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SLOT-MACHINE PREFERENCES AND SELF-RULES

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The present study was a replication and extension of Zlomke and Dixon (2006) investigating the impact of contextually trained discriminations on slot-machine gambling. In each of two experiments, 20 participants were exposed to two concurrently available slot-machines differing only in color. Thus, Experiment 1 was a replication, while in Experiment 2 we included an instruction to ensure that the participants attended to all of the onscreen stimuli. Following a pretest of slot machine preferences, a nonarbitrary relational training and testing procedure was used to establish contextual functions of MORE-THAN and LESS-THAN for two cues. After relational training the participants were exposed to a posttest identical to the pretest. The results of Experiment 1 showed that only a small number of the participants allocated their posttest responses to the slot machine that shared nonarbitrary properties with the contextual cue for MORE-THAN. In Experiment 2, the posttest showed that an increased number of participants who reported having attended to the contextual stimulus increased their preference to gamble on the yellow slot machine.

Keywords: Gambling, slot-machines, non-arbitrary relational training, self-rules, transformation of functions, instructions.

There has been an increase in gambling related problems over the last decade. The literature describes a prevalence of pathological gambling usually between 1-3%, but some studies report prevalence rates up to 10% (e.g., Petry, 2005). Oren and Bakken (2007) found that about 0.7% of people aged between 16 and 75 years in Norway reported gambling problems. However, it is important to be aware that there are no casinos in Norway. Thus, Norwegian gamblers may participate in different betting games hosted by Norsk Tipping, a governmental company that control gambling in Norway. A Norwegian study showed that slot-machines were a highly preferred form of gambling: 61% of the total amount of money spent on gambling was related to slot machines (Oren & Bakken, 2007; Stiftelsestilsynet, 2006).

The behavior analytic approach to understanding gambling is a growing field. Thus, many authors have argued that a behavioral model of gambling would extend and help us to understand variables related to gambling. Furthermore, such an approach would make possible effective treatment for pathological gamblers (Dixon, 2007; Ghezzi, Lyons, Dixon, & Wilson, 2006). There are several variables that seem to be important for the understanding and analysis of gambling behavior. For example, gambling behavior will occasionally lead to reinforcement. A well-known fact is that behavior maintained by intermittent reinforcement is known to have a high, stable response rate and resistance to

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extinction (Ferster & Skinner, 1957). Intermittent reinforcement can be one of several reasons why people continue gambling and it seems important to find out why people choose to gamble on specific slot machines or other games. Factors like stimulus control, contextual control by sound, light or colors and verbal behavior must be manipulated and analyzed to see if these factors can control and predict gambling behavior.

Gambling behavior leads to many problems and therefore, it is important to find out more about the variables that lead to or maintain gambling and pathological gambling in order to help people suffering from problems related to gambling. Experiments with people in real gambling environments could, of course, give us relevant knowledge, but it is difficult to conduct experiments with participants' own money, mainly for ethical reasons. With respect to problems with generalization, we might simulate gambling in controlled settings, using technological solutions and artificial reinforcers, even though this is far from a real gambling situation (Weatherly & Meier, 2007; Weatherly & Phelps, 2006). By using recreational gamblers as participants, experiments with simulated gambling have been conducted by some researchers (e.g., Daugherty & MacLin, 2007; Dixon & Schreiber, 2002; MacLin, Dixon, & Hayes, 1999; Weatherly, Austin, & Farwell, 2007).

For instance, Zlomke and Dixon (2006) conducted an experiment showing that slot-machine gambling can come under contextual control by using conditional discrimination training. First, the participants gambled on simulated slot-machines on a PC (MacLin, Dixon, Robinson, & Daugherty, 2006). Nine participants could chose between two concurrently available slot-machines differing only in the colors, yellow and blue. After playing the slot-machines, the participants were trained to choose a comparison stimulus greater than the sample stimulus with a yellow contextual cue present, and to choose a comparison stimulus less than the sample stimulus with a blue contextual cue present. Lastly, the participants were presented with the same simulated slot-machines. The results showed that eight of nine participants allocated most of their responses to the yellow slot machine after conditional discrimination training.

Recently, two studies have tried to replicate Zlomke and Dixon's (2006) findings. The first study by Hoon, Dymond, Jackson, and Dixon (2007) reported mixed success with several variations of the original training procedure. The second study by Hoon, Dymond, Jackson, and Dixon (2008) replicated Zlomke and Dixon (2006), although the change in preferences was not as strong. Despite the small differences in subsequent replications and extensions, Zlomke and Dixon (2006) argued that self-rules acquired through conditional discrimination training can maintain certain responses related to slot machine gambling. Their explanation was related to transformation of functions (see Dymond & Rehfeldt, 2000), which is said to occur when the functions of one stimulus are altered or transformed by virtue of the derived relation between it and another stimulus. The differing procedures employed and results obtained from the Hoon et al. (2007, 2008) studies indicates that more research needs to be conducted to contribute to a better understanding of transformation of functions related to gambling behavior.

The purpose of the current study was to run two experiments with a Norwegian sample of participants by manipulating two contextual cues. In the first experiment, we wanted to replicate and further extend the study of Zlomke and Dixon (2006). In the second experiment, we introduced an instruction to ensure that the participants attended to all the stimuli on the screen.

EXPERIMENT 1
METHOD

Participants

Twelve women and eight men over 18 years old, all students or fulltime workers, participated in this experiment. Everyone reported knowledge of slot machines. None reported any gambling problems. The two first authors recruited participants, and participation was voluntary. Everyone was told that they could withdraw from the experiment whenever they wanted to do so. After the experimental session, participants received a booklet about behavior analysis.

Apparatus and setting

The experimental sessions took place in small rooms (3.5 meters by 4 meters) containing a chair, a desk, office equipment and a computer. Participants were alone in the room during the experiment, but one or both of the two first authors were available for questions in the room next door. A computer controlled presentation of stimuli and data collection. The software program was made by Mark Dixon and coworkers in Microsoft® Visual Basic 6.0, but we used Microsoft® Visual Basic 2008 Express Edition to run it. Three IBM-compatible laptops, one containing an Intel® Pentium® M 1,73 GHz processor and 512 MB RAM, and two containing an Intel® Pentium® 1.66 GHz processor and 512 MB RAM ran the Microsoft Windows XP Professional operating system, version 2002 with Service Pack 2 were used in the experiment.

Procedure

Slot-Machine Task Pretest. The purpose of this pretest was to acquire baseline data on participants' response allocation toward two simulated slot-machines that were equal concerning pay-off probability and reinforcement magnitude, but differed in color. One of the slot-machines was yellow, and the other slot-machine was blue. This phase of the experiment started with the following instructions displayed on the computer screen (the text in Norwegian was available on the table beside the PC):

> On the following screen you will see a button in the middle of the screen. When you click on the button with your mouse, two slot machines will be revealed. Click your mouse on the slot machine you would like to play and earn as many points as possible.

The experimenter answered any questions by repeating the instructions in Norwegian and then left the room. Then, two buttons were presented on the screen. One of the buttons was blue with the text "Slot Machine 1", and the other button was yellow with the text "Slot Machine 2". The buttons were approximately 4 x 8 cm. A mouse click on either button resulted in the presentation of a slot-machine with the same color as the button selected. Each participant started a trial by clicking a button with the text "Spin". Clicking the spin-button resulted in spinning the machine reels for approximately 3s and one credit being subtracted from the participants "cumulative credits" (initially set at 100). Three identical symbols on the payoff line resulted in two credits added to "cumulative credits" and the text "AWESOME… YOU WIN!!" presented on the screen. Any other variation on the pay-off line resulted in removal of the initially bet credit.

A button with the text "Press HERE to continue" was presented on the screen, and by clicking this button trials were repeated as described above. To avoid the possibility for position bias, the blue and yellow buttons were randomly positioned on either side of the screen across trials. In addition, an observer response was instated between all trials, by the presentation of a button with the text "Click here".

Each slot-machine was programmed on a RR schedule of reinforcement with a probability of reinforcement of .5 and the magnitude of reinforcement was held constant. The RR sequence was generated by the program,

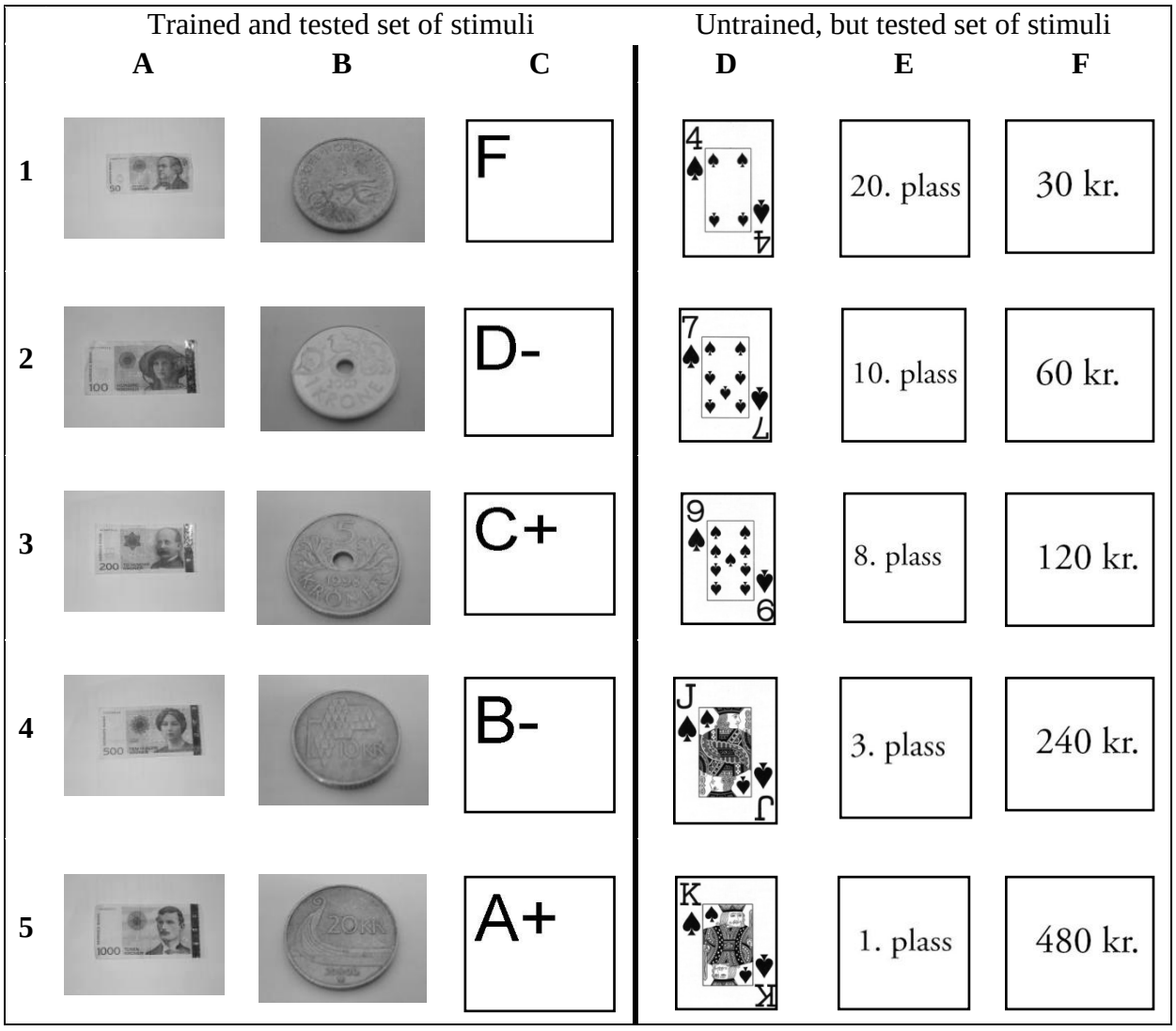

Figure 1. Overview of the stimuli sets which were used in the conditional discrimination training and tests.

and resulted in identical sequences and density of trial outcomes for each participant, as well as identical amount of reinforcers obtained. Each participant ended this task after 50 trials with 100 credits.

Conditional Discrimination Training. Following the slot-machine pretest, conditional discrimination training was conducted to establish the relations of less than (blue) and greater than (yellow). In this condition, the participants were instructed to choose one of three comparisons presented below a single sample stimulus, by mouse clicking one of the comparisons (i.e., only one of the three comparisons would be the correct one in presence of a sample stimulus). There was never two comparisons worth "more than" sample if the contextual cue indicated more than. Similarly, there was never two comparison worth "less than" the sample if the contextual cue indicated less than. Six sets of five stimuli and two contextual cues were used during this procedure. Each of the six sets contained five images or words, and the contextual cue was

presented as a blue or yellow rectangle behind the comparisons.

As shown in Figure 1, each of the six sets represented a continuum from least to most. Three of the sets was stimuli related to gambling (playing cards, bills, and coins), while three of the sets not was related to gambling (letter grades on universities, placement in competitions, and written amounts). For example, Set B included pictures of a Norwegian ”50-oring” coin, ”1-krone” coin, ”5-krone” coin, ”10-krone” coin and ”20-krone” coin. The pictures were approximately 5 x 5 cm. The contextual cue was approximately 20 x 8 cm.

At the beginning of the conditional discrimination training condition, the following instructions were presented on the screen (the text in Norwegian was available on the table beside the PC):

> 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 your 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 any questions by repeating the relevant part of the instructions in Norwegian and then left the room. During the training phases, a point counter was visible. The counter displayed the cumulative points earned by each correct choice. In addition, a correct answer resulted in the text “Correct” and a 1 s chime. Incorrect choices resulted in the text “wrong” and a 1 s chord. The relations of greater than and less than were trained in three separate phases using three sets of stimuli. Number of trials to criterion in training and test phase was preprogrammed by Dixon and coworkers. There were no limits for number of trials for each participant, and participants were requested to leave if they did not reach mastery criterion.

Less than. The purpose of this phase was to train the relation of less than. When the sample stimulus was presented, comparisons were presented with a blue contextual cue. A click on the comparison less than sample stimulus resulted in the programmed positive consequence. A click on any other comparison resulted in the programmed negative consequence. For example, when the ”5-krone” coin was shown as sample, with the ”1-krone” coin, the ”10-krone” coin and the ”20-krone” coin as comparisons, clicking the ”1-krone” coin would be the correct response in Phase 1. Stimuli from sets A, B, and C were randomly presented. Each block consisted of 30 trials, and 27 correct answers resulted in advance to the next phase. If this criterion was not met, the block of 30 trials was re-presented.

Greater than. The purpose of this phase was to train the relation of greater than. When the sample stimulus was presented, comparisons were presented with a yellow contextual cue. A click on the comparison greater than sample stimulus resulted in the programmed positive consequence. A click on any other comparison resulted in the programmed negative consequence. For example, when the ”10-krone” coin was shown as sample, with the ”1-krone” coin, the ”5-krone” coin and the ”20-krone” coin as comparisons, a click on the ”20-krone” coin would be the correct response in Phase 2. Stimuli from sets A, B, and C were randomly presented. Each block consisted of 30 trials, and 27 correct answers resulted in advance to the next phase. If this criterion was not met, the block of 30 trials was re-presented.

Mixed less than and greater than. During this phase, blue and yellow contextual cues were presented randomly 30 times each in a 60-trial block. A correct answer had to meet

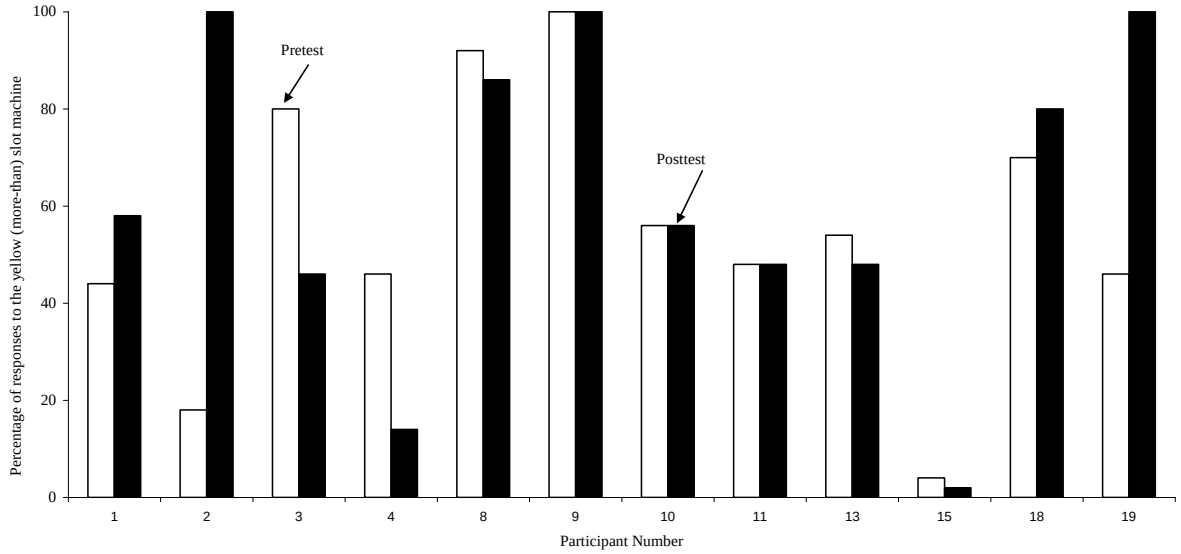

Figure 2. Percent of responses on the yellow slot machine in pre- and posttest in Experiment 1.

the criterion described in Phase 1 and 2. The same stimulus sets as used in Phase 1 and 2 were used. Each block consisted of 60 trials, and 55 correct answers resulted in advance to the next phase. If this criterion was not met, the block of 60 trials was re-presented.

Test. This phase consisted of 120 trials. In addition to stimulus sets A, B, and C, the novel stimulus sets D, E, and F were used to test if the trained relations between contextual cue and comparisons are applied to novel stimuli. The criterion for correct and incorrect choices was the same as in the past phases. Before the first trial in Phase 4, the following text was displayed on the screen: "You will no longer receive feedback following your responses. Continue to do the best you can. The computer is recording your score" (Available on the table was a Norwegian translation). No feedback or points were provided at any time during this test. The criterion for completion of Phase 4 was 103 correct answers in a block of 120 trials. If this criterion was not met, Phase 3 (Mixed training) was re-presented. Completion of Phase 3 then resulted in presentation of a 120-trial block in Phase 4, and so one until participants met criterion.

Slot-Machine Task Posttest

The purpose of this task was to determine whether the participants had changed their preferences and allocated their responses differently than in the pretest. Participants were re-exposed to the exact same slot-machines and conditions as in the pretest.

RESULTS

Twelve participants reached the trials to criterion and finished Experiment 1 (see Figure 2). At pretest, participants chose the yellow slot-machine between 4% and 100% (M = 55%, SD = 27.9). The blue slot-machine was chosen between 0% and 96% (M = 45%, SD = 27.9) at pretest. These findings indicate that some of the participants showed a preference for one of the two slot-machines before conditional discrimination training. Twelve participants who completed conditional discrimination training in Phase 1 took between one and seven blocks to meet criteria (M = 2), in Phase 2 from one to three blocks (M = 2), and in Phase 3 between one to four blocks

Table 1
Data from participants who failed to complete the experiment

Experiment	Participant	Quit During Phase	Number of training blocks in final phase	Number of training trials in final phase	Variation in number of correct responses in final phase		Total number of minutes before requesting to leave
					Lowest - highest	Mastery criteria	
1	5	3	11	644	32-40	55	101
	6	3	21	1240	37-48	55	136
	7	3	12	737	14-29	55	72
	12	2	13	397	10-20	27	69
	14	3	21	1272	30-40	55	121
	16	3	16	918	19-33	55	85
	17	4	3	349	87-97	103	120
	20	3	27	1611	20-34	55	176
2	23	3	6	389	31-48	55	92
	28	4	2	909	39-60	103	133

(M = 2). All twelve participants reached the criterion in Phase 4 in one block. Only four of the twelve participants played more on the yellow slot-machine in the posttest; three participants gambled equally on the slot-machines in pre- and posttest, and five participants gambled less on the yellow slot-machine during posttest, as shown in Figure 2. On average, the participants chose to play 55% on the yellow slot-machine in the pretest and 62% on the yellow slot-machine in the posttest. A t-test indicated that the difference between pre- and posttest was not statistically significant (t (11) = 0.49, (α = 0.05)).

Table 1 shows data for eight participants who chose to withdraw from the experiment before they had completed discrimination training. Session-length for these 8 participants ranged between 69 to 176 minutes (M = 110 minutes), while the participants who completed the conditional discrimination training phase took only 35 minutes on average. In summary, 12 out of 20 participants completed all phases of the Experiment 1, but only 4 showed an increase in preference for the yellow slot machine at posttest.

DISCUSSION

The results from Experiment 1 did not replicate the findings of the Zlomke and Dixon (2006) study. The participants in the current study showed much more variation in their allocation of responses between the slot-machines than participants in Zlomke and Dixon (2006). Our findings from the 12 participants who completed the experiment show an average increase in preference of 7% for the yellow slot-machine, while Zlomke and Dixon (2006) reported a 32% increase. There are several possible explanations for this. First, we used another version of the simulated slot-machines. Our participants choose slot-machines by clicking yellow or blue quadrangle with the written words ”Slot Machine 1” or ”Slot Machine 2”. Participants in Zlomke and Dixon (2006) choose between two concurrently slot-machines, and clicked the one they wanted to continue with for the gambling. The differences in procedures may not be essential since the total number of clicking-responses to access the preferred slot-machine were the same in both experiments. Second, the version we used required at least 240 trials during conditional discrimination training. Zlomke and Dixon’s (2006) version required at least 136 trials. This indicates that the participants in the current study

were exposed to more trials in the conditional discrimination training in training yellow color to "more-than" than the participants in Zlomke and Dixon (2006). Nevertheless, the participants in the current study showed a lesser change in preference than in Zlomke and Dixon (2006). Third, we replaced the US training stimuli (pictures of money) with Norwegian training stimuli, we translated written words to Norwegian, and amount of money (US $) was calculated to Norwegian kroner (NOK). We did this to avoid unfamiliarity with the training stimuli from influencing the results. Fourth, verbal reports from at least one participant told us that it was possible for the participants to reach trials to criterion for all phases in conditional discrimination training without paying attention to the contextual cue. This is possible because to avoid that more than one comparison stimulus could be "the right one" at the same time, only one of three comparisons would be "more-than" or "less-than" sample stimulus, as pointed out in Hoon et al. (2007). Two comparisons would always be "the wrong ones". Participants could choose the comparison that was the only one "more-than" or the only one "less-than" sample stimulus and receive feedback, and reach trials to criterion in all phases, without noticing the color of the contextual cue. Eight of twenty participants did not continue with the experiment after struggling to reach trials to criterion in the conditional discrimination training. In contrast, all nine participants in Zlomke and Dixon's (2006) study met the criterion for conditional discrimination training and finished the experiment.

It is possible that instructions could influence different types of attending behavior. Some studies have discussed the influence of general and specific instructions in conditional discrimination procedures (Arntzen, Vaidya, & Halstadtro, in press; Pilgrim, Jackson, & Galizio, 2000; Smyth, Barnes-Holmes, & Barnes-Holmes, 2008) and there is need for further research. Therefore, the purpose of Experiment 2 was to study the effects of extra instructions on the importance of attending to all stimuli on the screen. The instruction was given to the participants who did not reached trial to criterion within a time limit in training conditional discrimination. A short post-experimental interview was conducted to determine if participants noticed the contextual cue during the conditional discrimination training.

EXPERIMENT 2
METHOD

Participants

In the current experiment twenty adults participated, eleven women and nine men. Everyone was more than eighteen years old and had a full time job. All the participants said they had knowledge about slot machines, but no one reported when asked to have any gambling problems. The participants participated voluntarily and were recruited by the two first authors. Before the experimental session started, everyone was told that they could withdraw from the session at any time. After the experiment, all participants received a booklet about applied behavior analysis.

Procedure

The procedure was the same as in Experiment 1 except for two important differences. First, if a participant had not finished the experiment after sixty minutes, the experimenter interrupted the study, repeated the start instruction and emphasized to the participant that they should attend to all the five different images on the screen. The experimenter pointed to the image on top of the screen, the three below and the large image that encompassed the three below to draw participants' attention to the contextual cue of the background color. Second, we conducted a brief interview with every participant who finished the experiment. The following question was asked: "How did you solve the task where

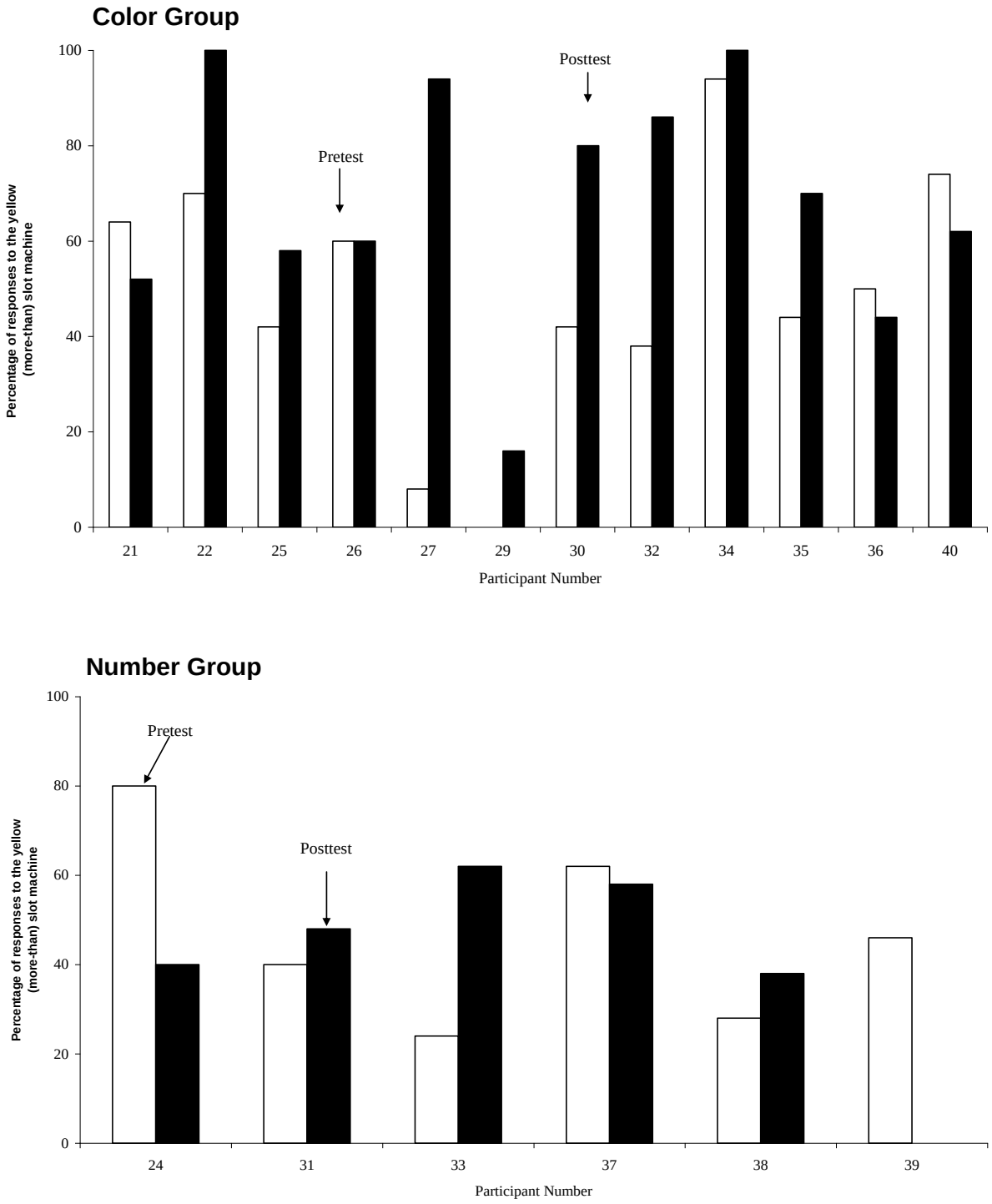

Figure 3. The upper panel shows the percent of responses on the yellow slot machine in pre- and posttest for the Color Group (the participants that reported to have attended to the contextual stimulus in the training phase) in Experiment 2. The lower panel shows the percent of responses on the yellow slot machine in pre- and posttest for the Number Group (the participants that reported not to have attended to the contextual stimulus in the training phase) in Experiment 2.

you were going to choose between three images?" We asked the question to determine if the participants had attended to the color of the contextual stimulus or the number of comparison stimuli.

RESULTS AND DISCUSSION

Eighteen participants finished Experiment 2. In the pretest, the choices for the yellow slot machine were from 0% to 94 % (M = 48%, SD = 24.3), while the blue slot machine was chosen from 6% to 100% (M = 52%, SD = 24.3). This finding indicates that some of the participants had a preference for one of the slot machines before the conditional discrimination training was introduced. Thus, the finding is also in accordance with the results in Experiment 1.

The eighteen participants who finished the conditional discrimination training in Phase 1 took between one and nine sessions (M = 3 sessions), between one and five sessions (M = 2 sessions) in Phase 2, and between one and fifteen sessions (M = 3 sessions) in Phase 3. All participants, except for one, finished Phase 4 in one session. Participant #40 finished Phase 4 in two sessions. In Experiment 1, twelve of twenty participants (60%) finished the experiment, while eighteen of twenty participants (90%) finished Experiment 2 (see Table 1). Therefore, it seems reasonable to presume that the detailed instruction was effective. Two of the participants in Experiment 2 did not finish the conditional discrimination training and were not exposed to the post-test. Participant #28 reached the criterion in Phase 3 two times, but did not reach the criterion in Phase 4. Thus, the participant was not re-exposed to Phase 3 and did not finish the experiment.

In the analysis of the results, the participants were divided into two groups dependent on the answers in the post-experimental interview. That is, one group consisted of the participants who reported that they had chosen the comparison stimulus by looking at the color of the contextual stimulus (Color Group), while the other group consisted of the participants who reported to have chosen the one comparison stimulus that was either greater or smaller than the sample stimulus, independent of the color of the contextual stimulus (Number Group). The Color Group consisted of twelve participants, eight of whom gambled more on the yellow slot machine in the posttest than in the pretest, as shown in Figure 3. One of the twelve participants gambled the same on the yellow and the blue slot machine in pretest and posttest. Furthermore, three of the twelve participants gambled less on the yellow slot machine in the posttest. Participants # 21, 22, and 25 received the detailed instruction. Participants in the Color Group gambled a mean of 49% of their responses on the yellow slot machine in the pretest and 69% on the yellow slot machine in the posttest. A t-test indicated a statistically significant difference: t (11) = 0.04 (α = 0.05). This indicates that the procedure was effective in increasing preferences for the yellow slot machine, providing that the color of the contextual stimulus had been attended to.

The Number Group consisted of six participants, two of whom gambled more on the yellow slot machine in the posttest than in the pretest, while four gambled less on the yellow slot machine. It is important to notice that participants # 37, 38, and 39 were given detailed instruction and reported to have solved the task by looking at the comparison stimuli. Since the detailed instruction did not include information about attending to changes in the color of the contextual stimulus, it is possible that the instruction functioned as input to continue the experiment. The Number Group gambled with a mean of 47% of responses allocated to the yellow slot machine in the pretest and 41% in the post-test, as shown in Figure 3. A t-test indicated that the difference was not statistically significant: t (5) = 0.72 (α =0.05).

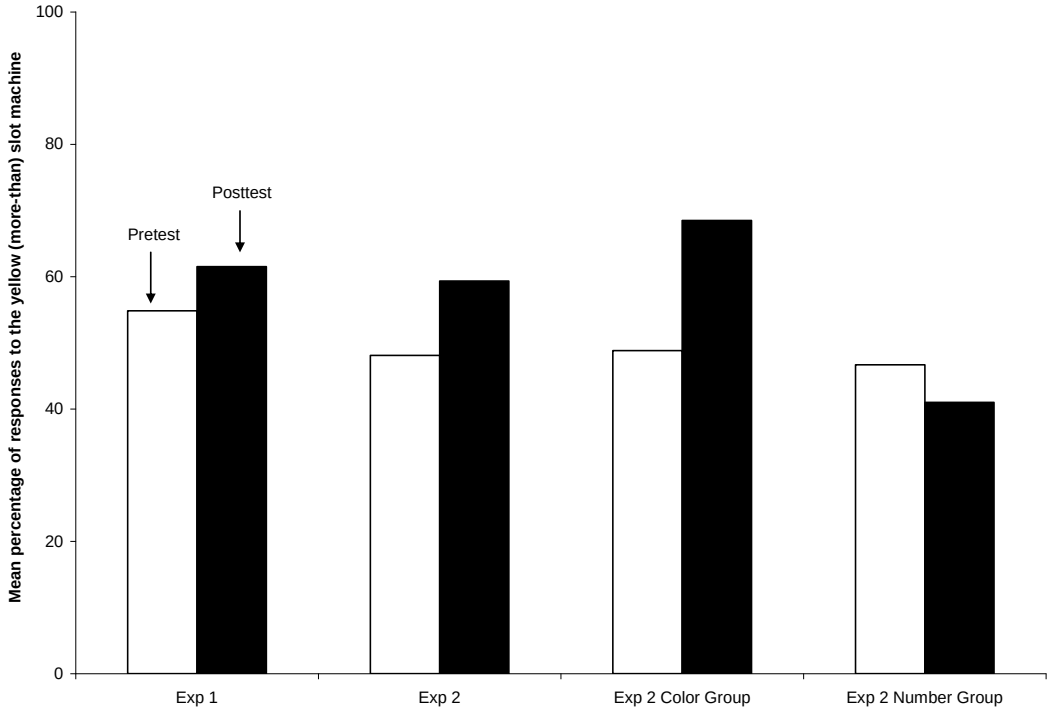

Figure 4. The Figure shows the mean number of responses to the yellow slot machine in pre-and posttest for both Experiment 1 and 2. Furthermore, the results are divided into Color Group and Number Group.

The purpose of Experiment 2 was further to investigate the possible implication that some of the participants did not attend to the colors. We replicated the findings from Experiment 1 as we did find a greater variation than Zlomke and Dixon (2006) in responding to the yellow slot machine in the pretest. The posttest shows that eight of twelve participants (Color Group) who reported to have attended to the contextual stimulus increased their preference to gamble on the yellow slot machine (one participant responded the same in pre and posttest, while three participants gambled less on the yellow slot machine). As a group, these participants had the largest increase in preference from pre- to posttest (see Figure 4) and nearly three times as great an increase in preference change as in Experiment 1.

GENERAL DISCUSSION

We sought to replicate Zlomke and Dixon (2006) and also to expand the knowledge about instructional control in the gambling literature. The results from Experiment 1 in the current study did not replicate all of the findings from Zlomke and Dixon (2006). First, during the pretest we found more variability among participants' preferences for the slot machines. In the study by Zlomke and Dixon (2006), the greatest shift in preference was 20% for the yellow slot machine (M = 49%). Thus, in the current study the shift in preferences ranged from 0% to 100% for the yellow slot machine (M = 51%). Second, the data from the posttest show that eight of the participant in the Zlomke and Dixon (2006) study played more on the yellow slot machine compared to the pretest. The participants in the current study did not show the same consistency in change of preference. Only four of

the twelve participants who finished Experiment 1 had an increase in preference for the yellow slot machine, and five participants showed a reduced preference for the yellow slot machine after the conditional discrimination training. Some of the participants reported that they had not attended to the contextual stimulus, even if they finished the training and test phase. We think that this finding could be important since it might be that the participants had not conditioned the yellow color to the contextual stimulus "more than". Furthermore, it could have implications for the interpretation of the results of Experiment 1. One could not account for an increase in preferences on the yellow slot machine for the participants who have not attended to the contextual stimulus (i.e., if the color on the slot machines was not of importance, then the choices in both pre- and posttest will be largely random).

The change in preference for the Color Group is remarkably lower than in the Zlomke and Dixon (2006) study. One implication from the current study seems to be that it is important to find out if the participants are attending to the contextual stimulus or not. The group (Number Group) that had been looking at or attending to comparison stimuli showed a small reduction in change in preference to the yellow slot machine after training.

The results from the current study are in accordance with the results of Hoon et al. (2007), even if in the current study the changes in preferences were greater. Hoon et al. (2007) presented three experiments with six participants in each experiment. Group data from Experiment 1 showed 18% reduction in gambling on the yellow slot machine, while group data from Experiment 2 and Experiment 3 showed a small increase of 4%. In an another study by Hoon et al. (2008), they showed that when we just look at group data an increase in preferences of 20% is observed. They argued that establishment of non-arbitrary contextual control is most efficient with two comparisons and gambling related stimuli. The results from Experiment 2 in the current study, albeit with three comparisons, are in accord with this notion providing that we exclude the participants who reported not to have been attending to the contextual stimulus.

Hoon et al. (2007) reported that 13 of 18 participants finished the experiments. In the current study, all of the participants that finished both experiments showed one self-generated rule that was important in the test phase in which three new stimulus sets were introduced. Therefore, we will argue that the rule about the five stimuli on the screen in training phase was controlling the participants' behavior in the test phase. Furthermore, the self-generated rule was probably also used during the post-test for those who gambled more on the yellow slot machine in the pretest even if it did not produce more reinforcers. Thus, there are some problems with self-report data (e.g., Critchfield & Epting, 1998; Holth & Arntzen, 1998), such as the fact that participants' self-generated rules are asked about in a post-experimental interview and the questioning by itself could influence the self-reports. Therefore, we suggest that future research should include talk aloud procedures (e.g., Cabello & O'Hora, 2002; Rehfeldt & Dixon, 2000). The focus on self-generated rules will be in accordance with researchers who have pointed out that analyses of different verbal behavior are important in understanding gambling behavior (Brandt & Pietras, 2008; Dixon & Delaney, 2006). Thus, it seems important to increase the understanding of self-generated rules in gambling behavior since such rules like "play the yellow slot machines, and you will win more". Such a rule may make individuals gamble more on yellow machines than machines with other colors. Thus, it could be that the gambler thinks he or she can control or have influence on the outcome of gambling

(e.g., Ladouceur, Sylvain, Boutin, & Doucet, 2002; Petry, 2005).

There are several limitations to the present findings. First, a potential threat to the validity of the findings is the relatively low requirement of 50 slot machine trials in the pretest, which could be too few responses for the participants to show a stable preference. Also, the participants may have determined the schedules of reinforcement in the pretest and therefore have no reason for gambling more on the yellow slot machine in the posttest. Second, although open-ended questions were used during the post-experimental interview in Experiment 2, participants' responses were readily assigned to one of two categories. This made it clear for the experimenter how to score the answers, but had all verbalizations been audio recorded and later transcribed it would have allowed for reliability testing to be undertaken. Third, we did not use a standardized measure for screening gambling problems. All the participants were given some formal written information about the experiment and they had to answer two questions about gambling. All participants reported knowledge of slot-machines, but no one reported problems with gambling. By this we concluded that the participants may best be described as "non-gamblers" or recreational gamblers. A standardized measure like South Oaks Gambling Screen (SOGS) (Lesieur & Blume, 1987) may be better to screen and categorize participants. Fourth, employing a research design other than the pretest-posttest design, such as a multiple baseline design, is important for future research, as is targeting the least preferred color slot machine from the pretest as the subsequent more-than contextual cue. Finally, it would be helpful to replicate the present procedures with gamblers.

In conclusion, the current study showed that preferences for gambling on one of two slot machines could come under contextual control by two different colors. The results support the studies by Zlomke and Dixon (2006) and Hoon et al. (2007). There is a need for more replications since the results are not quite unambiguous. In any case, the results show that preference for slot machines can be established and transformed to other stimuli. Furthermore, the results showed that self-generated rules can lead to responding in a special pattern even if the reinforcement for such responses is very lean and could be the reason for the choice of some responses and not other even if the contingencies of reinforcement are the same

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