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THE MULTIPLIER POTENTIAL OF SLOT MACHINES PREDICT BET SIZE

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The current study extended previous findings that the multiplier potential of a slot machine is related to gambling losses (Sharpe, Walker, Coughlan, Enerson & Blaszczyński, 2005). The multiplier potential of a slot machine was defined as comprising three components; the monetary denomination, the maximum number of pay-lines and the maximum bet multiplication. The relationship between these three components of the multiplier potential and a slot machine's average bet size was examined in a sample of 323 Australian machines. All machines were operating in gaming venues and expenditure measures were obtained from data recorded by the machines. Results indicated that machine denomination (e.g., 1-cent, 2-cents) and the maximum number of pay-lines were significant predictors of average bet size but no significant relationship was found between the bet multiplication variable and bet size. These results are discussed with regard to established contingencies and reinforcement rates.

Keywords: gambling, multiplier potential, bet size, gaming machines

The basic structure of slot machines has remained the same since they first occupied gaming rooms at the end of the nineteenth century (Fey, 1983) and they continue to operate under an intermittent schedule of reinforcement with a high continuity and contiguity of gambling events. However, advances in technology and design have generated a number of additional structural characteristics to the basic operations of the game. The influence that these newer structural characteristics of gaming machines have on gambling behaviour has been speculated on for some time, but there has been little empirical evaluation by researchers outside of the gaming industry.

Griffiths (1993) argued that sophisticated gaming machines are designed with extra structural characteristics that may serve to

increase persistent play.

He listed a range of machine characteristics which included the multiplier potential of the machine. This feature of the modern game allows a player to wager more than one coin per spin for a proportionate increase in potential payback. On Australian slot machines, the multiplier potential is a composite variable made up of three machine characteristics; the monetary denomination, the number of pay-lines and the bet multiplication. These last two structural characteristics may be considered structural enhancements to the modern game and can be adjusted by the player whilst playing to influence the amount staked. From a behaviourist perspective, these two characteristics represent the operant link between the gambler and the reinforcer and may play a role in understanding gambling as an elicited, contingency-shaped behaviour.

In the Australian gaming environment, a player will typically choose the denomination of the machine (e.g., 2-cents) first and gaming venues usually group machines by their denomination. Hence, in many venues there will be a section on the gaming room floor for 1-

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cent machines and a section for 5-cents machines and so on. Each section is also typically highlighted with a large, neon sign displaying the denomination. The reason for this appears to be historical, leftover from a time when players could not manipulate their bet size on a slot machine.

After selecting a machine, the player typically selects the number of pay-lines to play (e.g., 9) and then multiplies this bet (e.g., by 5). This combination determines the stake size ($2 \times 9 \times 5 = 90$ cents). Hence, the maximum amount that can be staked on a machine is a combination of the machine's denomination, the maximum number of pay-lines and the maximum bet multiplication.

Increases in the multiplier potential of machines can lead to increases in the stake size capability of a machine and this has the potential to proportionally increase the size of any win. However, it also has the potential to increase the rate of loss experienced by the player. This has been recognised as potentially harmful by the government in New South Wales, Australia and it has legislated that slot machines cannot be designed with a maximum stake greater than A\$10.

A number of other researchers have also speculated about the role that modern machine characteristics play in gaming behaviour. Dickerson, Hinchy, Legg England, Fabre and Cunningham (1992) noted that players exhibited stereotypical playing behaviour in relation to staking patterns, machine events and characteristics. However, Dickerson et al. (1992) only examined bet size, without examining the individual features of the multiplier potential. Delfabbro and Winefield (1999) extended the Dickerson et al. study and suggested that changes to the multiplier potential may explain behavioural differences in research findings over time. Dickerson and Baron (2000) stated that machine characteristics, such as the multiplier potential, have been researched and developed by manufacturers to promote persistent

play, which can lead to problem gambling behaviour. However, like Dickerson et al., neither Delfabbro and Winefield (1999) or Dickerson and Baron (2000) provided empirical evidence that the multiplier potential of slot machines affected gambling behaviour.

The most comprehensive studies of the structural effects of gaming machines are two Australian studies published by Sharpe et al. (2005) and Blaszczynski, Sharpe, Walker, Shannon and Coughlan (2005). Both of these modified the reel speed, the multiplier potential and the bill acceptors of slot machines in actual gaming venues. That is, machines were created with a slower reel speed, a reduced multiplier potential (maximum bet of \$1) and were restricted to only accepting smaller denomination bills (no greater than \$20). Blaszczynski et al. found that participant satisfaction and enjoyment were not related to any of the structural changes. However, Sharpe et al. reported that machines with a reduced multiplier potential were related to shorter gaming times, a fewer number of bets and smaller overall losses. Interestingly, they were also associated with lower levels of both cigarette smoking and alcohol consumption. These two adjunctive behaviours have been shown to be related to schedules of reinforcement in a wide range of contexts (Pear, 2001) and may further support behavioural explanations of gaming machine play.

The Sharpe et al. (2005) finding is particularly interesting as limiting the maximum bet does not have any direct relationship with overall losses. The multiplier potential of machines allows for manipulation of bet sizes, but players can still lose as much, in total, on a machine with a \$1 maximum bet as they can on a machine with a \$10 maximum bet. This result suggests that bet size is related to overall losses.

The aim of the present study is to extend the findings of Sharpe et al. (2005) and further examine the role of the multiplier potential of gaming machines. Specifically, it

will examine the relationship between each individual component of the multiplier potential with the average stake size on slot machines. It will also extend previous research by utilising a methodology that removes demand characteristics and patterns of play that may be influenced by human observation.

METHOD

Gaming Machines

From a convenient sample of eight registered clubs in New South Wales, Australia the average bet size was retrieved from 381 slot machines in operation. Initially, the data included machines with a \$1 denomination. However, when testing the assumptions of multiple regression, these machines were shown to be outliers, exerting significant influence on the regression coefficients (i.e., DfFit statistics greater than 1, Tabachnick & Fidell, 2007). Based on this, all \$1 machines were deleted from the sample. This left 323 machines in the final sample. The average stake size of these machines was 26.21 cents (SD = 12.97). A description of these machines, in terms of their multiplier potential

features, is given in Tables 1, 2 and 3.

Procedure

The average stake size from all players is automatically recorded on each machine's hard-drive. This information was retrieved with the assistance of the gaming venue. The observed variables (denomination, maximum number of pay-lines, maximum bet multiplication) were visible on the cabinet of each machine and recorded. The only viable sampling technique was one of convenience due to limited access (outside of trading hours or early morning), although some attempt was made to ensure that as many different levels of each observed variable was measured. Data were collected by a pair of researchers which minimised the time spent at each venue.

RESULTS

A hierarchical multiple regression was performed between average stake size as the criterion and the three predictor variables entered in the order of denomination, the maximum number of pay-lines and the maximum bet multiplication. Results of evaluation of assumptions were satisfactory with no mul-

Table 1.
Frequency of machine denomination (N = 323)

Denomination	1 cent	2 cents	5 cents	10 cents	20 cents
Frequency	69	74	108	38	34

Table 2.
Frequency of maximum number pay-lines (N = 323)

Pay-lines	1	3	5	9	15	20	25
Frequency	5	57	73	115	40	21	12

Table 3.
Frequency of maximum bet multiplication (N = 323)

Bet multiplication	3	5	10	15	20	25
Frequency	5	41	143	7	105	22

tivariate outliers ($p > .001$) and no DfFit statistic greater than 1. Furthermore, the analysis was considered to be sufficiently robust given the large sample size relative to the number of predictors (Tabachnick & Fidell, 2007). The hierarchical regression results are presented in Table 4.

The two significant predictors of average stake size were the monetary denomination of the machine and the maximum number of pay-lines. The r-square change figures indicate that denomination variable was a more important contributor to the model than the maximum number of pay-lines. The maximum bet multiplication was not a significant predictor of average stake size and did not contribute to the final model. Clearly, the results indicate that the most important predictor of machine average stake size is the machine's denomination, and that the maximum number of pay-lines is a better predictor of average stake size than the maximum bet multiplication.

DISCUSSION

The aim of the current study was to test the relationship between the multiplier potential of slot machines and the average bet size of the players. The results indicated that a significant positive linear relationship exists between a slot machine's multiplier potential and the average bet size. In particular, the most important component of the multiplier

potential in this relationship is the monetary denomination of the machine. The only other component of the multiplier potential to achieve significance was the maximum number of pay-lines. Again, a positive linear relationship was found, although the strength of this relationship was weaker than that for denomination. The maximum bet multiplication of a slot machine was not found to be a significant predictor of bet size, after controlling for the effect of denomination and pay-lines.

The results of the current study not only confirm the relationship between two components of the multiplier potential and staking patterns but also offer some insight into behavioural explanations of persistent gaming machine play.

The significant result for the maximum number of pay-lines variable provides tentative support for operant conditioning explanations of persistent gambling. Dixon, MacLin and Daugherty (2006) and Griffiths (1999) suggested that players preferred slot machines with small frequent wins and Haw (2008) demonstrated that increasing the number of pay-lines available increases the frequency of rewards whilst playing. Increasing the number of lines played on a slot machine also increases the probability of each single gamble resulting in the presentation of a reward. Hence, the maximum number of pay-lines feature on a slot machine is a ma-

Table 4.

Hierarchical regression results for multiplier potential variables predicting machine average bet size ($N = 323$)

Variables	B	SE B	<i>B</i>	R ² change
Step 1				.42**
Denomination	1.50	.10	.65**	
Step 2				.08**
Denomination	2.047	.12	.89**	
Pay-lines	.85	.12	.38**	
Step 3				.00
Denomination	2.06	.12	.89**	
Pay-lines	.83	.13	.37**	
Bet multiplication	.03	.11	.01	

** $p < .001$

chine characteristic with an established contingency between itself and a reinforcer and the results of the current study show that this contingency has an influence on one type of gambling behaviour (i.e. staking patterns or bet size).

Of course, each extra line played costs the player and the reward provided may be less than the overall outlay. However, there exists strong empirical support that organisms have a preference for an intermittent schedule of reinforcement, even when it is disadvantageous (Hernstein, 1964; Mazur, 1986).

The result for the bet multiplication variable also provides some insight into the role of reinforcement in gaming machine play. This component of the multiplier potential does not influence the frequency of wins, but does influence the size of wins. Each bet multiplied by, say, 10, also increases the size of the reward by 10. However, the null result for this variable in the current study suggests the absence of any contingency between the bet multiplication function and reinforcement. That is, the size of the reward does not appear to be acting as a reinforcer in a manner similar to the frequency of rewards, as suggested by the pay-lines result.

A limitation of the current study is the inadequacy of aggregated machine data in testing hypotheses based on behavioural principles. Single-subject data showing that an individuals' bet size is systematically related to changes in different components of the multiplier potential would significantly strengthen the validity of the current findings. However, the results of the current study do lend support to the utility of behavioural explanations in an applied setting, such as the gaming venue. For example, understanding slot machine characteristics from a behavioural perspective makes an important contribution to the findings of Sharpe et al. (2005) regarding the effect of limiting the maximum bet size of slot machines. They reported that decreasing the multiplier poten-

tial of a machine (from \$10 to a maximum of \$1) was related to shorter gaming times and a reduced number of bets and overall losses. They concluded that reducing the multiplier potential is likely to be the only structural change to a machine that can effectively act as a harm minimisation strategy for problem gamblers. Behaviourally, this is an interesting hypothesis as the multiplier potential of a machine does not have any direct relationship with total expenditure. A player can lose as much, in total, on a machine with a \$1 maximum bet as they can on a machine with a \$10 maximum bet.

Overall, the stake size results suggest that players do have stereotypical patterns of play, in accordance with Dickerson et al. (1992) and Delfabbro and Winefield (1999). Once selecting a machine of a certain denomination, players do tend to increase their stake via the pay-lines option, ignoring the bet multiplication option. Taken into consideration with the findings of Sharpe et al. (2005) it would appear that the increase in stake size is also related to increases in time spent playing and overall losses. Future research can extend the current findings by examining single-subject behaviour on slot machines with a range of different structural characteristics.

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