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Can An Athlete Be Streaky?

Alex Mayyasi - Feb 10, 2014

When the Super Bowl's first snap sailed past Peyton Manning's dumbstruck face and into the endzone for a safety, Broncos fans everywhere had a bad feeling. By the time Peyton Manning threw his second interception and watched Seahawks linebacker Malcolm Smith return it for a touchdown to take a 22-0 lead, everyone knew it. Peyton Manning, his offense, and most of the Broncos team was having a bad day.

They were off -- uncharacteristically bad. The NFL's hottest offense had gone cold. It was like watching Kobe Bryant start the game with an air ball, and then clunk shots off the rim all game.

According to statisticians, however, Super Bowl fans exhibited a textbook cognitive mistake when they took the Broncos' early stumbles as a sign that they would play poorly all night. As do coaches who try to get the ball to players on a hot streak to "feed the hot hand," fans who feel confident when streaky players like David Ortiz come up to bat after a string of successes, and players who tell reporters what they are doing to "get out of their slump."

Academics believe that coaches, fans, and players make the same mistake as gamblers who yell that they're "on a run" while playing a game of chance or refuse to leave a table after a string of losses because "they're due" for a win. (After all, the odds of winning craps or baccarat stay the same no matter whether you won or lost the last round.) They say that people are merely ascribing a story to random events.

Every athlete has experienced the euphoria of a hot streak and the disappointment of a slump. It seems impossible to believe that it's mere chance. But the statisticians have the data -- and the peer reviewed research papers -- to prove it.

Researchers call the idea -- that someone “who has experienced success with a random event has a greater chance of further success in additional attempts” -- the hot-hand fallacy. Dating back to a 1985 paper called "The Hot Hand in Basketball: On the Misperception of Random Sequences," they look for evidence of streaks in basketball.

Basketball lends itself to the analysis. While good play can be difficult to measure statistically in a sport like football, hitting or missing a shot in basketball is binary and occurs frequently. And even though a layup may be easier than a three point shot, on a macro level, streaks should still be observable in the data.

Examining shooting data from the Philadelphia 76ers 1980 season, the authors of “The Hot Hand in Basketball” found no evidence of streaky shooting. They did not find unusually large clusters of misses or makes, nor did they find that the result of a player’s previous shot could predict the result of his next one. (In effect, players were no more likely to make a shot after scoring a basket or a string of baskets than after a miss or string of misses.)

Many other papers have come to similar conclusions, with only a few dissenters. Famed psychologist Amos Tversky, author of the original, draws a comparison with coin tosses. Since the chance of flipping a heads is 50%, people assume that flipping 4 heads in a row is extremely rare, even though it’s not uncommon during a string of 20 coin tosses. Similarly, when people see a player make 4 shots in a row, they assume he or she must be feeling it, rather than just benefitting from a random streak of luck.

When you think about it, though, basketball is a terrible place to go looking for the “hot hand.”

No one doubts that Kobe Byrant shoots much better than the average player, yet his shooting percentage is pretty average. In fact, as Brett Green of Berkeley and Jeffrey Zwiebel of Stanford note in a **working paper**, the median shooting percentage of the top 20 leading scorers in the NBA during the 2012-2013 season was slightly lower than the shooting percentage of the average starter. This does not mean that Kobe Bryant and Lebron James are frauds or ball hogs. Rather, they take (and make) harder shots than their teammates in the face of more tenacious defense.

Simply put, statistic-wielding professors can't find any evidence of streaky players in basketball because teams increase the defensive pressure on "hot" players.

As Green and Zwiebel put it, teams can "transfer defensive resources" among players. When facing an all star, defenses switch their best player to cover the all star, double team him, or use other strategies that leave the worst offensive players less well defended. Bryant and his teammates make the same percentage of baskets, but Bryant makes much harder shots.

The same thing happens when a player goes on a hot streak. When an average player starts hitting shot after shot, the defense adjusts until he, like Bryant, shoots at an average rate. Of course, the player is still hot. He's making half his shots over double teams instead of making half his shots while wide open.

After pointing out the flaws in looking for evidence of hot streaks in basketball, Green and Zwiebel look at a sport where hot streaks and slumps should be obvious to the econometrician. It's the statisticians dream sport, the sport of moneyball: baseball.

Unlike in basketball, baseball teams can't shift defensive resources between players. There are exceptions -- bringing in a fresh (or left-handed) pitcher,

watching extra film, or intentionally walking a hot batter -- but they are the exception to basketball's norm. When Alexander Rodriguez strikes out, it's because he failed, not because the pitcher is focusing on Rodriguez and ignoring his teammates.

To look for evidence of streaks and slumps in baseball, Green and Zwiebel assembled 10 seasons worth of baseball data and looked at 10 player statistics including home runs, hits, and strikeouts (all per at bat). The two then compared players' averages for the entire season with their stats over periods of 25 at bats -- the equivalent of about 5 games of at bats.

(The working paper, "The Hot Hand Fallacy: Cognitive Mistakes or Equilibrium Adjustments? Evidence from Baseball," is available for free here. So baseball fanatics can check the professors' accounting for variables -- like facing left or right handed pitchers or the difficulty of hitting homers in different stadiums -- and wonks can review their methods in detail.)

The results are vindication for sports fans who love the psychological battle of sports, as Green and Zwiebel find that MLB players enjoy hot streaks and suffer slumps. They write:

> "Strikingly, we find recent performance is highly significant in predicting performance in all ten statistical categories that we examine. In all cases, being "hot" in a statistic makes one more likely to perform well in the same statistic. A recent history on the order of about 25 at bats, which equals about 5 games or close to one week for the average hitter, has the most predictive power over the next at bat. Furthermore these effects are of a significant magnitude: for instance, a 30 percent increase in the number of times that a batter has gotten on base in the last 25 at bats predicts a 5% increase in the likelihood of getting on base in the next at bat, after controlling for all other explanatory variables."

Five percent may sound modest, although in baseball, where failing to reach base is the norm, a 5% improvement is more significant than it may sound.

(A 5% improvement or regression in someone batting .250, for example, would mean a slump spent hitting .238 and a hot streak hitting .263.) Zwiebel and Green describe the effect, "A 50th percentile hitter will hit like a 75th percentile hitter following strong recent performance." Streaks seem to be real, and a big deal.

Creating a mathematical model for streakiness, the two researchers also suggest why prior work -- whether looking at basketball or a more suitable sport like bowling -- has failed to find a hot hand effect: not enough data. Ten seasons of baseball's 162 game season offers an incredible amount of data. In contrast, the first paper on streakiness in basketball looked at 48 home games worth of shooting results for one team.

Green and Zwiebel's research does not let sports fans off the hook completely. Because while the existence of streakiness in the MLB is good reason to think it exists in the NBA as well (and the two offer additional evidence), sports fans do mistake the effect of streaks.

Basketball fans interviewed by Tversky in 1985, for example, believed that players who just made a basket would shoot at a significantly higher clip (61%) than someone who missed their last shot (42%). Expecting this substantial an effect based on just the previous shot suggests people do seriously underestimate the role of chance. And given that hot players in basketball have normal shooting percentages, it also demonstrates that fans at least fail to appreciate what streaks actually look like in a sport like basketball (average shooting percentages against more defensive attention rather than swish after swish).

But the professors do find that their research is in line with common intuitions about hot streaks and slumps, with an effect great enough to warrant press coverage of an impressive streak or in-game adjustments by players and coaches. After years of academics looking smugly down on players', coaches', and fans' belief in hot streaks, it may be vindication.