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On the Probability of Streaks, Runs and Cycles in Political Data or,
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On the Probability of Streaks, Runs and Cycles in Political Data or,
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Charlie Brown:  Lucy, you’re the worst player in the history of the game!
Lucy:  You can’t prove that!  You should never say things that you can’t prove!
Charlie Brown:  In all probability, you are the worst player in the history of the game!
Lucy:  I can accept that...

(Schultz, 17 Jun 93)

Announcer #1:  "...and this crowd is still buzzing about Orin Lake, Marty!
Announcer #2:  "And with good reason:  He replaced Bell with 4:09 left in the half and sparked a nine-point
    turnaround!
Assistant Coach (to Gil Thorp):  "You going to start Orin Lake the second half?"
Gil Thorp:  He has the hot hand, Roy!

(Berrill, 3 Mar 93)

Like Lucy and Charlie Brown, most of us prefer to limit our public
pronouncements to things we can prove -- or at least, to things others cannot easily
disprove.  For us, like these Peanuts characters, statistics and probability extend the range
of claims we can safely make because they let us hedge our bets, expressing the odds we
may be mistaken.  But, properly applied, statistics and probability will also limit the
claims to explanation we can safely make, because they give us a more accurate
assessment of the role that chance plays in events.

Like Gil Thorp, most of also believe in "momentum, the "hot hand," the idea that
we can predict future outcomes on the basis of current wins and losses.  At the very least,
most of us believe that winning or losing streaks, even relatively short ones, are good
indicators that some meaningful process is at work.  In all probability, however, we are
mistaken.

This paper provides a review of recent work by statisticians interested in sports
data that shows why we are often mistaken when we perceive momentum and how to
know for sure.  It then applies similar methods to evaluate common, well-known, and, I
believe, over-explained patterns that occur in American party politics.  The purpose is to
improve our "feel" for the importance of patterns in political data by giving concrete
examples of meaningful -- and not-so-meaningful -- streaks and runs in national politics.
(Let me say at the outset, however, that I do not believe that fans of American politics are
more likely than other political scientists to mistake randomly generated patterns in data
for meaningful ones.  It’s just that the data I use here provide proximate and well-known
political examples of a common misconception more often observed publicly in sports.)

1I would like to thank Lawrence Baum and Herbert Weisberg for their help and insights. Without
them, I’m quite sure most of the ideas in this paper would never have occurred to me.  Nevertheless, neither
bears any responsibility for the results.
The Illusion of Momentum in Sports

In a widely-read and, initially, controversial paper, Tversky and Gilovich (1989a; also 1989b and Larkey, et.al, 1989) tested the generalizability of earlier research findings that "people's intuitive conceptions of randomness do not conform to the laws of chance" by studying common perceptions of the dynamics of basketball games. Although it is common for announcers, players, and spectators alike to perceive momentum and swings of momentum from one side to another in athletic contests, Tversky and Gilovich were skeptical. They observed subjects' perceptions of pattern in simulated sequences of basketball shooting and found that

As expected, people perceive streak shooting where it does not exist. The sequence of \( p(\text{alteration}) = 0.5 \), representing a perfectly random sequence, was classified as streak shooting by 65% of the respondents. Moreover, the perception of chance shooting was strongly biased against long runs: The sequences selected as the best examples of chance shooting were those with probabilities of alternation of 0.7 and 0.8 instead of 0.5. Basketball fans "detect" evidence of the hot hand in perfectly random sequences. (Tversky and Gilovich, 1989a, p. 18)

The reason we mistake random sequences for meaningful sequences is that we expect even very short sequences to have the same aggregate characteristics as longer ones. When they don't, we question their randomness. For example, "the occurrence of four heads in a row -- which is quite likely in even relatively small samples -- makes the sequence appear nonrepresentative. Random sequences just do not look random." (Tversky and Gilovich, 1989, p. 16)

When they analyzed shooting sequences in the NBA, Tversky and Gilovich found no evidence that players shoot in streaks -- hot or cold -- in actual games. Streaks and runs are defined as meaningful if they occur more often than we would expect given a chance process with a constant shooting (or analogous) probability. Momentum (usually thought of as positive, but negative momentum is also possible) exists if the probability of scoring is affected by the outcome of the previous attempt. Given data and such definitions, it is a relatively straightforward matter to test for streaks and momentum by looking at the conditional probabilities of scoring following hits and misses, by seeing if the outcome of previous attempts improves our predictions about current ones and/or if the number and length of runs in the sequence of outcomes depart from chance. Similar tests are used in the political example below.

The phenomenon of momentum has been sought, in vain, with these statistical methods in other sports as well. For example, after making several studies, Bill James (1988, p. 92) concluded,

"that which is called momentum in baseball is not a characteristic of play but a characteristic of the perception of play. When we see a team win 17 of 18 games then start losing with almost equal determination, it becomes irresistible to form a psychic link, momentum, to explain the swings. The position that the swings from
high to low are essentially random data patterns probably seems incomprehensible to the average sports fan and announcer, although in fact many baseball people agree with me... The illusion of momentum will in time, I think, be overpowered by its own absurdities.

Lock or Luck? The Illusion of Momentum in American Politics

Like fans and announcers, many, if not most, political scientists sometimes mistake randomness for meaningful pattern and believe in momentum even when it does not exist. This kind of misconception seems to be a universal tendency. James’ description of analytic illusion applies to us equally as well as to sophisticated sports observers: "...patterns emerge and seem to become meaningful long before they actually are. It’s a familiar cycle: the analyst detects a pattern early, watches it run through two or three repetitions, and predicts the fourth revolution -- which never comes, because what he has been watching was just a statistical quirk."

Perhaps no such failed prediction has been so well noted in American politics as the failure of electoral realignment to appear in the last 25 years. (For overviews of the large literature on modern realignment, see, among others, Shafer, 1991 and Niemi and Weisberg, 1993). In his textbook, Asher (1992) provides a good description of the ups and downs of contemporary realignment theory:

... After the 1968 and 1972 Republican presidential victories, some observers thought the country was in the midst of a realignment from Democratic to Republican dominance. Then there came the debacle suffered by the Republicans in the 1974 midterms election, the Democratic presidential victory in 1976, and the minimal gains of the GOP in 1978. All these events raised speculation that the GOP was permanently the minority party that could only occasionally win the presidency because of internal contradictions in the Democratic coalition. But the Republican presidential and senatorial victories of 1980 once again caused observers to speculate that the GOP might emerge as the majority party. In fact, poll results in the first years of the Reagan administration showed an increase of Republican loyalists. However, the decline in the economy, the drop in president Reagan’s popularity, and the substantial Democratic gains in 1982 put to rest for a time such speculation [etc.]. ...Bush’s victory in 1988 once again stimulated talk about a Republican lock on the White House.... (pp. 29-31)

An imminent shift from Democratic to Republican dominance in the electorate has been predicted since the mid-1960s largely because three earlier periods of comparable electoral change had taken place at 36 to 40 year intervals. Because the last realignment occurred during the New Deal in the 1930s, the next was expected in the late 1960s. James’ apt observation provides a simple explanation of why realignment has been so widely anticipated in spite of overwhelming evidence that it has not occurred -- and is not pending: we mistakenly attributed causality to what, on analysis, appears to be a coincidental periodicity in electoral change.
Many contemporary expectations of realignment born of past "cycles" of change have been kept alive by Republican dominance of the presidency for the past 25 years. Much has been made of the fact that between 1968 and 1988, Republicans won 5 out of 6 presidential elections. Nevertheless, it has not been necessary to believe in the probability of full scale realignment to doubt the Democratic party’s chances of regaining the White House in 1992, to look for (and find) underlying processes that have ensured divided government at the national level, and to explain Republican victories in the electoral college in terms of the GOP’s recently established grip on the southern, western, and midwestern states. Most of us have made such unexamined leaps of statistical inference from a run of 5 successes in 6 tries to underlying causal processes. But here, as in basketball and baseball, statistical analysis suggests that the last quarter century of Republican victories does not indicate change in the underlying probabilities for each party of winning the White House; it can be readily explained as chance.

Streaks

The basic method for testing any hypothesis of meaningful (that is, not coincidental or random) change is to compare the pattern we find in the data to that we would expect to find if it had been generated by chance. The claim that the Republican "lock" on the White House reflects good luck rather than real change in the two parties’ relative advantage can be tested directly by estimating the probability of one party winning 5 out of 6 presidential elections by chance alone.

Although the expected Republican party vote has been estimated to be 46 or 47 percent for the past several decades (Petrocik, 1989), I assigned even odds to both parties for this analysis. The probability of at least 5 successes on 6 tries is calculated using the binomial distribution which takes into account not only the probability of winning at least 5 times on one particular series of 6 tries, such as DRRRRR, but also the different combinations of 5 victories that are possible (e.g., RRRRR, RRRDR, etc.) If the probability of winning any one election is .50, the probability of winning at least 5 out of 6 elections turns out to be a little less than 9.5 percent (.0937).

By itself, this probability is not statistically significant at the .05 level, but it actually underestimates a party’s true chances of winning so often. Nine and a half percent is the probability that either the Republicans or the Democrats could have won at least 5 times in only 6 elections, such as the elections from 1968 to 1988. However, Democrats and Republicans have been around since 1856, that is, for 35 elections, not just six, and have had more than 6 chances to win 5 times. Table 1 shows this election series.

To get a more accurate assessment of the relevant odds and to evaluate the streakiness of presidential elections more generally, (cf. Tversky and Gilovich, 1989 and

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2This is partly for ease of calculation and partly because the correct method of analysis depends on data over the whole period of the current two-party system, not just the past 25 years.
Mock and Weisberg, 1992), I used the entire sequence of 35 presidential elections from 1856 and divided it into five non-overlapping series of six elections. I then counted the number of times one of the parties won at least five times. It was once. The probability of winning at least 5 out of six elections in five tries is about 1 in three (.34). In other words, streaks like the recent Republican run of presidential victories are not unusual over long periods of time. In fact, several such streaks have occurred since 1856.

Because 5 elections were unused in the first division of the data set, it was possible to repeat the analysis just described five times by starting the division on succeeding election years. This method makes full use of the information in the data without violating the necessary independence of each series. In addition, it allows us to answer the question of whether having several streaks of 5 or 6 victories by one party in 24 years could have occurred by chance. The results for each analysis were similar to the first: in five of the six analyses, one party won at least 5 elections once. In the sixth, neither party did so well. The combined analyses show 5 series of at least 5 out of 6 victories in 30 total series. The probability of this particular result occurring by chance is .12, again, not statistically significant.

Further analysis of the data further supports the radical hypothesis that the recent Republican lock on the White House is illusory and that the party of elected US presidents does not fluctuate any more (or less) than we should expect by chance. For example, a Wald-Wolfowitz runs test shows 15 changes of party over the 35 elections in the data with a probability of .316. This result indicates that the recent streak is not unusual; it also suggests that realignments defined in terms of long-lasting changes in the dominant presidential party have not occurred less often than they would by chance, although they should if the electoral system is characterized by such long-term cycles. (See also the example in Wilkinson, et. al., 1992.)

Momentum

The concept of momentum is usually associated with the kinds of streaks in data we have not found in the election series, but it may still be the case that one party, having won the White House, improves its probability of beating the other in subsequent presidential elections. Is there momentum over a series of presidential elections? The best way to answer this question is to see if knowing the outcome of previous elections improves our prediction about the outcome of a present one. This question was investigated first, by examining the relationship between one outcome and the next and second, by calculating the conditional probabilities of each party’s winning depending on previous runs of one, two, or three or more wins or losses.

The chi-squared statistic and Phi for the simple lagged relationship between the winning party in one election and the previous winner show no statistically significant relationship. The probability for the chi-square value is .324. Phi, which quantifies the degree of interaction tested by chi-square and is scaled the same as a correlation coefficient (Wilkinson, et.al., 1992) is only .167.
Table 2 shows the probabilities of winning conditional on previous wins or losses compared to the overall probability of winning (column 7). Note that since one party must win whenever the other loses, the probabilities in the table are not independent. The sample is small and the data are noisy. For example, the difference in probabilities of winning after winning once (column 1) for the two parties is due to Carter's failure to get reelected in 1980. Nevertheless, the probabilities do suggest that once having gained the presidency after being out of office, both parties usually manage to stay awhile (in fact, all the Republican terms lasted at least two elections.) This pattern may reflect the advantages of incumbency and the modern President's ability to command public attention. But the effect is limited: each party's chances of returning to office improve after eight years out.

Conclusion

Although I began thinking about this study before the 1992 elections and although I expected to find little evidence in the data for momentum or evidence that one party's tenure in the presidency would enhance its probability of winning again, I was still surprised by Clinton's victory in November. I have been even more surprised by how well the null hypothesis of streaks due to chance has done in the simple tests reported here. The illusion of momentum is powerful. James (1988, p. 92) writes, "Momentum is one of those superficial concepts that is hard to resist if you don't think it through and try to resolve the problems it creates."

The results reported here do not show that the outcome of an election is a chance event. Nor do they show that election outcomes will be "fair" in the sense that no party will ever stay in office for long periods. They don't even show that 'there is no such thing as momentum in politics.' What they do suggest is that except for the second term advantage of incumbency, a party's chances of winning an election are independent of its previous wins and losses. This is surprising, but it surprising only because we didn't think to look.

If a man gets two hits today, how does that make him a better hitter tomorrow? Confidence, of course, but what does the confidence do? Does the confidence make him stronger? Does it give him better eyesight? Does it make his reflexes quicker or his knowledge of the strike zone more comprehensive? And, most importantly, if a hitter's ability changes so dramatically from week to week, how can it remain so much the same from year to year? (James, 1988, p. 92)

As political scientists, we might ask ourselves similar questions about the causal processes that we infer, often unconsciously, from patterns in data. Then we might hold ourselves to test the answers that we devise more systematically. The illusions of meaning suggested by pattern are so powerful that we often fail to test their reality. But when the patterns that concern us are due to chance, we waste good effort explaining "events" that have no explanation.
References


-------------------------------. 1989b. The "Hot Hand": Statistical Reality or Cognitive Illusion? Chance, v. 2 (Fall), pp. 31-34.

Table 1  
Presidents and Parties, 1856–1992

<table>
<thead>
<tr>
<th>Election</th>
<th>President</th>
<th>Party</th>
<th>Election</th>
<th>President</th>
<th>Party</th>
</tr>
</thead>
<tbody>
<tr>
<td>1856</td>
<td>Buchanan</td>
<td>Dem</td>
<td>1925</td>
<td>Hoover</td>
<td>Rep</td>
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<tr>
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<td>Lincoln</td>
<td>Rep</td>
<td>1932</td>
<td>Roosevelt</td>
<td>Dem</td>
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<td>Lincoln</td>
<td>Rep</td>
<td>1936</td>
<td>Roosevelt</td>
<td>Dem</td>
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<td>Grant</td>
<td>Rep</td>
<td>1940</td>
<td>Roosevelt</td>
<td>Dem</td>
</tr>
<tr>
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<td>Grant</td>
<td>Rep</td>
<td>1944</td>
<td>Roosevelt</td>
<td>Dem</td>
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<tr>
<td>1876</td>
<td>Hayes</td>
<td>Rep</td>
<td>1948</td>
<td>Truman</td>
<td>Dem</td>
</tr>
<tr>
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<td>Garfield</td>
<td>Rep</td>
<td>1952</td>
<td>Eisenhower</td>
<td>Rep</td>
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<tr>
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<td>Cleveland</td>
<td>Dem</td>
<td>1956</td>
<td>Eisenhower</td>
<td>Rep</td>
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<tr>
<td>1888</td>
<td>Harrison</td>
<td>Rep</td>
<td>1960</td>
<td>Kennedy</td>
<td>Dem</td>
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<td>1892</td>
<td>Cleveland</td>
<td>Dem</td>
<td>1964</td>
<td>Johnson</td>
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<td>McKinley</td>
<td>Rep</td>
<td>1968</td>
<td>Nixon</td>
<td>Rep</td>
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<td>Rep</td>
<td>1972</td>
<td>Nixon</td>
<td>Rep</td>
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<td>Rep</td>
<td>1976</td>
<td>Carter</td>
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<td>1980</td>
<td>Reagan</td>
<td>Rep</td>
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<td>Wilson</td>
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<td>1920</td>
<td>Harding</td>
<td>Rep</td>
<td>1992</td>
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<td>Dem</td>
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<td>1996</td>
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<td>Dem</td>
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Table 2: Probability of Winning the White House
After Winning (W) or Losing (L) Previous Elections (1896 - 1992)

<table>
<thead>
<tr>
<th>Party</th>
<th>(1) P(w/1w)</th>
<th>(2) P(w/2w)</th>
<th>(3) P(w/3-w)</th>
<th>(4) P(w/1l)</th>
<th>(5) P(w/2l)</th>
<th>(6) P(w/3-l)</th>
<th>(7) P(w)</th>
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<td>.87</td>
<td>.33</td>
<td>.56</td>
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<tr>
<td>Dem</td>
<td>.60</td>
<td>.33</td>
<td>.67</td>
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