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Monetary Incentive and Range of Payoffs as Determiners of Risk Taking

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Introduction

The few studies on the decision to gamble have been primarily concerned with measurement of utility (e.g., Mosteller & Nogee, 1951; Royden, Suppes, & Walsh, 1959) and, therefore, have provided no systematic data on variables affecting this decision. In several studies gambling behavior was related to distribution of payoffs (Edwards, 1954; Coombs & Pruitt, 1960). Subjects chose between bets rather than between gambling and not gambling. Subsequently, Myers and associates have been concerned with the effects of parameters of the payoff distribution upon the choice between gambling and not gambling.

Myers and Sadler (1960) varied the number of chips which might be won or lost on each gamble (range), the average payoff being zero. When the alternative to gambling was the sure gain of one chip, gambling increased with increases in range; when the alternative to gambling was the sure loss of one chip, gambling decreased with an increase in range.

Had the chips been exchangeable for money, Myers and Sadler's results might have been different. Both monetary incentive and range of payoffs increase the risk associated with each gamble. The implied hypothesis, which is the op-

posite of that generated by data on effects of incentive on sequential choices, is that increased monetary incentive, like a wider range, should increase gambling, where the alternative to gambling is the sure gain of one chip, and decrease gambling when the alternative to gambling is the sure loss of one chip. To decide between these alternative implications, in the present study the decision to gamble was investigated as a function of monetary incentive and payoff range. The chips were worth no money or 5 cents and a decision to gamble involved a narrow, medium, or wide range of unknown payoff.

In addition to providing data on the effects of monetary incentive, the present study investigated the effects of a payoff range greater than that used in the Myers & Sadler study. To control for any range effects due to differences among ranges due to sequences of payoffs, one sequence was randomly generated, and the other two were derived from it in the manner described in the procedure section.

Method

Materials. Four decks of 100 3 x 4 white cards were prepared. In the known payoff deck 50 cards with +1 written on them alternated randomly with 50 cards with -1. The

three other decks of 100 cards each provided different ranges of unknown payoffs. The narrow-range deck (N) had integers randomly chosen from +2 to +6 and from -2 to -6. The medium range deck (M) was constructed by adding 10 to every positive number of (N) and subtracting 10 from every negative number giving a range of +12 to +16 and -12 to -16. The wide range deck (W) was constructed by adding and subtracting 20 to the integers in (N). Thus the ordinal positions of the cards were the same in all three decks.

Procedure. Eighteen Ss gambled only for poker chips (0¢) and 18 others gambled for chips worth 5 cents apiece. On each of three successive days, S was presented with the known payoff deck, and a different one of the unknown payoff decks. Order of use of the (N), (M), and (W) decks was counterbalanced in a 3 x 3 Latin Square with six Ss administered each order. The main features of the experimental design are shown on the left-hand side of Table 1.

The Ss were run individually. They were given full instructions at the beginning of the first session. Briefly, Ss were told to turn over the top card in the deck of known payoffs at the beginning of each trial. They then chose between standing pat by accepting the gain or loss of one chip represented by the card and gambling by drawing the top card from the deck of unknown payoffs. If S

Table 1

Means and SDs of Proportions of Gambling Responses on +1 and −1 Trials for Successive 25-Trial Blocks under Each Combination of Incentive and Payoff Range

Monetary Incentive	Range of the Unknown Payoff	Alternative to Gambling (Known Payoff)	Trials 1-25 Mean	1-25 SD	26-50 Mean	26-50 SD	51-75 Mean	51-75 SD	76-100 Mean	76-100 SD
0¢	N	+1	.594	.284	.539	.318	.456	.282	.511	.337
		−1	.903	.150	.910	.114	.874	.138	.911	.130
	M	+1	.620	.270	.551	.302	.494	.221	.604	.311
		−1	.796	.197	.796	.170	.822	.190	.744	.230
	W	+1	.466	.286	.472	.300	.394	.259	.596	.335
		−1	.838	.187	.836	.219	.756	.242	.800	.239
5¢	N	+1	.654	.128	.588	.294	.489	.301	.563	.262
		−1	.833	.159	.893	.152	.831	.122	.878	.173
	M	+1	.688	.194	.537	.234	.461	.240	.574	.191
		−1	.796	.253	.790	.229	.815	.178	.761	.212
	W	+1	.658	.255	.574	.306	.483	.309	.689	.266
		−1	.782	.277	.756	.242	.741	.223	.750	.212

decided not to gamble, the top card in the unknown payoff deck was turned anyway, showing what he would have won or lost had he gambled. For each subsequent session, they were told only that the unknown payoff deck was new.

Two hundred poker chips were stacked in front of S, and those with a monetary incentive were told that each chip was worth 5 cents; their initial stake was worth $10.00.

Ratings. At the end of each session, Ss were given an 11-point scale from -5 to +5, along which they rated the means of the known payoff deck and of the unknown payoff deck of that session. They were also asked to describe their gambling strategies and changes in strategy. After the third session, Ss were also asked what they would have done differently in the first two sessions.

Subjects. Each of 36 men undergraduates enrolled in the University Summer Session was paid $3.00 to participate. They were randomly divided into two groups of 18 Ss each.

Results

Choices. The scores were proportions of choices to gamble on both +1 and -1 trials during each of four 25-trial blocks. For example, if an S gambled on 3 of the 12 or 13 +1 trials of a particular block, his proportion for that block was .250 or .231. Table 1 presents means and

SDs of these proportions for each combination and range; the means are plotted in Figure 1. Analysis of variance was performed on arc-sine transforms of the proportions. The results of this analysis (Table 2), in conjunction with the relationships shown in Table 1 and Figure 1, suggest the following conclusions: (a) under all combinations of range and incentive, more risk-taking occurred on -1 trials than on +1 trials ($P < .001$); (b) incentive had little effect on the total number of risks taken; (c) more gambling occurred with deck M than with deck N on +1 trials and the reverse on -1 trials ($P < .01$); and (d) gambling with deck W is affected by both value and incentive; there was more gambling with the 5 cent incentive than with no incentive on +1 trials, and the converse on -1 trials ($P < .001$).

In addition, there were a number of significant interactions involving blocks of trials. As of now, however, no rational explanations can be offered. Therefore, detailed description of the interactions involved would be of little use.

Ratings. Table 3 shows the means of Ss' ratings of the means of the known and unknown payoff decks for each combination of range and incentive. The means for the known payoff decks were from -.22 to +.44; those for the unknown payoff decks were from -.66 to 1.05. Thus, the

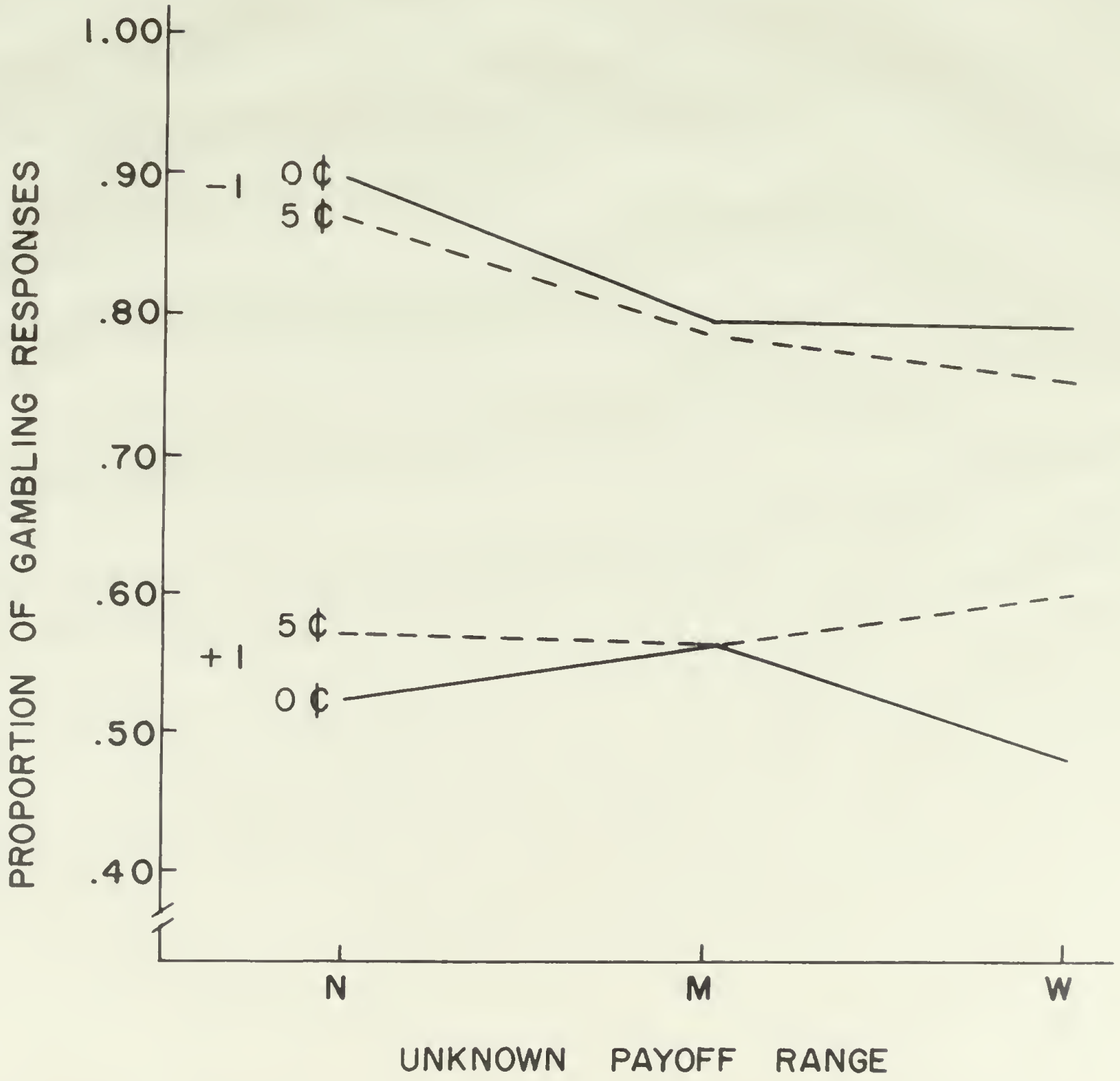

1.00
.90
.80
.70
.60
.50
.40
PROPORTION OF GAMBLING RESPONSES
-1
0¢
5¢
+1
5¢
0¢
N
M
W
UNKNOWN PAYOFF RANGE

Table 2

Summary of Analysis of Variance

Source	df	SS	MS	F
Incentive (I)	1	710.00	710.00	--
Ss/I	34	71,670.00	2,047.71	
Value (V) (Known Payoff)	1	103,825.00	103,825.00	33.72***
Range (R)	2	2,722.80	1,361.40	2.22
Blocks (B)	3	4,364.80	1,454.93	4.90**
V x B	3	2,961.70	987.23	3.28*
V x R	2	3,671.20	1,835.60	8.73**
R x B	6	1,122.10	187.01	8.87**
R x B x V	6	2,206.50	367.75	2.25*
V x I	1	2,910.50	2,910.50	1.07
B x I	3	170.40	56.80	0.19
R x I	2	585.40	292.70	0.47
V x I x R	2	3,212.20	1,606.10	13.66***
R x I x B	6	370.00	61.66	2.82*
V x I x B	3	714.50	238.16	1.39
R x B x V x I	6	5,399.70	154.27	1.57
Ss x V/I	34	94,547.86	2,701.36	
Ss x B/I	102	30,946.24	296.53	
Ss x R/I	68	42,774.16	611.05	
Ss x V x B/I	102	30,619.01	300.18	
Ss x V x R/I	68	21,441.39	210.20	
Ss x R x B/I	204	4,463.30	21.80	
Ss x V x B x R/I	204	33,233.87	162.91	

* $P \leq .05$
** $P < .01$
*** $P < .001$

Table 3

Means of Ratings of Deck Means

Range	Payoff			
	Known		Unknown	
	0	5¢	0	5¢
N	.33	.16	.44	-0.66
M	.33	.16	.00	1.05
W	.44	-.22	.88	0.88

means for the known payoff deck were closer to the true mean of zero and were less variable than the means for the unknown payoff decks. Neither set of means varied systematically with incentive or range of unknown payoff. Nor were there any systematic relationships between these deck means and either overall proportions of risks or proportions of risks for the last 25 trials. Most Ss reported following a gambler's fallacy strategy and none reported an awareness of gambling differentially with different decks of unknown payoffs. Incentive had no differential effect.

Discussion

The decision to gamble or not to gamble following known outcomes of loss or gain of a poker chip was investigated as a function of three ranges of unknown payoff involving the loss or gain of chips worth nothing or worth five cents. Previous findings (Myers & Sadler, 1961; Myers & Katz, 1961) of more gambling when the alternative to gambling was the loss of a chip than when the alternative was the gain of a chip were confirmed. Monetary incentive reduced this difference: trials when the alternative was -1 were followed by fewer choices to gamble for chips worth 5 cents than for those worth nothing, while

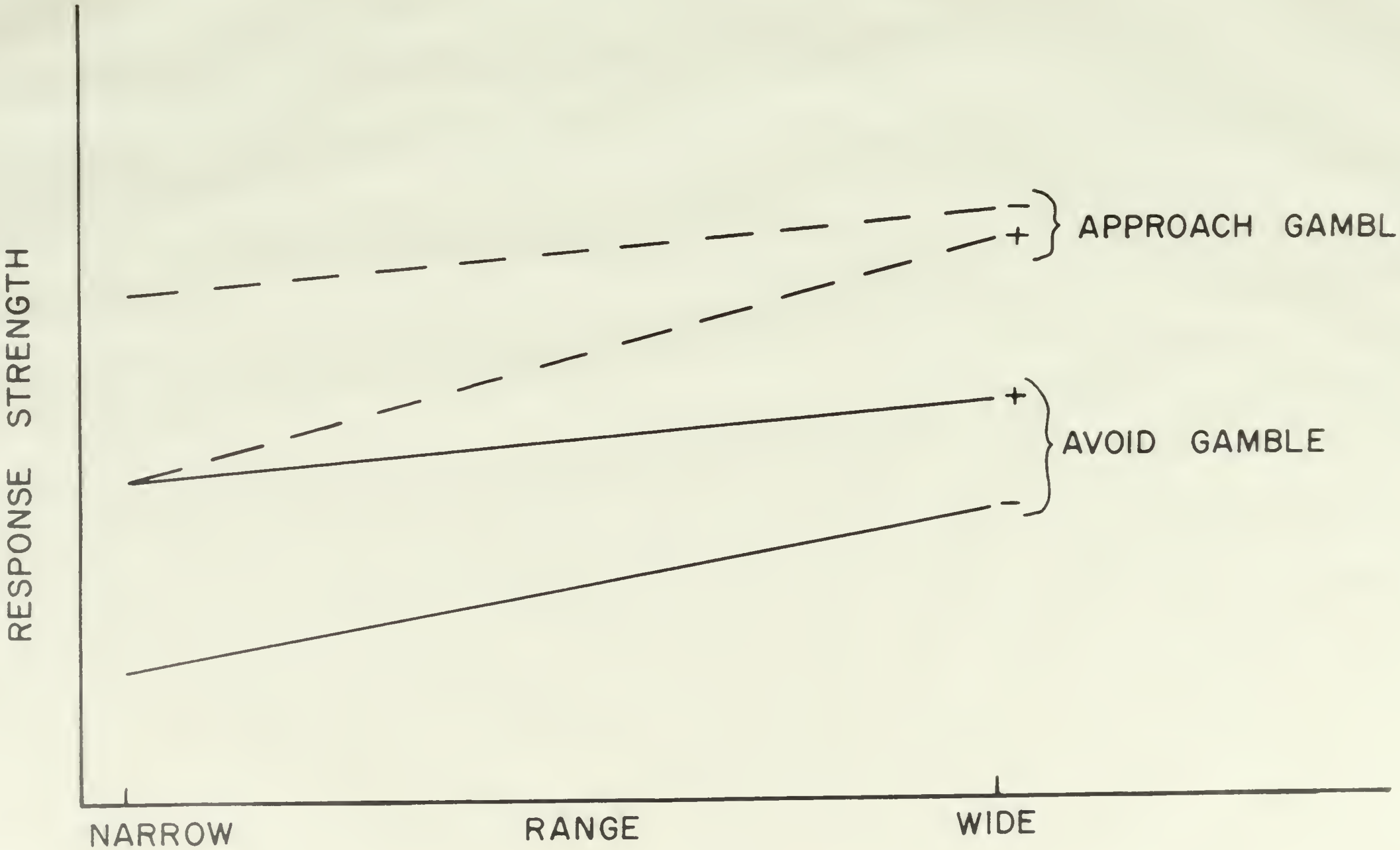
trials where the alternative was +1 were followed by more choices to gamble for chips worth 5 cents than for those worth nothing. Thus, contrary to the implication of findings for two-choice situations and in accordance with the notion that monetary payoff and range are functionally equivalent, for all three ranges monetary incentive yielded an increase in gambling on +1 trials and a decrease on -1 trials.

With monetary incentive, increasing the range resulted in more gambling after the +1 alternative and less gambling after the -1 alternative. With no monetary incentive, increasing the range reduced gambling after the -1 alternative; but after the +1 alternative gambling increased from the narrow to medium range and then decreased to the lowest value with the wide range.

Other experiments have shown the form of value and range interaction obtained for the 5 cent incentive group. With three ranges up to and including the medium range of the present study, Myers and Sadler found more gambling consistently with wider ranges when the alternative was the gain of a chip, but less gambling with wider ranges when the alternative was the loss of a chip. With ranges N and M, Myers and Katz obtained similar results, and Suydam (1961), using a very different procedure, also found

this convergence of curves for positive and negative values over several ranges.

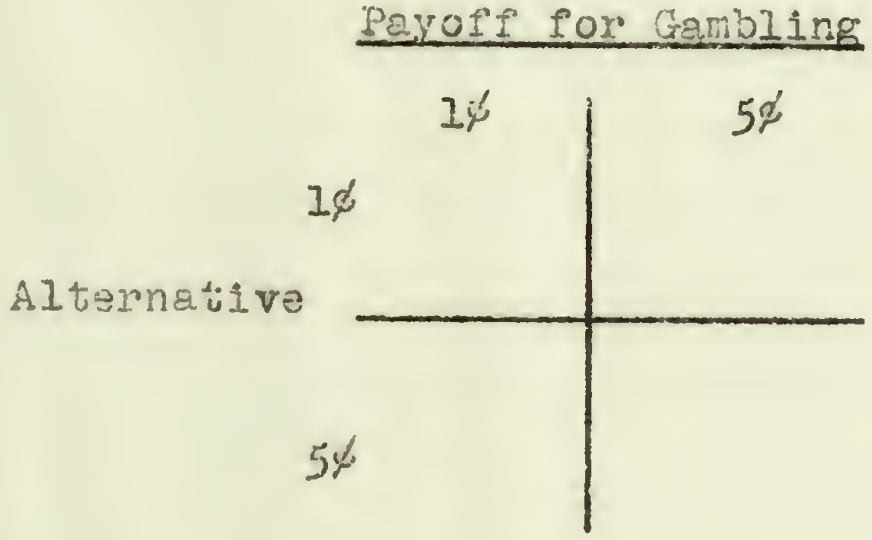
Figure 2 presents a possible explanation of the convergence effect. Response strength is plotted as a function of increasing range, the various curves representing gradients of approach and avoidance (tendency to gamble and not gamble) against positive and negative alternatives to gambling. The position of the curves is derived from the following assumptions: (a) both approach and avoidance tendencies increase as range increases, (b) the slope of the avoidance gradient is steeper than that of the approach gradient when the alternative is the loss of one chip, and (c) the slope of the approach gradient is steeper than that of the avoidance gradient when the alternative is the gain of one chip. If amount of gambling is considered to be directly related to net response strength (the difference between approach and avoidance), Figure 2 describes the experimental effects summarized above. The above points lead to the prediction that the curves will continue to converge as range increases. Assumption (c) appears to contradict a primary assumption of Miller (1959). However, Miller's gradients are invariably plotted as a function of either distance or time to a goal. Little data exist on rate of change of the gradient as a function of change in


RESPONSE STRENGTH
+
−
APPROACH GAMBLE
+
−
AVOID GAMBLE
NARROW
RANGE
WIDE

motivating conditions and there are no a priori grounds for rejecting assumptions (b) or (c). Since it is doubtful that Ss would ever gamble more on +1 trials than on -1 trials, no range can exist where the +1 gradients are further apart than the -1, which would occur if the approach-avoidance curves were linear over all ranges. Linear gradients have been used as a first approximation merely for the sake of simplicity. If amount of gambling is considered to be directly related to net response strength (the difference between approach and avoidance), Figure 2 describes the experimental effects summarized above. The above points lead to the prediction that the curves will continue to converge as range increases.

If the monetary worth of the alternative remains constant as incentive changes, incentive can be substituted for range. However, data for the 5 cent incentive represent not only the effect of increasing the monetary worth of each payoff for gambling but also the effect of increasing the monetary worth of each alternative to gambling. If number of chips and monetary worth of chips function similarly, (a) increasing the monetary worth of the payoff for gambling increases the tendency to gamble on the +1 trials and not to gamble on -1 trials and (b) increasing the monetary worth of the alternative to gambling decreases

the tendency to gamble on +1 trials and not to gamble on -1 trials. The data of the present study suggest that the effect of increased monetary worth of the payoff for gambling was the greater since Ss gambled more on +1 trials and less on -1 trials with the 5 cent incentive than with no incentive. The wide range showed this effect most clearly. However, a study is required which will separate the effects of increased incentive for gambling and increased incentive for not gambling. Such a study is represented by the following design which varies the monetary worth of both alternative and payoff for gambling.



The effect upon gambling behavior due to monetary worth of the payoff for gambling will be inferred from differences in the column means and the effect due to monetary worth of the alternative will be inferred from

differences in the row means. In addition, interaction data will be available which is lacking in the present study.

With no incentive, in both the present study and Myers and Katz's study, instead of continued convergence from M to W, the curves diverged. At present, this result cannot be explained. Further research is required with more levels of range, incentive and values of the alternative than have thus far been employed.

Summary

The decision to gamble was investigated as a function of monetary incentive, range of payoffs for gambling, and value of payoff in lieu of gambling. One group of 18 men undergraduates gambled for chips only and another group of 18 gambled for chips worth 5 cents each. Three ranges of unknown payoffs were used, one at each of three sessions. The alternative to gambling was a constant known payoff.

Neither incentive nor range influenced the total number of risks taken. More gambling occurred when the alternative to gambling was a loss than when it was a gain. As either range or monetary incentive increased, more gambling occurred when the alternative was a gain and less when it was a loss.

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