Humans have innate ability to assess probability, but odds are we're a bit off

Do you know someone who plays the lottery religiously? I knew a woman who would carefully track the local news–when a lottery win was announced nearby, she'd perk up immediately. She had to buy a ticket from the winning store, convinced that one win made another more likely. Of course, she's wrong, the odds of winning the lottery are catastrophically low and they don't change based on who wins where. But her behavior, and her flawed perception of statistical reality, belies a deeply rooted ability to intuitively asses probability.

Consider a recent study of the Kaqchikel and K'iche Mayans, who live in rural Guatemala and have never learned written language or a formal numerical system. When Italian researchers tested their ability to estimate the probability of chance events—by asking if two tokens removed at random from a bag of mixed-colored tokens were likely to match, for example—they did just as well as formally educated adults. This aligns with work indicating that babies and even other primates have inherent statistical skills.

Despite this instinctive sense, though, there is plenty of evidence suggesting that is has serious problems dealing with truly random events (e.g. lottery winnings). Daniel Kahneman, the psychologist who won the 2002 Nobel Prize in Economics for his development of behavioral economics, explained why in his book *Thinking, Fast and Slow:*

> We are pattern seekers, believers in a coherent world, in which regularities appear not by accident but as a result of mechanical causality or of someone's intention. We do not expect to see regularity produced by a random process, and when we detect what appears to be a rule, we quickly reject the idea that the process is truly random. Random processes produce many sequences that convince people that the process is not random after all. You can see why assuming causality could have evolutionary advantages. It is part of the general vigilance that we have inherited from ancestors.

We do not deal well with randomness, and instead see patterns where there are none. Our cousins, rhesus macaques, do it too. From an evolutionary standpoint, this probably served us well for two reasons.

First, consider foraging. When our hunter-gatherer forbears found berries growing somewhere, they (rightly) concluded that more berries would be growing nearby because resources cluster in a nonrandom manner in the wild. Today we only forage in the supermarket but we still conclude that clusters occur in a nonrandom manner. This is why we see "streaks" — like a string of heads in a coin toss — as predictive of future events, even though clusters and streaks can and do occur in fully random situations. This "hot-hand bias" has been noted among baseball, basketball, and poker fans, who think their favorite player is more likely to get a hit, sink a shot, or win a hand if succeeded previously — even though the two attempts are statistically independent of each other, like two consecutive coin tosses.

Second, consider predation and other risks. Life as an early human was fraught with danger from the environment. You hear a rustling in the grass – what is it? Back then, as today, it might most likely be the

wind. However, if our ancestors guessed wrong, they might face a saber-toothed cat or a python coming to eat them. Not responding to every rustle as though it were a threat could cost a life, a bigger evolutionary penalty for the species than overreacting to a breeze. Nowadays, with a greatly reduced threat level in our everyday lives, we still have a tendency toward pattern-seeking. It can make us see things that are most likely not there — like Jesus's face in a pancake.

It's easy to take the myriad everyday examples of people failing to make accurate judgments in the face of randomness, but the study on the Kaqchikel and K'iche is the latest in a long line of evidence demonstrating our innate ability to analyze probabilities. Kahneman's work and the hot-hand bias reveal that our analyses are skewed toward finding patterns for evolutionary reasons, but they do not negate the existence of our internal "probability sensor." It's just calibrated poorly. So how do we overcome the bias in our innate ability? Professional gamblers and weather forecasters are better than most modern, educated adults at estimating probabilities, and they acquire their skills through study, practice, and hard work. Perhaps that's all it ultimately takes to beat the odds.

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