Why Do People Gamble and Keep Gambling Despite Heavy Losses?

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Research Article

Why Do People Gamble And Keep Gambling Despite Heavy Losses?

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Abstract—*If a long series of gambles is subjectively structured into units each consisting of a string of consecutive losses followed by a win, positive valued strings will be short and negative valued strings will be long. Long negative strings will be temporally discounted more than short positive strings, increasing the gamble's subjective value. People, therefore, may gamble because even games of objectively negative expected value may be subjectively positive. People may keep gambling despite heavy losses because reduction of degree of discounting and expansion of the behavioral unit, characteristics of self-control in other areas, fail to significantly decrease a gamble's subjective value.*

Compulsive gambling has been called an addiction, like heroin and alcohol addiction; there exist chapters of Gamblers Anonymous which (like Alcoholics Anonymous) deal with gambling addiction as a disease, curable by a mixture of group therapy and religious faith. Whatever the success or failure of such practices, the major problem with the view of gambling as an addiction is that gambling does not involve a substance which is internally consumed. There is apparently nothing in gambling to be physiologically addicted to. Even strictly behavioral models of addiction (for instance, Becker & Murphy, 1988) presume the existence of a commodity that is consumed at an unusually high rate. But in gambling it is difficult to identify such a commodity. An alcohol addict consumes alcohol. If wine is unavailable, whiskey or beer will do. But while a compulsive gambler may also be a "big spender," spending in no way substitutes for gambling. Thus, it cannot be said that gamblers consume money in the way alcoholics consume alcohol.

Compulsive gamblers do seem to seek risk, but risk is not a commodity so much as a pattern of interaction between behavior and environment—exactly what behaviorists claim to be studying. This article's purpose, therefore, is to bring behavioral laboratory studies to bear on the problem of gambling in general and compulsive gambling in particular. A recent series of comprehensive empirical studies of the behavior and expressed attitudes of gamblers by Wagenaar (1988) provides the starting point for the present analysis.

OTHER THEORIES

Many theories have been proposed to explain people's attraction to gambling. Wagenaar's own preferred explanation of gambling is the cognitive action of a set of "heuristics and biases" upon a basic motive to win money. For instance, the heuristic of *availability* implies that what is most easily remembered affects probability judgments most strongly. Gamblers might remember wins better than losses and thus expect to win at games where they have actually lost in the past. But at least one study (Gilovich, 1983) has found that gamblers remember losses better than wins. A more serious problem with this theory, as Wagenaar himself says (1988, p. 115), is that "it does not specify rules telling us which heuristic will be applied in a given situation. Even worse, from the individual differences among gamblers, it is obvious that several heuristics could be chosen in one and the same situation, and that these heuristics lead to opposite behaviors." Another problem with the heuristics and biases theory, from a behavioral viewpoint, is its neglect of motivational factors. According to this cognitive theory all people have equal motivation to win; gamblers are simply less rational (more afflicted by heuristics and biases) than others. While it is true that the expressed beliefs and rationalizations of highly experienced gamblers reveal many heuristics and biases, there is no evidence that gamblers are any less rational in their judgments about probabilistic outcomes than are nongamblers. We are still left with the question of why some people gamble and some do not.

The previous theory closest to the one presented here is *prospect theory* (Kahneman & Tversky, 1979). According to prospect theory, after framing (accounting for context) and editing (restructuring alternatives) have been completed, each possible outcome is expressible as a product of a "decision weight," which is a function of the probability (p) of the outcome and a "value," which is a function of the amount (A) won or lost for that outcome. The overall value of an alternative is the sum of the products of decision weights and values of all possible outcomes contingent on choice of the alternative. Given a set of alternatives, people will choose the one with the highest overall value. Some people gamble and some do not, according to prospect theory, because of individual differences in framing and in the two functional relationships (stated) above.

A problem with prospect theory, critical with regard to gambling, is that the fundamental unit of prospect theory is the single one-shot bet with a fixed set of possible outcomes. In laboratory studies people typically avoid risk when choosing among one-shot alternatives with positive outcomes. Keren and Wagenaar (1987) found, however, that preferences reversed (people's preferred risk) with the same alternative to be repeated ten times. Thus the one-shot laboratory gambles that prospect theory was designed to explain differ drastically from the sequences of bets common in gambling.

The present theory differs from prospect theory in two respects. First, the present theory takes as its fundamental behavioral unit, not a one-shot choice with a set of possible outcomes, but a series of choices with a fixed outcome. Once

Table 1. *Values of 25 strings with a probability of .25, a bet of $1 and a payoff of $3 to win*

		Net Payoff	Probability of String	Expected Value of String	Discounted Value of String
1	W	+3	.250	+.750	+.750
2	LW	+2	.188	+.375	+.188
3	LLW	+1	.141	+.141	+.047
4	LLLW	0	.105	0	0
5	LLLLW	−1	.079	−.079	−.016
6	LLLLLW	−2	.059	−.119	−.020
7	LLLLLLW	−3	.044	−.133	−.019
8	LLLLLLLW	−4	.033	−.133	−.017
9	LLLLLLLLW	−5	.025	−.125	−.014
10	LLLLLLLLLW	−6	.019	−.113	−.011
11	– –	−7	.014	−.099	−.009
12	– –	−8	.011	−.084	−.007
13	– –	−9	.008	−.071	−.005
14	– –	−10	.006	−.059	−.004
15	– –	−11	.004	−.049	−.003
16	– –	−12	.003	−.040	−.003
17	– –	−13	.003	−.033	−.002
18	– –	−14	.002	−.026	−.001
19	– –	−15	.001	−.021	−.001
20	– –	−16	.001	−.017	−.001
21	– –	−17	.001	−.013	−.001
22	– –	−18	.001	−.011	−.001
23	– –	−19	.0004	−.009	−.0004
24	– –	−20	.0003	−.007	−.0003
25	– –	−21	.0003	−.005	−.0002
SUM				+.02	+.85

gambling is viewed as a series of events in time (few gamblers bet once and quit), the delay to an outcome assumes importance (Rachlin, Castrogiovanni, & Cross, 1987; Rachlin, Logue, Gibbon, & Frankel, 1986). Thus, the second difference between the present theory and prospect theory is its account of delay as well as probability.

THE STRUCTURE OF A GAMBLE

According to Skinner (1953) gambling has the structure of a variable-ratio (*VR*) schedule of reinforcement—a series of operant strings all culminating in the same event—positive reinforcement. Mowrer and Jones (1943), studying lever presses of rats, found that the number of responses required by the ratio schedule for reinforcement was reflected in the number of responses emitted during extinction. They speculated that the rat emits a given number of response-units in extinction rather than a given number of component responses. The response-unit in turn is defined by the conditions during reinforcement.[1]

The relevant probabilistic element in such a view is not the outcome of a given act (win or lose) but the length of the string of losses culminating in a win. For a given probability (p) of a gamble the average number of operants in a string is $1/p$ (the *VR* value). The key assumption of the present theory is that the fundamental behavioral unit is the string. An individual loss has no negative valence; the individual loss is a subunit of a string; only the string has value. Another way of putting this assumption is that the gambler's accounting system (Thaler, 1981) is such that wins and losses are added up only after a win (at the end of each string); then the system is reset. Consider, for instance, a string of $1 bets with an individual probability of winning equal to .25, paying $3 to win. The expected value (*EV*) of this bet ($3 × ¼ − $1 × ¾) is zero. Table 1 shows the 25 most probable strings and indicates their probabilities and individual expected values. The sum of the expected values of the 25 strings is +2¢. Of course, since the bet is of zero expected value, the rest of the negative strings, from 26 to infinity, would exactly counterbalance that quantity, with an expected value of −2¢. Let us ignore these low probability strings ($p < .0003$) for the present.[2]

1. We are concerned primarily with the relation between whole units and reinforcement. The more molecular question, what generates and maintains response units and patterns in various reinforcement schedules, is a matter of considerable debate (Zeiler, 1977) and beyond the scope of the present article.

2. Table 1 illustrates a gamble of zero expected value. For corresponding gambles of negative overall expected value, such as at casinos, the sum of the expected values of the first 25 strings would be negative.

The important point to note about Table 1 is that all of the positive strings are short and all of the negative strings are long. For the person about to gamble, all of the positive outcomes will occur soon while all of the negative outcomes will occur later; the more positive the outcome, the sooner it will occur.

Evidence from research with nonhumans (Mazur, 1987) and recent data obtained with humans (Loewenstein, 1989; Rachlin, Raineri, & Cross, 1989) indicate that delayed outcomes of a given amount are discounted by the hyperbolic function:

$$f(d) = 1/(1 + kd) \tag{1}$$

where d is the delay to outcome, and k is a constant reflecting degree of temporal discounting. According to prospect theory the value of a gamble is some function of probability, $g(p)$, multiplied by some function of amount, $h(A)$. If we consider strings with different delays as units (rather than individual gambles all with effectively zero delays) the value of a string is:

$$v = f(d)g(p)h(A) \tag{2}$$

For illustrative purposes let us assume $g(p)$ is equal to p, $h(A)$ to A and $f(d)$ to the value given by Eq. 1 with degree of temporal discounting (k) equal to unity and the outcome of the first string at $d = 0$. The last column of Table 1 gives the discounted value of each string. The sum of the discounted values of all 25 strings is now +85¢.[3]

As temporal discounting increases from $k = 0$ in Eq. 1, the positive value of the gamble as a whole (the sum of the values of all strings) increases to a maximum, then decreases to an asymptote equal to the value of the first (undelayed) string. As k continues to increase all other strings would eventually be 100% discounted. For the gamble illustrated in Table 1, the asymptote would be +75¢. Thus, if k were initially above the point of maximum value, decreases in the degree of temporal discounting (decreases in k) might actually increase the subjective value of the gamble. According to the present model, therefore, the critical factor that gives positive value to gambles is the mode of response structuring and accounting—adding up wins and losses only after a string of bets culminating in a win—not degree of temporal discounting. Gambles of zero expected value, structured in this way, would be valued positively regardless of degree of temporal discounting; such gambles would be subjectively valued at their nominal (zero) expected value only by a person who did not discount the value of future events at all ($k = 0$).

The present model would explain lottery participation in the same way as other gambling. In the case of lotteries, however, the many people who bet and never win essentially never settle accounts. Lottery players do not consider their losses because they would almost always be wiped away by an eventual win. For a gamble of a constant expected value, increase of probability of winning (hence, decrease in amount won) decreases the number of positive strings before a negative string is reached. For the gamble of Table 1 (probability of win = .25) there are three positive strings. If Probability of winning were .5, there would be only one positive string. conversely, in the case of lotteries, there would be a virtually infinite number of positive strings.

ALTERING STRINGS

Consider string #10 in Table 1. Suppose a gambler has already lost 9 times in a row and is considering a tenth bet. As it stands, even if the 10th outcome is a win the string will be negative (a loss of $6). A method of converting the string to a positive one would be to increase the payoff for the tenth bet by decreasing the odds—by playing a long shot. This would decrease the probability that the very next gamble would be a win but provide the possibility that the string as a whole would be positive. If the string and not the individual gamble is the basic unit, gamblers should tend to increase risk after losing. Wagenaar (1988, p. 53) found that roulette players did indeed increase risk after losses and it is well known that, at the race track, while long shots are generally overbet, they are overbet even more on late races when, presumably, more players are in the midst of losing streaks (McGlothin, 1956).

One can generalize this observation to the case of "sunk costs" (Northcraft & Wolf, 1984). In a probabilistic situation strings of losses are, effectively, investments that may be "protected" by increasing risk. Speculating further, the writer whose manuscripts have been repeatedly rejected needs, more and more, to produce a masterpiece. The situation is identical with respect to delay—the longer one has waited for a reward, the bigger that reward has to be to justify the wait. Writer's block may be a situation where the subjective size of the achievable reward is always just insufficient to justify the time and effort already spent in trying to achieve it.

The above considerations indicate why a person might begin to gamble and, in the case of lotteries, why a person might continue to gamble. But they do not explain why people continue to gamble despite heavy losses. What Wagenaar (1988, p. 106) concludes about prospect theory applies to the present theory as well: "Although it may account for incidental gambling [it] does not explain why people continue to gamble for years, despite their losses." Why don't people learn to adjust their betting behavior in the face of long strings of disastrous losses?

COMPULSIVE GAMBLING

As children grow older they become capable of delaying gratification longer; furthermore, individual differences in ability to delay gratification may persist from childhood at least through adolescence (Mischel, Shode, & Rodriguez, 1989). From a behavioral perspective, these differences may be char-

3. In general, the sum of the values of strings discounted by Equation 1 is:

$$W_p \sum_{n=0}^{\infty} (1 - np)(1 - p)^{n-2}(1 + k(n - 1))^{-1}$$

where W is the amount won divided by the amount bet, p is the probability of winning and n, the length of the string.

acterized in two ways: First, in terms of degree of temporal discounting; second, in terms of extent and complexity of behavioral structure. Suppose (as in the Mischel et al., 1989, experiments) a 4-year-old boy takes and eats an immediately available single cookie instead of waiting 10 min (with the cookie exposed in front of him) for two cookies, but a 6-year-old boy waits for the two cookies. The younger boy may be said to discount the larger delayed reward more than 50% over the 10 min while the older boy discounts the larger reward less than 50%. Alternatively, the younger boy may be thought of as incapable of organizing his behavior into a unit as much as 10-min long; in that case he would have to repeatedly reject the immediate reward. The older boy, however, who can organize behavior during the waiting period into a 10-min unit, needs to reject the smaller reward only once.

Correspondingly, adults (who may sacrifice years of income studying for a college degree) may be said either (1) to discount the ultimate expected rewards only slightly or (2) to organize their behavior over a large span of time and to count up the benefits and subtract the losses only after very long anticipated or experienced temporal units.

Behavioral and economic theories of self control based on studies with humans and nonhumans (Ainslie, 1975; Herrnstein & Prelec, in press; Logue, 1988; Thaler, 1981) have come to view self control in one or both of the above ways. If such viewpoints are valid, adults may be said to have learned to control themselves in various situations through the action of internal mechanisms (unspecified by the theories) that serve either (a) to decrease temporal discounting (decrease k) or (b) to increase the temporal extent of the behavioral unit. *The present analysis suggests, however, that no mechanism that normally accomplishes either or both of these ends will work to reduce compulsive gambling.* First, as previously indicated, reduction in degree of temporal discounting (k), except to unrealistically low values, may actually increase the subjective (discounted) value of gambles. Second, because of the stochastic nature of gambling, simply increasing the size of the response unit would only make matters worse.

A compulsive sports gambler, for instance, bets on several games in a day and, according to the present theory, resets accounts after each win. But the stochastic nature of gambling is preserved in larger units. Replacing the W's and L's in Table 1 by winning days, months or years and losing days, months or years with the bookie, at the track or at the casino merely magnifies the stakes and makes overall losses greater.

Of course there are structural systems that could check compulsive gambling. If the behavioral units were fixed numbers of gambles or fixed units of time, and if accounts were settled after each of such units, positive units would occur no sooner in time than negative ones. This sort of restructuring, however, requires not mere expansion of strings but reconstruction of units on the basis of a given number of gambles or time spent gambling. With variable-ratio structuring (such as in Table 1) the signal indicating the end of a unit (a win) is intrinsic to the activity itself. Count-based or time-based restructuring would require count or time signals not typically provided within the gambling situation (although running out of money would be one such signal—unfortunately a belated one).

Gradual expansion of the number of required variable-ratio responses in the animal laboratory has supported variable ratios of hundreds (occasionally thousands) of responses with no reinforcement (Ferster & Skinner, 1957). A history of such reinforcement patterning (ratio "stretching") might conceivably characterize compulsive gamblers. For such individuals, restructuring on the basis of extrinsic count-based or time-based signals might be particularly difficult.

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