THE HOT HAND

The Mystery and Science of Streaks

BEN COHEN

FIRST EDITION

Designed by Leah Carlson-Stanisic

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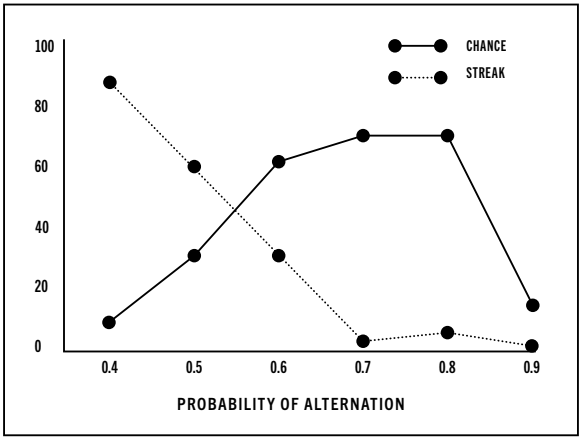
Here's how it works. Let's say there are nine songs in a playlist. We'll call that the existing sequence. Each song gets assigned a number between one and nine. Pick any number up to nine (call it n) and remove that nth number from this existing sequence to begin a new sequence. Then repeat that process with any n up to eight, seven, six, etc., until there is nothing left in the existing sequence. It will look something like this:

N	Existing Sequence	New Sequence
4	1, 2, 3, ~~4~~, 5, 6, 7, 8, 9	4
1	~~1~~, 2, 3, 5, 6, 7, 8, 9	4, 1
5	2, 3, 5, 6, ~~7~~, 8, 9	4, 1, 7
1	~~2~~, 3, 5, 6, 8, 9	4, 1, 7, 2
2	3, ~~5~~, 6, 8, 9	4, 1, 7, 2, 5
4	3, 6, 8, ~~9~~	4, 1, 7, 2, 5, 9
1	~~3~~, 6, 8	4, 1, 7, 2, 5, 9, 3
1	~~6~~, 8	4, 1, 7, 2, 5, 9, 3, 6
1	~~8~~	4, 1, 7, 2, 5, 9, 3, 6, 8

The students looked at six of these sequences. They were not too dissimilar from the sequences that Shuar foragers had been shown. There were twenty-one Xs and Os in all—always eleven Xs and ten Os—but the alternation rate varied. Some of them were more XXXOOO than XOXOXO. The students were instructed to study the Xs and Os and guess whether a sequence represented "chance" shooting or "streak" shooting. Chance shooting is what we think of as randomness. Streak shooting is how we think of skill.

Here's a visual representation of how they responded:



As they tried to make sense of these seemingly incomprehensible sequences, the students were told that the symbols were the disguised results of six experiments their professors had conducted: basketball shots, coin flips, soccer goals, dice throws, tennis serves, and roulette spins. What the students weren't told was that those experiments never really happened. The series had been spit out by a computer that randomly generated sequences with eleven at signs and ten hashtags. Ayton and Fischer split their fake experiments into two categories. They pitted human performance (basketball shots, soccer goals, tennis serves) versus pure chance (coin flips, dice throws, and, yes, roulette spins). The students looked at twenty-eight sequences with different alternation rates between the at signs and hashtags. The visual differences were striking. This is how a series with a low alternation rate looked compared with a series with a high alternation rate:

Low: @ @ @ @ @ @ @ @ @ # @ # # # # # # # # # @
High: @ # # # @ @ # @ # @ @ # @ # @ # @ # @ # @

Maybe it was a surprise to people who didn't understand statistics. But not Gelman. When he taught the hot hand, he liked to split his classroom in two groups. The students in one group flipped a coin one hundred times and recorded the results—*H* for heads and *T* for tails. The students in the other group created a sequence that *looked* like they had flipped a coin one hundred times. Gelman would leave the classroom and come back to a blackboard that appeared something like this—let's say there were twenty flips instead of one hundred—and tell his students he could guess which was real and which was fake:

Group 1	Group 2
TTHHHTTTHHTTHTTTTHTT	THTTTHTHTTHHTTTHTHTT
TTHTTTHTTTHTTTTTTTTT	HHHTHTTHHTTTHHHHTHTT
TTHHTTHTHTHHTTTTHHHH	THHHTHTTTHHTTTHHTHTT

Gelman would study the sequences for a few seconds, pause for dramatic effect, and blow their minds. Group 1 was real. Group 2 was fake. This was the statistics professor's version of pulling a rabbit out of a hat. But how did he know?

"The real one is the one that looks fake," he says, "and the one that looks real is fake."

Sequence of Three Coin Flips	# of Flips After Heads	# of Heads on Those Flips	Heads After Heads	Percentage of Heads After Heads
TTT	0	0	-	-
TTH	0	0	-	-
THT	1	0	0/1	0%
HTT	1	0	0/1	0%
THH	1	1	1/1	100%
HTH	1	0	0/1	0%
HHT	2	1	1/2	50%
HHH	2	2	2/2	100%

"It may be that the only way you can learn about randomness," he concluded, "is to toss coins on the side while you play."