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# Increasing Response Effort Impacts Wager Sizes of Slot-Machine Gamblers

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The current study investigated the effects of the physical location of the "Bet Max" wager button on a slot machine on 29 recreational gamblers. Distance from the Spin button varied across three groups of gamblers ranging from 9.52mm to 111.12mm. The results indicated a significant change in bet allocation between groups, mainly, greater distance between the Max Bet button and Spin button resulted in fewer responses allocated to the Max Bet button. Implications of the results are discussed in regards to response effort, and gambling device design.
*Keywords:* response effort, slot machine, gambling

As a leisure activity, gambling has become more popular and more accessible in the past two decades (Ghezzi, Lyons, & Dixon, 2000). The American Gaming Association (2010) reported that 62 million adults in the US visited a gambling establishment in 2009. Related to this popularity increase is the increase of revenue by gambling establishments, which in 2011 was reported to be $35.6 billion (American Gaming Association, 2012). In addition to the rising popularity and revenue, accessibility to gambling environments has been increased with changes in legislation that now permit gambling in 48 states as well as online gambling (Dixon, Whiting, Gunnarsson, Rowsey, & Daar, in press). As gambling activities become more accessible to more people, questions about problems related to these activities arise. The prevalence of gambling disorder in adults in North America has been reported to be between 1.14% and 1.60% and the prevalence of problem gambling has been reported to be between 2.80% and 3.85% (Potenza, Kosten, & Rounsaville, 2001). Significant societal problems are associated with gambling disorder such as unemployment, bankruptcy, arrests and incarceration, health problems, usage of welfare, and divorce (Potenza et. al., 2001). Given its societal significance, investigating the factors that influence the development of gambling disorder is important.

Previous gambling research has not been able to identify what causes gambling disorder or why less than 10% of adult gamblers acquire a gambling problem (Dixon et al., in press; Potenza et al., 2001). Weatherly and Dixon (2007) presented a model that identified possible contributing variables that create and maintain problem gambling. Their model identified three mechanisms that can lead to a gambling disorder: establishing operations and setting events, consequences, and verbal rules. Though this model is not without its limitations, it provides researchers with a valuable conceptual basis for future research. One of the consequence mechanisms that are thought to maintain gambling disorder in Weatherly and Dixon's (2007) model is response effort.

Response effort, in this context, refers to the effects of the effort or work required

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(cost) to engage in a behavior on the likelihood of that behavior being emitted (Weatherly & Dixon, 2007). Petry and Roll (2001) claimed that reductions in response effort, as well as immediacy of the reinforcement, could promote gambling behavior. In relation to response effort, after a behavioral pattern of gambling has been established, behavior can be maintained even when response effort is increased (Petry & Roll, 2006). Petry and Roll (2006) explained that this increase in wagering amounts was similar to the behavioral concepts of tolerance and one of the criteria for gambling disorder in the Diagnostic and Statistical Manual for Mental Disorders (American Psychiatric Association, 2013). Despite its possible contributing function to gambling disorder, limited emphasis has been placed in response effort in research on gambling with few studies including the phenomena as an independent variable. The methods and outcomes of these studies were different and the link between gambling disorders and response effort was not clearly demonstrated.

Weatherly, McDougal, and Gillis (2006) investigated whether saliency of money and response effort influenced gambling behavior on slot machines. The study included two experiments where the second investigated response effort. Participants were placed in one of three groups staked with the same amount of money ($5). Participants in the first group had 100 nickels (higher response effort) to play with, participants in the second group had 20 quarters (lower response effort), and participants in the third group were allowed to choose whether they played with nickels or quarters. The results indicated that increased response effort did not decrease the amount gambled by the participants.

Johnson and Dixon (2009) investigated how increased response effort changed gambling responses of two pathological gamblers in three gambling games. Participants were presented with a choice of making a gambling response themselves or having the researchers make one for them. For example, when playing slot machines, the participant would choose a slot machine and have the chance to stop the reels or have the researcher stop them. The results indicated that response effort was partially effective in reducing gambling responses of both participants.

Both of the aforementioned studies manipulated the response effort of gambling games by altering credits needed to gamble, neither altered the game that was being played. Little research has been conducted examining how response effort affects gambling behavior, and none has been conducted where the response effort within the topography of the gambling game has been altered. The aim of the current study was to investigate how topographical changes of the user interface of a slot machine would affect the gambling behavior of individuals playing a simulated video slot machine. By changing the location of the max bet credit button it was hypothesized that a decrease in bet allocation would be observed as the distance between the button and the spin button increased.

## METHOD

### Participants and Setting

Thirty-one undergraduate and graduate college students were recruited through on-campus solicitation (at the campus library) and through classroom solicitation. Inclusion criteria required each participant to be a current student at the university, score less than 5 on the South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987), and be able to operate a computer-mouse. Two individuals scored higher than 5 on the SOGS and were excluded from the study. Scores of 5 or higher on the SOGS indicate a potential gambling disorder, therefore exclusion

of these individuals from the current study was meant to reduce the possibility of either exacerbating an existing gambling disorder or creating any other harmful effects for the participants. The remaining 29 participants (12 male, 17 female) were aged 18 to 26 (M = 21.27, *SD* = 2.52) years. Participants in the study did not receive any incentive for their participation. All sessions were conducted in a reading hall at the university library. The specific area the participants sat in included a table, four chairs, two laptop computers, headphones, and, a computer-mouse for each laptop. All participants signed informed consent before participating in the study.

**Procedure and Apparatus**

The digital slot machine the researchers utilized was a traditional three-reel slot machine with three buttons directly below the reels: spin, Max Bet (five credits), and Bet 1 (one credit). Figure 1 displays a graphical image of the slot task. The slot machine was programmed by one of the researchers using Visual Basic 2010 such that the schedule of reinforcement across all groups was kept constant on a variable ratio 5 schedule. In this schedule, participants experienced wins after a range of 3 to 7 trials for an average of every 5 trials regardless of amount bet or which group the participant was in. Hence, all participants had the opportunity to earn the same amount of credits in the game. To play the game, the participants first selected a bet option, either Max Bet or Bet 1 (Bet 1 could only be pressed once, so only bets of one or five were allowed), and then clicked on the Spin button that began the reel animation. Once the animation ceased, the slot machine added credits on winning spins and simply reset the bet to zero on losing spins. The slot machine was programmed to run for 10 minutes and to randomly assign participants to one of three groups which differed in the placement of the Max Bet and Bet 1 buttons: Max Bet on Right, Max Bet on Left, and Max Bet on Far Left. In all groups, the Spin button was in the bottom right corner of the screen, below the reels. All buttons were the same size (22.22mm x 29.99mm) and all distances were measured from the left edge of the Spin button to the right edge of either the Max Bet or Bet 1 button. In the Max Bet on Right group, the Max Bet button was next to the Spin button (9.52mm to the left) and the Bet 1 button was on the left side of the Max Bet button (57.15mm to the left). In the Max Bet on Left group the location of the Max Bet and Bet 1 buttons was reversed such that the Bet 1 button was next to the Spin button (9.52mm to the left) and the Max Bet button was to the left of the Bet 1 button (57.15mm to the left). In the Max Bet on Far Left group, the Max Bet button was positioned at the far left edge of the slot machine window (111.12mm to the left) and the Bet 1 button was positioned next to the Spin button (9.52mm to the left). Aside from the placement of the Bet 1 and Max Bet buttons, all other features of the slot machine remained the same for all participants.

After completing a demographic survey and the SOGS, participants with scores lower than 5 were asked to open the slot machine program on the computer. When they opened the program, it randomly assigned each participant to one of three groups and the researchers told the participants:

> For the next ten minutes you will be playing this slot machine. The machine will automatically stop. Your main goal here is to try to win as many credits as you can. If you have any questions let the researchers know.


**Figure 1**. Screenshot of Slot Machine Program in Max Bet on Far Left Condition.

After 10 minutes, the software prompted the participants to stop playing and disabled the buttons on screen. The participants were then debriefed and thanked for their participation.

**Data analysis**

Prior to the start of each session, the computer system ran a debugging sequence to ensure that all operations were working. No errors were found during any of the debugging processes, indicating reliable stimuli presentation and data recording. Following establishment of reliability, all dichotomous responses (Choice of Max Bet or Bet 1 buttons) assessed for each one of the Max Bet positions (Far left, Left, and Right; n = 2278) were then analyzed with logistic regression to determine the how position of the Max Bet button affected the selection of either the Max Bet or Bet 1 buttons.

**RESULTS AND DISCUSSION**

The results of the current study indicated that the location of the Max Bet button had a significant effect on bet allocation of participants; selecting the Max Bet button more often as opposed to the Bet 1 button (see Table 1). A logistic regression was conducted to examine the effects of the distance of the Max Bet button in relationship to the Spin button on the selection of the Max Bet or Bet 1 button. The logistic regression model explained 9.4% of the variance as estimated by Nagelkerke $R^2$, and measure of goodness of fit was statistically significant, $\chi^2(2) = 166.909$, $p < .001$, and the model correctly classified 63.4% of the cases. Figure 2 displays the percentage of selections of the Max Bet button in each group. Compared to participants betting in the condition where the Max Bet button was on the far left of the screen (farthest away), participants betting when the Max Bet button was to the left of the Bet 1 button (sec-

**Table 1**. Logistic Regression Analysis

| Independent Variable | B | S.E. | Wald | df | Sig. | Exp(B) | 95% C.I.for EXP(B) Lower | Upper |
|---|---|---|---|---|---|---|---|---|
| Max Bet Far Left | | | 159.540 | 2 | .000 | | | |
| Max Bet Right | 1.283 | .109 | 138.128 | 1 | .000 | 3.609 | 2.914 | 4.471 |
| Max Bet Left | .363 | .115 | 9.963 | 1 | .002 | 1.438 | 1.148 | 1.801 |
| Constant | -.776 | .086 | 81.538 | 1 | .000 | .460 | | |
| Model $\chi^2$ = | 166.909 | *P* <.001 | | | | | | |
| Nagelkerke $R^2$ = | .094 | | | | | | | |
| n = | 2278 | | | | | | | |

Note: The dependent variable in this analysis is selection of bet amount so that Max Bet = 1 and Bet 1 = 0.

ond farthest away) were 1.44 times more likely to select the Max Bet button while participants betting when the Max Bet button was directly next to the Spin button (on the right side or closest), participants were 3.61 times more likely to select the Max Bet button. The Max Bet on Right group demonstrated a more frequent selection of the Max Bet button than either of the other two groups, and the Max Bet on Left group demonstrated a more frequent selection of the Max Bet button than the Max Bet on Far Left Group.

The aim of the current study was to investigate whether topographical changes to user interface on a slot machine would change bet allocation. The researchers altered the distance between Max Bet buttons and Spin button in three groups to evaluate the behavior changes. The results indicate a significant change in bet allocation between groups, mainly, greater distance between the Max Bet button and Spin button resulted in fewer responses allocated to the Max Bet button. Participants in the Max Bet on Far Left group bet a total of 1420 credits while those in the Max Bet on Left and Max Bet on Right groups bet 1849 and 3267 credits, respectively. The results are interesting because one would not assume that operating a computer mouse would be considered an especially effortful or costly behavior, yet by changing the location of the Max Bet button such that the mouse had to be moved farther to bet the maximum amount, participants' allocation of bet placement was affected.

There were some potential limitations in the current study. There were no available tangible rewards in the current study. This might be a limitation because it remains to be seen how response allocation differs when there is an actual monetary contingency based on the bet such that individuals are risking their own money. While the participants were all asked to play as if they were playing for real money and told that the aim of the program was to end with as many credits as possible, it still remains unknown how rate of play would have been different if tangible rewards were offered.

A second potential limitation of the current study is that the Nagelkerke $R^2$ yielded a low score. There is debate among the experts regarding the importance and utility of measures such as the Nagelkerke test, which are regarded as pseudo $R^2$ tests. Generally, it is accepted that in studies in which the dependent variable involves human behavior, low scores on pseudo $R^2$ tests are neither

uncommon nor do they indicate the remainder of the findings are not important. As discussed in Bedeian and Mossholder (1994), the pseudo $R^2$ is not especially relevant when assessing an interaction as opposed to forming a predictive model. As the current data are being used only to assess the interaction between button location and button selection and other essential statistical analyses within the regression analysis are statistically significant, the low Nagelkerke score does not preclude analysis of the other results.

The current study extends previous research by specifically investigating the topographical features of response effort. Previously, researchers had focused on altering monetary cost when investigating how response effort or cost may affect gambling behavior (Johnson & Dixon, 2009; Weatherly et al., 2006). Results from the current study support the previous findings that the response effort of emitting a behavior has an effect on gambling behaviors of individuals (Petry & Roll, 2001, 2006; Weatherly & Dixon, 2007), and add to them by demonstrating that gambling behavior can be affected by altering the gambling game itself, without altering credits or money needed to play. Weatherly and Dixon (2007) hypothesized that when an environment (i.e. casino) is arranged to facilitate gambling, the gambling behavior should increase. The current study supports that hypothesis by demonstrating that environmental manipulations can increase or decrease betting. While the current study adds to previous literature on the phenomenon of response effort and its relation to gambling behavior, further research should continue to investigate the effects of response effort and how it may contribute to gambling disorders as well as how it might be manipulated to decrease potentially problematic gambling behavior.

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