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Risk As A Function of Response Effort To Gain Points

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The amount of risk an individual is willing to take may be a function of the amount of work required to earn the item that is risked. Twenty-four competitive basketball players were recruited and randomly assigned to one of three groups each representing either a low, moderate, or high work requirement to earn points. Participants were then given shots of varying point values and degrees of difficulty in which to wager points. Results indicate participants who were given a low response effort to gain points took significantly more risk as evidenced by choosing shots with the least probability of success. Those that were required to earn their points took significantly less risk evidenced by choosing shots with the highest probability of success.

Keywords: risk, gambling, sunk cost, house-money effect

The amount of risk an individual is willing to take depends on many factors including payback probability, reward magnitude, context (Dixon, Jacobs, & Sanders, 2006), degree of impulsivity, value of the item being risked (Brandt, Sztykiel, & Pietras, 2013), previous investment in the matter (Arkes & Blumer, 1985), and individual history of gambling or gambling pathology (Dixon, Marley, & Jacobs, 2003). In the gambling context, material reinforcers are repetitively risked in contrived games of chance (Lyons, 2006). Many Americans gamble and as bookies and casinos are not in the business of providing favorable odds, money is typically lost. Petry (2005) reported that 5.4% of North Americans exhibit problem gambling at some point in their lifetime. Although only a fraction of gamblers develop pathology, the fraction equates to a substantial number of people. Due to the large number of people who engage in

sub-optimal choices and take high degrees of risk, an analysis of such behavior is of value.

In the past, risk taking behavior has been studied empirically. Studying risk in a contrived casino setting, however, may be difficult. Mimicking the actual conditions found in a casino by allowing participants to wager their own money on games of chance poses an ethical dilemma due to the possible debt incurred by the participant (Weatherly & Brandt, 2004). Brandt et al. (2013) circumvented such ethical dilemmas by having participants earn points to later wager. The researchers then measured the level of risk when participants earned points versus when the experimenter gave them points. When provided with options to either earn or wager credits, Brandt et al. (2013) found that participants may wager more frequently if the experimenter freely provides money or credits versus when credits or money is earned. The amount of risk taken may be a function of where the money or points originated. Credits earned may have more value than credits given freely. Thaler and Johnson (1990) found a “house money effect” in which participants took greater risks after having experienced gains and conversely

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took less risk after having lost money. This finding suggests that losses may be experienced as less aversive when playing with “house money” thus contributing to greater overall risk. Weatherly and Brandt (2004) found that increasing the value of credits decreased bet size. Participants bet more when credits were worth \$.01 or \$0 compared to when credits were worth \$.10. Increasing the value, whether subjectively by having participants earn credits or objectively by assigning a monetary value to them may decrease the amount of risk an individual will take with regards to credit wagering.

An investment of time, money or resources in acquiring a material reinforcer may increase the subjective value of the item. When the subjective value is increased, an individual may refuse or unwillingly surrender the items. This unwillingness to surrender the item may be because these losses are experienced as more aversive when compared with items that required less investment. An individual’s persistent commitment based not off of the future benefit but of the previous investment in the matter is known as a sunk cost (Arkes & Blumer, 1985). In such cases the persistent commitment is detrimental because there is little to no benefit for continuing the course of action. The individual’s persistence is based solely on the previous time, investment, and commitment in the matter. Alessandri, Darcheville, Delevoye-Turrell, & Zentall (2008) demonstrated that people show preference for a conditioned reinforcing stimulus following response requirements that were high compared to low response requirements. As money and points may function as conditioned reinforcers, it is likely that individuals will show a greater preference for them, thereby demonstrating less risk when points require a high response effort to attain. Following Alessandri et al. (2008) it was postulated that participants’

preference for points would be related to the amount of work required to earn the points.

In a research setting, experimenters may encounter legal dilemmas in allowing participants to gamble with their own money in contrived games of chance. As an alternative, sports such as the game of basketball may be used due to the subjective value of winning and scoring points amongst competitive basketball players. Similar to the lights, sounds, and celebratory feedback heard while playing a slot machine; hearing the point total, the crowd cheer or seeing a scoreboard light up may all serve as conditioned reinforcers that follow the behavior of making a shot. Gaining points or winning a game may serve as generalized conditioned reinforcers that lead to social contingencies of reinforcement (notoriety or bragging rights) and tangibles such as trophies. Risk is a fundamental part of sports and the aforementioned reinforcers are inherently risked through various courses of action in each game. Players are said to take “risky shots” and coaches are said to “gamble” on given plays when the probability of success for those behaviors are low. Points are of value amongst competitive athletes and can be awarded or taken away to produce reinforcing or punishing effects. The purpose of this study is to measure the level of risk as a function of response effort to gain points. Points earned may have more value than points given freely. Increasing the work requirement to earn points may increase the subjective value and as the subjective value increases participants may experience a loss of those points as more aversive. As a result, those who are not required to earn points may take more risk compared to those that must earn their points.

METHOD

Participants

Twenty-four college students were recruited at a student recreation center at a

Midwestern university. Inclusion criteria included previous experience playing competitive basketball: junior high, high school, college or other organized basketball league as well as no gambling pathology. Participants were screened using the South Oaks Gambling Screen (Lesieur & Blume, 1987) to account for any high degree of risk taking associated with pathological gambling. No participants scored higher than 3, suggesting potential gambling pathology. Of the 24 males recruited, 12 were African American, nine Caucasian, two Asian and one identified as other (non-Hispanic). Five had played basketball in junior high, 17 played in high school, one played in college, and one played basketball in another organized league. Participants ranged in age from 18-26.

Experimental Design and Measures

Participants were told they were playing a “hot shot basketball challenge” in which the object was to “earn and keep as many points as possible.” Baseline data were collected on free throw and three point shot accuracy prior to group assignment to account for accuracy as a determinant in shot selection. Participants were randomly assigned to one of three groups by the roll of a die. The groups were designed so that only the response effort to gain points varied across groups, and each group began with approximately the same number of points prior to wagering. Group one was awarded 60 points which represented low response effort to obtain points. Group two was given the opportunity to make as many baskets as possible in 40 seconds, for every shot made the participant earned three points. Group three was given the opportunity to make as many baskets as possible in 2 minutes, for each basket made the participant earned one point. Due to the number of points earned per shot, participants in group three were required to make three times as many shots

(54 shots total) to gain the same average amount of points as those in group two. Participants in group two could have earned 54 points to wager after making just 18 shots.

After earning or being awarded points, each participant was given the opportunity to take 20 shots from anywhere on the court. Shots in front of the foul line (layups) were worth one point, shots behind the foul line (free throws) were worth two points, and shots behind the three point line were worth three points. Participants were told “If you make the shot, you get to keep the points, if you miss the shot you lose that many points. Your goal is to earn and keep as many points as possible. Pretend that you are playing a real game. You may shoot wherever you like.” Layups represented a low risk due to the high probability of making the shot, free throws represented a moderate risk and three-pointers a high risk. The independent variable was group assignment and the level of difficulty required to achieve initial points that would later be wagered. The dependent variable was shot selection: layups, free-throws or three-pointers.

Setting

Sessions took place in a large gymnasium containing three regulation sized basketball courts. The experimenter was granted permission to conduct the study during normal recreation center hours. The basketball used was a standard men’s regulation sized basketball. Courts were marked with the standard National Collegiate Athletic Association (NCAA) free throw line and three point arc. A single basket was used for the experiment. Students were permitted to use the other baskets throughout the course of the experiment. Data were collected by an observer using a clipboard and pen. The observer stood near the basket and inside the three point arc. Participants were told their point total following each shot throughout the experiment.

Procedure

After obtaining consent, and screening for basketball experience and potential gambling pathology, each participant shot 10 free throws and 10 three pointers to gauge their overall accuracy. Following baseline measures each participant was randomly assigned to a group by the roll of a die. To obtain points with which to wager, group one was given 60 points, group two earned three points for each basket made in 40 seconds and group three earned one point for each basket made in 120 seconds (2 minutes). Group two earned an average of 54.43 points (range 39-75), and group three earned an average of 53.33 points (range 39-69). After earning or being given points, each participant wagered their points by taking 20 shots of varying difficulty. Making a shot resulted in an addition of the shot value to the point total, missing a shot resulted in a deduction of the shot value from the point total. Participants were told shots in front of the foul line (layups) were worth 1 point, behind the foul line (free throws) were worth two points, and behind the arc (three-pointers) were worth three points. Participants were updated after every shot of their point total. Data were collected on shot selection, whether the shot was made or missed and point total following each shot. After 20 shots were taken, participants were debriefed as to the purpose of the study. A second independent observer scored shot selection for 32% of trials in which shots were taken. Inter observer agreement was calculated by dividing agreements by agreements plus disagreements and multiplying by 100%. Inter-observer agreement was 100% for all trials.

RESULTS AND DISCUSSION

A multivariate analysis of variance (MANOVA) was conducted to measure the effects of group assignment (points awarded, points earned with moderate difficulty, and

points earned with increased difficulty) on shot allocation: layups, free throws, and three pointers. Significant differences were found between the three groups, Wilk's Lambda of .26 is significant, $F(6,38) = 6.19$, $p < .01$ indicating that the dependent measures (shot selections) are significantly different for each group. The multivariate partial eta squared = .49 indicates that 49% of the variance is associated with the grouping factor.

Analyses of variances (ANOVA) were conducted as follow up tests to the MANOVA. The ANOVA comparing the number of layups taken (least amount of risk) in each group was significant $F(2, 21) = 9.15$, $p < .05$, partial eta squared = .47. The ANOVA comparing the number of free throws taken in each group was significant $F(2,22) = 11.0$, $p < .05$, partial eta squared = .51, and the ANOVA comparing the number of three pointers taken for the three groups was significant $F(2, 22) = 7.83$, $p < .05$, partial eta squared = .43. Post hoc analyses consisted of pairwise group comparisons that were tested at the bonferroni adjusted .017 level. A Tukey post hoc analysis to the ANOVA comparing the number of layups taken revealed significant differences between groups one and three as well as two and three, $p < .017$. Post hoc analysis to the ANOVA comparing the number of free throws taken in each group found significant differences between groups one and two as well as between groups two and three. Significant differences in the number of three pointers taken were found between groups one and two as well as one and three.

Taken together, these results indicate that group one (low response effort to gain points) took the most amount of risk as evidenced by taking a significantly greater amount of three-pointers ($M = 11.44$, $SD = 5.57$) compared to groups two (moderate effort to gain points) ($M = 2.67$, $SD = 2.42$) and three (high response effort to gain

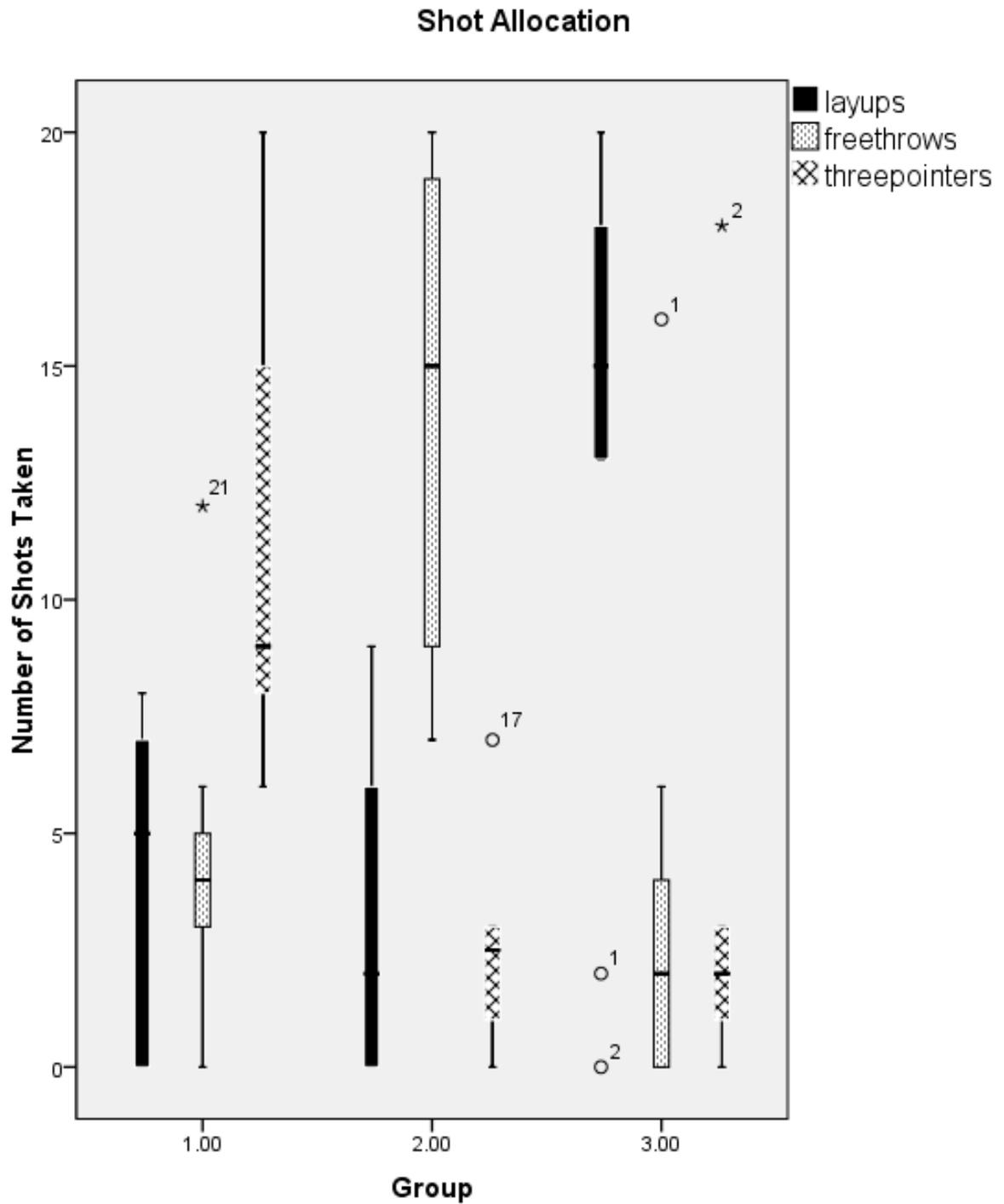


Figure 1. Shot allocation for groups one, two, and three.

points) ($M = 3.44$, $SD = 5.55$). Group three, who had to work the hardest to earn their points, took the least amount of risk evi-

denced by taking a significantly greater amount of layups ($M = 13.22$, $SD = 7.28$) than groups two ($M = 3.17$, $SD = 3.82$) and

one ($M = 4$ and $SD = 3.46$). These results support the conclusion that the level of risk can be experimentally manipulated. Shot accuracy did not vary between groups ruling out skill for each shot as a potential confound.

The purpose of this study was to investigate if risk varies as a function of response effort to gain points. Prior to group assignment, shot accuracy data indicated three point accuracy was 31.6% and free throw accuracy was 54% across groups. Figure 1 shows the mean and inter-quartile ranges for each shot across the three groups. Results indicate that participants who were given points to wager took more risk evidenced by selecting the most low percentage shots; three pointers. Given the probabilities of successful payout a participant who selected only three point shots would lose 27.6 points on average from there total given that misses resulted in point deductions. Shooting three pointers generally resulted in an overall net loss, therefore this choice represented the highest level of risk. Individuals who were freely given points shot significantly more three-pointers, resulting in the greatest net loss. Given the probability of making a free throw, a participant shooting only free throws would accrue four additional points on average. Participants in group two, who engaged in moderate effort to earn points, took significantly more free throws which represented a moderate risk. The shot yielding the most points, assuming 100% accuracy would be the layup. Participants shooting only layups would net 20 points total. Participants who were required to expend high amounts of effort to earn points (group three) took significantly less risk when wagering the points, indicated by shooting significantly more layups compared to participants who were given points; group one. Participants who were required to work for their points may have experienced losses as more aversive, resulting in less risk taken.

When points were simply given, participants took the most risk and lost the most points.

These results extend findings by Alessandri et al. (2008), Brandt et al. (2013) and Thaler and Johnson (1990). When presented with a repetitious task to shoot layups, participants who earned points continued to show a selective preference for shooting the layups when the consequence resulted in only one point compared to free throws that were worth two and three pointers that were worth three. Findings by Alessandri et al. (2008) suggest that although the points awarded were minimal for the low risk shot (layup), they may have functioned as a strong conditioned reinforcer for group three due to the high work requirement to earn each point. Thaler and Johnson (1990) suggested that losses may be less aversive when playing with house money. In this experiment, individuals given points were likely to take high amounts of risk resulting in the greatest amount of loss. The group given points (group one) wagered and lost the points by taking the most risky shots. It is possible that the points for participants in group one did not function as a strong reinforcer compared to participants in groups two and three. The group who had to commit the most effort to gain points took shots with the highest probability of payback. For members of this group, prior investment likely raised the value of each point. Shots that were missed for group three resulted in point deductions which may have been experienced as more aversive due to an increased prior investment.

A significant portion of the analysis of gambling behavior involves the study of choices and risk taking. Throughout sports, risk is inherent in the probabilistic outcomes of various choices or courses of behavior. The study of choice and risk taking may extend beyond the context of gambling into all contexts in which risk is taken. In the present study, the amount of risk was assessed

with basketball players to show the overall generality of the analysis of choice, risk, the house money effect, and sunk cost. Due to only a probabilistic nature of making a shot, the sunk cost error was likely high because players were not certain whether they would make or miss a shot. Additionally, players may give added value to an outcome that is more difficult to achieve (Alessandri et al., 2008). Such is the case when athletes win close games, play an “intense match,” or conquer a difficult opponent. The current data suggests that this sunk cost was high for participants who had a previous investment (high response effort) to gain and later wager their points.

Although points gained in basketball may serve as generalized conditioned reinforcers the points earned and wagered in this study were not tied to additional programmed rewards delivered by the experimenters. Despite this limitation, making shots and earning points while playing basketball may have been intrinsically reinforcing for the participants involved. Another limitation and unintended consequence of the current study was that the point allocation during the point earning phase for group two may have made selection of three-pointers and layups less desirable. The point value assigned to each shot by the experimenter may help explain the disproportionate amount of free throws shot by group two. Participants in group two earned three points for each layup made in a 40 second timed trial. After earning three points for each layup, shooting three-pointers when wagering may have been less appealing due to the same payout rate despite increased response effort and lower overall probability of success. Similarly, changing the value of the layup from three points (during the timed trial) to one point (when wagering) may have made the layup less appealing because the reward for making the shot had decreased. Nonetheless, the finding supports

the conclusion that shot allocation and risk taken was a product of the amount of effort required to achieve points (Brandt et al., 2013).

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