Implications of Derived Rule Following of Roulette Gambling for Clinical Practice

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Abstract Problem gambling is a global concern, and behavior analytic attention has increasingly focused on reasons for why problem gambling occurs and conditions under which it is maintained. However, limited knowledge currently exists on the process to which self-generated rules maintain gambling behaviors. Therefore, the current study assessed six recreational gamblers on a roulette game before and after discrimination training to establish a self-rule to wager on red or black. Following discrimination training, all six participants altered their response allocation among red or black and consistently responded according to the newly derived self-rule. Results maintained during 1-week follow-up sessions across all participants. Implications for clinical application of self-awareness and self-generated rule following are discussed.

Implications for practice

- Demonstration of how stimuli such as color can alter gambling behavior
- Procedures to assist clients with changing self-rules about gambling behavior
- Using self-generated rule formulation for more contextually appropriate target behaviors
- Highlights how self-generated rules can be altered to change clinical target behaviors

Keywords Gambling · Rule-governed behavior · Self-awareness · Behavior analysis

Behavior analysis has been applied across a range of socially significant behaviors, from disruptive classroom behaviors to medication compliance and recycling. One area of recent focus is problem gambling (Zlomke and Dixon 2006; Hoon et al. 2008; Guercio et al. 2012). Problem gambling is often maintained by a combination of reinforcement schedules and verbal behavior (Weatherly and Dixon 2007; Dymond and Roche 2010). For example, the development of stimulus equivalence classes and transformation of function has been shown to alter gambling preference and response allocation (Zlomke and Dixon 2006; Nastally et al. 2010; Wilson and Dixon 2014), and self-reporting of slot machine outcomes (Dixon et al. 2009).

While behavior analytic attention on problem gambling is growing (e.g., Witts 2013), limited knowledge currently exists on how problem gambling is established or the process to which verbal behavior in the form of self-rules is developed and subsequently maintained. Wilson and Dixon (2014) demonstrated self-tacting and subsequent self-rule following of recreational gamblers' preferences for concurrently available coin options on a slot machine. Six gamblers were asked to (a) tact arbitrary stimuli posted on the slot machine by completing fill-in-the-blank and multiple-choice assessments; (b) wager red or silver coins on a slot machine, which had no impact on the contingencies of the game; and (c) complete a conditional discrimination training procedure to establish a three, three-member equivalence class (A1-B1-C1; A2-B2-C2; and A3-B3-C3), where the C stimuli were presented as the words "play," "red," or "silver" and "coins". Following training, transitive relationships emerged between stimulus sets A and C, as all six participants correctly tacted the rule "play red/silver coins," while five participants altered response allocation to the color coin as indicated by stimulus C2 (e.g., red or silver).

Although Wilson and Dixon provided empirical support regarding the development of self-tacting, future research in this area is warranted. First, replication of the effect demonstrated by Wilson and Dixon is needed. Second, the extent to

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which untrained response classes will persist overtime is unknown. Third, subjects who participated in Wilson and Dixon included graduate students who had completed an introductory course on the topic of stimulus equivalence. Therefore, the extent to which the author's findings would generalize to a population with less familiarity and history regarding equivalence is unclear. Therefore, the purposes of the current study were twofold: (1) replicate and extend the findings of Wilson and Dixon by evaluating the effects of self-rules on the wagering behavior of naïve recreational gamblers during roulette and (2) assess maintenance of novel topographical responses during 1-week follow-up.

Six female gamblers, aged 19 to 37 years ($M=24.33$, $SD=5.95$), were recruited to participate in the study in exchange for extra course credits. Participants were randomly assigned to one of three legs of a multiple baseline design, with each participant exposed to varying lengths of gambling durations during the roulette game. All participants played roulette for a total of 24 min between pretest and posttest, and 20 min during follow-up. Participants 1, 2, and 3 started the experiment on 1 day, while participants 4, 5, and 6 started the experiment on a different day.

The primary dependent measure was response allocation between red and black outside wagers on the roulette table. Supplementary measures assessed the self-rule generation of the stimuli posted on the wall above the roulette table (i.e., the A stimulus class; see Fig. 1) and response selection during discrimination training and testing.

The gambling pretest, posttest, and follow-up sessions were identical to that of Wilson and Dixon (2014). Three arbitrary symbols (e.g., stimulus A1, A2, and A3) were posted above the roulette table, and participants were instructed to

tact each stimulus by completing a multiple-choice and fill-in-the-blank assessment. A computer monitor displayed a prerecorded croupier spinning a roulette wheel and a ball in opposite directions. Trials began with the croupier spinning the ball on the screen. The participant wagered one chip on either red or black to win, before the croupier stated, “no more bets.” A random-ratio schedule of reinforcement was in effect, as reinforcer magnitude and contingent loss was held constant (i.e., one credit net gain or loss). Participants did not receive any programmed contingencies for winning or losing during the roulette activity.

Following the pretest, participants completed a match to sample task presented in Visual Basic 9.0, where three stimulus classes (A1-B1-C1, A2-B2-C2, and A3-B3-C3) were trained and tested across six discrimination phases. Stimuli included three posted symbols (e.g. A1, A2, A3), arbitrary shapes (e.g. B1, B2, B3), and words “bet,” “on,” and “red/black” (e.g. C1, C2, C3). The C3 stimulus corresponded to participants' response allocation during the roulette pretest. For instance, the stimulus of “red” was selected for participants wagering more on black during the pretest (e.g., participants 1, 3, 5, and 6) while the stimulus “black” was selected for participants wagering more on red during the pretest (e.g., participants 2 and 4). Participants completed the training independently and received feedback on their responses from the computer program only during training trials. Following training, participants completed the roulette posttest. During the posttest, all participants completed both the fill-in-the-blank and multiple-choice worksheets before playing roulette. Follow-up sessions were conducted 1 week following the posttest, and procedures were identical to the posttest gambling session.

Table 1 represents percent correct on both the fill-in-the-blank and the multiple-choice worksheets. Prior to discrimination training, all six participants incorrectly completed the fill-in-the-blank worksheet, while four of six participants answered one or two questions correctly on the multiple-choice worksheet. Following training, five participants scored with a high degree of accuracy on both worksheets. During the discrimination training, five participants met mastery criteria within two or three trial blocks during all training phases, while all six participants met mastery within one testing block across all testing phases.

Figure 2 represents cumulative response allocation for each participant across 1-min trial blocks. Following discrimination training, all participants wagered on the trained color more than the non-trained color. Although participant 5 scored a 0 on the fill-in-the-blank posttest worksheet, she wagered on the trained color (red) during all trials following training. The effects of the training maintained during 1-week follow-up with all participants.

The present findings replicate and extend Wilson and Dixon (2014), as all participants effectively self-tacted and

Fig. 1 Roulette activity with the posting of the A stimulus class indicated by the arrow

Table 1 Percent correct across worksheets

Subject	Color trained	Fill-in-the-blank			Multiple-choice		
		Pre	Post	Follow-up	Pre	Post	Follow-up
1	Red	0	100	100	66	100	100
2	Black	0	100	100	0	100	100
3	Red	0	100	100	0	100	100
4	Black	0	100	100	67	100	100
5	Red	0	0	100	33	100	100
6	Red	0	100	100	33	100	100

subsequently followed the trained rule during both posttest and maintenance gambling sessions in a novel gambling context. Similarly, these findings suggest that participants may engage in rule following without programmed monetary contingencies of reinforcement (e.g., Dixon et al. 2012; Wilson et al.; Zlomke and Dixon 2006). A potential limitation is the extent to which the participants were following the trained rule rather than other rules, such as “the experimenter wants me to do X.” Future research should consider using talk-aloud procedures to determine which rules participants follow. Similarly, future research may also consider extending follow-up sessions to systematically evaluate when rule

following diminishes, or conditions under which rule following is suppressed.

The current demonstration can be useful for applied behavior analysts in a variety of ways. Behavior analysts working with gambling clients can use the current study to show clients how something as simplistic as color can maintain and alter their gambling behavior. Gambling clients may find this information helpful, to assist in understanding why they continue to gamble, even when faced with negative consequences (e.g., loss of family, bankruptcy, etc.). Similarly, practitioners may use similar protocols to assist gambling clients with changing self-rules about when or how to gamble.

Fig. 2 Cumulative response allocation across 1-min trial blocks

Practitioners may consider establishing self-generated rule following for more socially or contextually appropriate target behaviors, such as saying no to gambling or gambling responsibly. The current study also highlights how rules can be altered to increase (or decrease) behaviors that may be of clinical importance within the verbal community between practitioners and clients.

Method

Six females participated in the study for extra course credits. Experimental sessions took place in a behavioral laboratory (15 ft. $\times$ 20 ft.), containing a roulette table, poker chips, chairs, computers, and desks. Once computer monitor played a pre-recorded roulette wheel, another computer controlled the stimuli presentation and data collection during discrimination training. Participants read and signed a consent form before completing a demographic form and the South Oaks Gambling Screen (SOGS; Lesieur and Blume 1987). The SOGS is a 26-item (20 of which are scored) self-report questionnaire on gambling proclivity, as indicated by total scores of 5 or higher. All participants scored as non-pathological gamblers with SOGS scores of 0.

A multiple baseline design across participants was used to evaluate the effects of the independent variable. During the gambling activity, three stacks of 20 roulette chips were placed in front of the participant. A computer monitor was placed on the roulette table next to the “0 and 00” outside bets. A prerecorded spinning roulette wheel was projected via the computer monitor throughout the gambling activity. The A stimuli were printed on 3 in. $\times$ 8.5 in. white paper and posted eye level on a cubicle partition. Prior to each gambling session, the experimenter read instructions, which are available from the first author upon request, to the participant. Next, participants completed the fill-in-the-blank and multiple-choice worksheets. Participants were instructed to either write down one word below each symbol (fill-in-the-blank worksheet) or to circle one word among the array (multiple-choice worksheet). No feedback was given for the completion of the worksheets and any relevant questions were addressed by re-stating the scripted instructions.

After the participant completed each worksheet, the experimenter started a timer and the roulette video, while the participant wagered on red or black while the experimenter removed or delivered chips contingent upon the outcome of the participants’ wager. At the end of the gambling activity, the researcher counted the sum of wagers on red and the sum of wagers on black to determine the C3 stimuli during discrimination training.

Next, participants completed the discrimination training on a desktop computer. For each trial, a sample stimulus appeared

on the left side of the screen and three comparison stimuli appeared on the right side of the screen. Participants were instructed to select the correct symbol from among the three by clicking on it with the computer mouse. Participants completed the activity independently and received feedback on their responses from the program during the training phases. The software randomly determined all trials within each trial type, as follows: A-B relations (16 of 18 correct selections needed for mastery), B-C (16 of 18 correct selections needed for mastery), and mixed A-B/B-C (32 of 36 correct selections needed for mastery). Testing trial types were as follows: B-A (16 of 18 correct selections for mastery), C-B (16 of 18 correct selections for mastery), and A-C/C-A (32 of 36 correct selections for mastery). Participants were required to respond correctly and to meet mastery criteria to move to the next trial type. If participants failed to meet the criteria, they were re-exposed to the failed trial type before moving to the next trial type.

Following discrimination training, participants were asked to complete the same fill-in-the-blank and multiple-choice worksheets. After the participant completed each worksheet, the experimenter started a timer and the roulette video. One week following the completion of the posttest, the participant completed the follow-up session. Participants completed both worksheets during the follow-up session before completing the roulette activity for 20 min.

The primary dependent measure was response allocation across two concurrently available operants (black or red). Supplementary measures assessed the degree to which participants accurately generated the rule displayed above the roulette table (i.e., the A stimulus class). Interobserver agreement (IOA) data were collected on the total number of wagers placed on either red or black for 30 % of sessions from video recorded sessions by a secondary independent observer. Agreement was scored by dividing the number of agreements by the number of agreements plus disagreements multiplied by 100. Agreement for wager color was 98.5 %.

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