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Brief article

Carry on winning: The gamblers' fallacy creates hot hand effects in online gambling

Juemin Xu *, Nigel Harvey

Department of Cognitive, Perceptual and Brain Sciences, University College London, UK

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ABSTRACT

People suffering from the hot-hand fallacy unreasonably expect winning streaks to continue whereas those suffering from the gamblers' fallacy unreasonably expect losing streaks to reverse. We took 565,915 sports bets made by 776 online gamblers in 2010 and analyzed all winning and losing streaks up to a maximum length of six. People who won *were* more likely to win again (apparently because they chose safer odds than before) whereas those who lost were more likely to lose again (apparently because they chose riskier odds than before). However, selection of safer odds after winning and riskier ones after losing indicates that online sports gamblers expected their luck to reverse: they suffered from the gamblers' fallacy. By believing in the gamblers' fallacy, they created their own hot hands.

1. Introduction

The hot-hand fallacy and gamblers' fallacy are assumed to be common among gamblers because it is thought that they believe that outcomes for future bets are predictable from those of previous ones.

1.1. Belief in a hot-hand: "If you have been winning, you are more likely to win again."

The term a "hot hand" was initially used in basketball to describe a basketball player who had been very successful in scoring over a short period. It was believed that such a player had a "hot hand" and that other players should pass the ball to him to score more. This term is now used more generally to describe someone who is winning persistently and can be regarded as "in luck". In gambling scenarios, a player with a genuine hot hand should keep betting and bet more.

There have been extensive discussions about the existence of the hot hand effect. Some researchers have failed to find any evidence of such an effect (Gilovich, Vallone, & Tversky, 1985; Koehler & Conley, 2003; Larkey, Smith, & Kadane, 1989; Wardrop, 1999). Others claim there is evidence of the hot hand effect in games that require considerable physical skill, such as golf, darts, and basketball (Arkes, 2010, 2011; Gilden & Wilson, 1995; Yaari & Eisenmann, 2011).

People gambling on sports outcomes may continue to do so after winning because they believe they have a hot hand. Such a belief may be a fallacy. It is, however, possible that their belief is reasonable. For example, on some occasions, they may realize that their betting strategy is producing profits and that it would be sensible to continue with it. Alternatively, a hot hand could arise from some change in their betting strategy. For example, after winning, they may modify their bets in some way to increase their chances of winning again.

* Corresponding author. Address: Department of Cognitive, Perceptual and Brain Sciences, University College London, Gower Street, London WC1E 6BT, UK. Tel.: +44 (0)2076797570.
E-mail address: juemin.xu@ucl.ac.uk (J. Xu).

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1.2. The gamblers' fallacy: "If you have been losing, you are more likely to win in future."

People gambling on sports outcomes may continue to do so after losing because they believe in the gamblers' fallacy. This is the erroneous belief that deviations from initial expectations are corrected even when outcomes are produced by independent random processes. Thus, people's initial expectations that, in the long run, tosses of a fair coin will result in a 50:50 chance of heads and tails are associated with a belief that deviations from that ratio will be corrected. Hence, if five tosses of a fair coin have produced a sequence of five heads, the chance of tails on the next toss will be judged to be larger than 50%. This is because the coin "ought to" have a 50:50 chance of heads and tails in the long run and, as a result, more tails are "needed" to correct the deviation from that ratio produced by the first five tosses.

1.3. Odds and stake size: A conflict between belief in a hot hand and the gambler's fallacy

Betting strategies are often based on the previous betting results (Oskarsson, Van Boven, McClelland, & Hastie, 2009). The strategies based on a belief in a hot hand and gamblers' fallacy may conflict. For example, when trying to decide what odds to select in the next round, a belief in the gamblers' fallacy would result in betting on higher odds and with more money after losing than after winning. A believer in the hot hand would do the opposite.

2. Method and data

To date, there is little research on real gambling. Our research (1) demonstrates the existence of a hot hand, (2) investigates gamblers' beliefs in a hot hand and the gamblers' fallacy, and (3) explores the causal relationship between a hot hand and the gamblers' fallacy.

2.1. Analysis methods

We used a large online gambling database. First, we counted all the sports betting results to see whether winning was more likely after a streak of winning bets or after a streak of losing ones. Second, we examined the record of those gamblers who has long streaks of wins to see whether they had higher returns; this could be a sign of real skill. Third, we used the odds and the stake size to predict the probability of winning.

2.2. Data set

The complete gambling history of 776 gamblers between 1 January 2010 and 31 December 2010 was obtained from an online gambling company. In total, 565,915 bets were placed by these gamblers during the year. Characteristics of the samples are shown in Table 1.

Each gambling record included the following information: game type (e.g., horse racing, football, and cricket), game name (e.g. Huddersfield v West Bromwich), time, stake, type of bet, odds, result, and payoff. Each person was identified by a unique account number. All the bets they placed in the year were arranged in chronological order by the time of settlement, which was precise to the minute. The time when the stake was placed was not available but, according to the gambling house, there is no reason to think that stakes are placed long before the time of settlement. Each account used one currency, which was chosen when the account was opened; no change of currency was allowed during the year.

If there is a hot hand, then, after a winning bet, the probability of winning the next bet should go up. We compared the probability of winning after different run lengths of previous wins (Fig. 1). If the gamblers' fallacy is not a fallacy, the probability of winning should go up after losing several bets. We also compared the probability of winning in this situation.

3. Results and analysis

3.1. The hot hand

To produce the top panel of Fig. 1, we first counted all the bets in GBP; there were 178,947 bets won and 192,359 bets lost. The probability of winning was 0.48.

Second, we took all the 178,947winning bets and counted the number of bets that won again; there were 88,036 bets won. The probability of winning was 0.49. In comparison, following the 192,359 lost bets, the probability of winning was 0.47. The probability of winning in these two situations was significantly different ($Z = 12.10$, $p < .0001$).

Third, we took all the 88,036 bets, which had already won twice and examined the results of bets that followed these bets. There were 50,300 bets won. The probability of winning rose to 0.57. In contrast, the probability of winning did not rise after gambles that did not show a winning streak: it was 0.45. The probability of winning in these two situations was significantly different ($Z = 60.74$, $p < .0001$).

Fourth, we examined the 50,300 bets which had already won three times and checked the result of the bets followed them. We found that 33,871 bets won. The probability of winning went up again to 0.67. In contrast, the bets not having a run of lucky predecessors showed a probability of winning of 0.45. The probability of winning in these two situations was significantly different ($Z = 90.63$, $p < .0001$).

Fifth, we used the same procedure and took all the 33,871 bets which had already won four times. We checked the result of bets followed these bets. There were 24,390 bets that won. The probability of winning went up again to 0.72. In contrast, the bets without a run of previous wins showed a probability of winning of only 0.45. The probability of winning in these two situations was significantly different ($Z = 91.96$, $p < .0001$).

Sixth, we used the same method to check the 24,390 bets which had already won five times in a row. There were 18,190 bets that won, giving a probability of winning of 0.75. After other bets, the probability of winning was 0.46. The probability of winning in these two cases was significantly different ($Z = 86.78$, $p < .0001$).