon, 2006) and theories of gambling (e.g., Weatherly & Dixon, 2007).

The present findings do not demonstrate that people can never discriminate a very high-paying from a very low-paying machine under controlled conditions, but they do show that such discrimination may not emerge under conditions found in casinos. From a treatment standpoint, behavior analysts would be wise to identify procedures that help gamblers to discriminate payback rates. It is also important for them to recognize that gambling behavior may be largely rule governed.

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