HOT HAND

THE STATISTICS BEHIND SPORTS' GREATEST STREAKS

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藏书章

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To Sylvia, with love:

Being married to you is a perpetual winning streak.

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Writing about the hot hand for roughly a dozen years—first in messages to online discussion groups, then on a blog, and now with this book—has been a true labor of love. Numerous people have supported me in this endeavor, many of whom I never would have met, but for my interest in the hot hand.

Tom Gilovich, a cofounder of "hot hand" research, has always been there to bounce off ideas and to fulfill requests (such as being the first guest of honor to field e-mailed questions from readers of my Hot Hand website for an online "chat"). *Curve Ball* coauthor Jim Albert (with his writing partner Jay Bennett) inspired me to conduct and write about sports statistical analyses, and also responded to questions from website visitors. Professor Jim Sherman of Indiana University, whom I first met in the spring of 1984 when I traveled around looking at graduate schools, later shared stories with me of how then–IU men's basketball coach Bob Knight reacted to the initial "hot hand" studies with skepticism, because so many factors go into shooting a basketball. Jim also invited me to a sports decision-making conference nearly twenty years after our first meeting, at which I met prolific "sabermetrics" baseball writers Bill James and Rob Neyer. Bill has never hesitated to share his streakiness-related analyses with me and let me post them on my blog, whereas Rob's mention of my analyses of the 2002 Oakland A's winning streak in one of his ESPN.com columns greatly increased my site's hit count. Two *Wall Street Journal* writers, Stefan Fatsis (during his NPR appearances) and "Numbers Guy" Carl Bialik, have also mentioned the site on multiple occasions. David Myers was one of the first academics to cite my "hot hand" analyses and has always written passionately on the topic. Phil Birnbaum's Sabermetric Research blog has been virtually a companion site to the Hot Hand blog, as we've referred each other to various sports-statistical studies over the years. I'm also thankful to members

of the local Lubbock, Texas, media (Ryan Hyatt, Snead & Gus) who've had me on their radio shows to discuss the hot hand and various ongoing streaks. These, and other characters you'll meet in the book, have contributed their critical and analytic skills, and enthusiasm, to the study of the hot hand.

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I
Foundations

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1
Introduction

The date was January 22, 2006. The Los Angeles Lakers were hosting the Toronto Raptors in a National Basketball Association (NBA) game. Lakers star Kobe Bryant had scored 26 points in the first half, a pace that would put him over 50 for the game, but the hometown fans were probably not in a jovial mood at that point. The Raptors, who came in with only 14 wins in 40 games, had led by 14 points at halftime and upped their advantage to 18 points a few minutes into the second half, 71–53.

With 8:41 remaining in the third quarter, Bryant hit a long two-pointer. At the 8:14 mark, Bryant lined up for a three-pointer. Good! At the 7:39 mark, he hit another shot from behind the arc, then another with 6:22 to go in the period! Next thing you know, Bryant had scored 27 points in the third quarter and the Lakers were now leading, 91–85. Ultimately, Bryant would add another 28 in the fourth, bringing his total to 81 points and propelling L.A. to a 122–104 victory.

Something special was going on in Oakland, California, in the latter part of the 2002 Major League Baseball (MLB) season. The Athletics, known as the A's, were on an amazing run, approaching an American League record 20th consecutive win. As Michael Lewis described the pregame scene on September 4 in his book, *Moneyball*:

> A traffic jam extraordinary even by Northern California standards stretched as far as the eye could see. The Oakland A's ticket office had never experienced anything quite like the crush of the previous two days. When the Kansas City Royals came to town, the A's sales department expected about ten thousand fans to turn up. In just the last twenty-four

> hours more than twenty thousand people had stopped by, in the flesh, to buy seats in advance. Before the game, an aerial view of Oakland would reveal nearly everyone in sight heading toward the Coliseum.[1]

These two vignettes illustrate two things. First, streaks happen, sometimes reaching truly amazing lengths. Second, sports fans love streaks. (In this book, we will use both the everyday definition of "streak," as some result that keeps repeating itself several times in a row, and more formal statistical definitions that will be introduced later.)

Indeed, streaks are among the greatest accomplishments in sports. Allen St. John's 2006 book *Made to be Broken* reviewed 50 spectacular sports achievements (a year later, Michael Ferraro and John Veneziano released a similar book entitled *Numbelievable!*). St. John's list included Hank Aaron's overtaking of Babe Ruth's career home run record (later passed by Barry Bonds), and Bob Beamon's first-ever 29-foot-long jump in track and field (later passed by Mike Powell). Also presented were Wilt Chamberlain's 100-point NBA game in 1962 and Jerry Rice's National Football League (NFL) career record for touchdowns, both of which are still active records. A sizable subset (13) of the 50 legendary records cited by St. John, though, involve streaks, from Joe DiMaggio getting at least one hit in 56 straight games in 1941 to Coach John Wooden's University of California, Los Angeles (UCLA) basketball team winning 88 straight games in the early 1970s.

These kinds of achievements—along with miscellaneous other sports oddities—have been my motivation in maintaining the Hot Hand website on sports streakiness (http://thehothand.blogspot.com) since 2002. I also teach statistics at Texas Tech University, so I am able to blend my website with my academic interests. Over the years, I have been fortunate to have several media outlets do stories related to the Hot Hand website, including the *New York Times*, *Wall Street Journal* (online), National Public Radio (NPR), *Sports Illustrated on Campus*, the World Series program magazine, and even *Cigar Aficionado*. Now, having chronicled more than 350 streak-related stories on my blog, I would like to share some of them in this book.

SUSPENSE AND ENTERTAINMENT VALUE

One can enjoy streaks on many different levels, adding to the richness of the subject matter. For some sports fans, there's the suspense of whether a streak will keep going or end. Will he get a hit in the next game? Will she make her

next shot? Will the team win (or lose) yet another game? Some streaks, of course, involve more pressure than others. If we're talking about a basketball shooting streak (such as Micheal Williams's NBA record of 97 consecutive made free throws)[2] or a baseball streak of hits in consecutive at-bats (the MLB record of 12, set by Mike "Pinky" Higgins in 1938 and Walt Dropo in 1952)[3], then the survival of the streak is at stake *each and every time* that person attempts a shot or comes to the plate.

Other streaks leave a little margin for error. With hitting streaks like Joe DiMaggio's, for example, as long as a batter gets multiple official at-bats in a game, he (or she, in the case of organized softball) can afford one or more outs during a game, as long as one hit is obtained. The suspense would only seem to reach fever pitch, therefore, when a player is up for what is likely his or her last at-bat in a game, having gone hitless thus far. Acknowledging that a consecutive-game hitting streak allows room for error should in no way diminish DiMaggio's accomplishment, of course. If it were so easy, someone else would surely have broken the record by now, but no one has. Why not?

Last, there are some streaks based purely on longevity, whose continuation doesn't depend at all on an athlete's performance in one specific opportunity (e.g., an at-bat in baseball or a shot in basketball) or even in a full game's worth of opportunities. In the 1990s, Cal Ripken Jr. of baseball's Baltimore Orioles not only broke New York Yankee Lou Gehrig's record of playing in 2,130 consecutive games, but Ripken extended the record to 2,632.[4] In this case, Ripken's accomplishment would appear to derive from at least three factors: (a) staying healthy for the roughly 16 years needed to compile the streak; (b) maintaining the quality of his play at a high enough level during this time period such that Oriole managers would have no inclination to bench him; and (c) determination to play every day, when other players might have asked for a day off. Though fans probably felt some degree of suspense as Ripken approached Gehrig's record—regarding whether Ripken could continue to avoid serious injury—I suspect that their fascination with Ripken's quest had to do with other factors. Fans presumably admired his work ethic and recognized that getting out of bed every morning to go to work is not always easy.

Readers may have noticed by now that many of the most famous streaks (or single nights of "hotness") have been compiled by athletes and teams who are among the all-time greats in their respective sports. In addition to Kobe Bryant, Joe DiMaggio, and the UCLA basketball program of 35–40 years ago, other major streak-holders include Tiger Woods (making the cut at 142 straight golf tournaments, over a period of 7 years) and the University of

Southern California (USC) and University of Miami football teams of the mid-2000s (each with 34 straight wins, the longest such streaks in roughly 30 years, with Oklahoma's 47 straight wins in the mid-1950s still standing as the all-time record).[5]

Although any long streak is likely to capture widespread attention, having a celebrated athlete or team involved almost certainly raises the entertainment value. The reason that legendary athletes and teams are often involved in major streaks is that they succeed on most occasions, simply by virtue of their overwhelmingly superior talent. Further, when the occasional bump in the road occurs, some kind of bizarre chance occurrence may give the athlete or team a lucky break that keeps the streak going. Many readers will recall the USC–Notre Dame football game of October 15, 2005, when the Trojans' 27-game winning streak appeared to be in jeopardy in the waning seconds, only to be saved by an unusual play in which a USC fumble rolled out of bounds, stopping the clock and giving the Trojans one last chance to win the game.[6] As the late Harvard paleontologist Stephen Jay Gould (about whom we'll hear more) once wrote, "Long streaks always are, and must be, a matter of extraordinary luck imposed upon great skill."[7]

STATISTICAL PERSPECTIVE

Another perspective for viewing streaks—my preferred one—is from a statistical or probabilistic view. When we observe some unusual occurrence, not just in the sports realm, but when, say, the same person wins the lottery twice, a common reaction is to ask, "What are the odds of that?" (We'll examine the lottery problem later, as it is analogous to how we can look at sports streaks.) Statistical analyses can be both simple and complex. Many of the formulas are pretty simple, such as that for the probability of rolling double sixes (or any particular matching pair) with a couple of dice. The probability in this case is simply 1/6 (the probability of a 6 on one die) multiplied by 1/6 (the probability of a 6 on the other die), which yields 1/36. This calculation can also be represented graphically, as a roll of 6-6 is one of 36 possible combinations of two dice (table 1.1).

Table 1.1

	1	2	3	4	5	6
1						
2						
3						
4						
5						
6						X

However, probability analyses often involve a number of assumptions if they

are to be applied in a given situation. For example, the dice-rolling illustration involves the assumption of *independence*, i.e., that the outcome of one die has no impact on that of the other die. One can therefore ask a seemingly straightforward question—*What was the probability of Joe DiMaggio going on a 56-game hitting streak, given his prior batting statistics?*—and find that different sports analysts arrive at different conclusions, depending on their assumptions. One of the upcoming chapters will focus on basic probability calculations, and another on the DiMaggio hitting streak.

To academic statisticians, probability calculations help answer another question: How likely is it that a given streak could have occurred by chance? After all, if one flipped a coin a thousand times, occasional "streaks" would occur, perhaps six straight heads or eight straight tails. To impress an academic statistician, therefore, one would have to show that a streak was so spectacular and so rare that it must be considered "beyond chance."

ORGANIZATIONAL CULTURE

Yet another lens through which to view streaks is that of organizational culture. The morning of Thursday, November 15, 2007, I was listening to the ESPN radio show *The Herd with Colin Cowherd*. The host was giving a commentary about how success stories such as pro football's New England Patriots (who would finish the regular season with a perfect 16-0 record) and disasters such as the Miami Dolphins (who would finish 1-15) don't happen by accident. Regarding the latter, years of poor drafting, a merry-go-round of coaches, and bad management decisions had taken their toll. Then on December 21, 2007, the Dolphins hired Bill Parcells, who had been a very successful coach with four different franchises.[8] While holding a high position in the team's front office, he essentially redesigned the team for the next season. Parcells hired a new general manager and coach, and brought about a major turnover in player personnel. The next season, the Dolphins went 11-5 and made the playoffs.

Cowherd's commentary reminded me of a book I had read about a year earlier, *Confidence: How Winning Streaks and Losing Streaks Begin and End*, by Harvard Business School professor Rosabeth Moss Kanter.[9] Kanter presented several case studies from corporate America and the sports world (including the Patriots), arguing that long-term success and failure—and turnarounds from one to the other—are heavily rooted in organizational culture. In the athletic realm, Kanter highlighted two women's collegiate teams, University of North Carolina soccer and University of Connecticut basketball, to present the most detailed case studies of winning cultures, as well as the Prairie View

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