

become accustomed in sports and in life—may have earned her widespread ridicule and disapproval, but she also won fans that night, including Mike Carey: “Making the hard call or the unpopular call, that’s where guts are tested, that’s the mark of a true official,” he says. “You might have a longer career as an official if you back off. But you won’t have a more accurate career.”

GO FOR IT

Why coaches make decisions that reduce their team’s chances of winning

The sun retreated behind the hills on the west side of Little Rock on a warm Thursday in September 2009. The Pulaski Academy Bruins and the visiting Central Arkansas Christian Mustangs emerged from their locker rooms and stretched out on the field and applied eye black. Apple-cheeked cheerleaders alternated between practicing their routines and checking their backlog of text messages. The air was thick with concession stand odor. The PA blasted AC/DC’s “Thunderstruck” and the predictable medley of sports psych-up songs. A thousand or so fans found their seats on the bleachers, filing past the placards for a store called Heavenly Ham, Taziki’s Greek Tavern, and other local businesses and insurance agents. It was conventional stuff, in other words, a typical high school football tableau.

Then the game started.

On the first possession, Pulaski marched steadily downfield until it faced fourth down and five at the Mustangs’ 14-yard line. The obvious strategy, of course, was to attempt an easy field goal and be happy with a 3–0 lead. But without hesitation, the offense remained on the field and went for it. The quarterback, Wil Nicks, rolled left, looked for a blue jersey, spotted one of his *five*

receivers, and zipped a swing pass near the sidelines that a junior receiver, Garrett Lamb, caught for a six-yard gain. First down.

A few plays later, thanks to an intentional grounding penalty and a bad snap, Pulaski faced fourth and goal from the opponent's 23-yard line. Again, conventional wisdom fairly screams: Attempt the field goal! Again, Pulaski did otherwise, going for it, lining up five receivers. Nicks was pressured out of the pocket and threw his *ninth* pass of the drive, a wayward throw, well behind the intended receiver, that fell innocuously to the turf. Central Arkansas Christian took over on downs.

By the end of the first quarter, the Bruins had declined to punt or attempt a field goal on all four of their fourth downs, field position be damned. Then again, this wasn't so surprising given that the team's roster listed neither a punter nor a kicker among its 45 players. Nicks, the quarterback, had already attempted 15 passes, on a pace to eclipse the 50 tosses he'd thrown in his previous game.

Early in the second quarter, Pulaski scored its first touchdown. After a nifty play fake, Nicks threw over the defense to a streaking receiver, Caleb Jones. On the ensuing kickoff, eleven Pulaski players massed near the 40-yard line. With the ball propped horizontally on the tee, resembling an egg on its side, the Pulaski players ran in different directions, as if performing an elaborate dance for which only they knew the choreography. With the play clock winding down, a burly senior tackle, Allen Wyatt, squirted a nine-yard kick that hugged the turf and bounced awkwardly before the visiting team pounced on the ball and hugged it like a long-lost relative.

As one of the texting cheerleaders might have abbreviated it: WTF? Who ever heard of deploying an onside kick in the second quarter, much less when you aren't behind?

But none of it provoked surprise among the Pulaski fans. After the opponents fell on the ball, the Bruins jogged off as if nothing remarkable had happened. And in retrospect, nothing had. Turns out that after most of Pulaski's touchdowns, the team went for a two-point conversion, not an extra point. On kickoffs, either they attempted fluttering onside kicks from any of a dozen formations

or the designated kicker—who's not really a kicker—would turn sideways and purposely boot the ball out of bounds, preventing a return.

And the, um, avant-garde play-calling didn't stop there. When Central Arkansas Christian punted, Pulaski didn't position a man back, much less attempt a return. Instead, it chose to let the ball simply die on the turf. Pulaski threw the football on the majority of downs—except for third and long, when they often ran the ball. They sometimes lined up eight men on one side of the field. From a spread offense formation, they deployed crafty shuffle passes, direct snaps to the running back, end arounds, reverses, and an ingenious double pass. Pulaski often showed greater resemblance to a rugby team than to a football team.

The players, not surprisingly, love it. What teenager who goes out for the high school football team wouldn't be enthralled with a system that encourages passing on most downs, routinely racks up 500 yards a game in total offense, and is chock full of trick plays? "You can't imagine how fun it is," gushed Greyson Skokos, a thickly proportioned running back and one of four Bruins players who would go on to catch at least 50 passes in the 2009 season.

The defensive players don't mind it, either. Though they're not on the field much, they welcome the challenge that comes when the offense fails to convert a fourth down and the opponent suddenly takes possession of the ball in the "red zone," sometimes just a few yards from scoring. The Pulaski fans are accustomed to it by now, as well. Most enjoy the show, shake their heads, and almost uniformly refer to the team's coach, Kevin Kelley, as a "mad scientist."

Truth is, Kelley isn't mad at all. Quite the opposite. He's relentlessly rational, basing his football philosophy not on whimsical experimentation or hot spur-of-the-moment passion but on cool thinking and cold, hard math.

Playing high school ball in Hot Springs, Arkansas, in the 1980s, Kelley watched in frustration as his conservative coach ordered the team to run on first and second downs, pass on third down, and punt or attempt a field goal on fourth down. To Kelley it made no

sense: "It was like someone said, 'Hey, it's fourth down, you have to punt now.' So everyone started doing it without asking why. To me, it was like, 'You can have an extra down if you want it. No, I'll be nice and just use three.'" At college at Henderson State, Kelley took a few economics courses, and though demand and supply curves didn't captivate him—he ended up majoring in PE—he was intrigued by the thought of applying basic statistics and principles of economics to football. Within a few years, he had his chance. In 2003, he was promoted to head football coach at Pulaski Academy, an exclusive private school where Little Rock's prominent families sent their kids. He decided to amass statistics and, based on the results, put his math into practice.

Among his early findings: His teams averaged more than six yards per play. "Think about it," he says. "[At six yards per play] if you give yourself four downs, you only need two and a half yards per down. You're in great shape. Even if you're in, like, third and eight, you should be okay. I'll keep all four downs, thank you very much!" Kelley also realized quickly that using all four downs and breaking with hidebound football "wisdom" confused defenses, enabling his team to gain even more yards. "When third and seven is a running down and fourth and one could be a passing down, and defenses don't know whether to use dime packages or nickel packages, the offense does even better."

Although Pulaski is hardly successful on every fourth-down attempt, it succeeds roughly half the time, enough to convince Kelley that statistically, his team is better off going for it every time. And keep in mind that this is *without* the element of surprise.

According to Kelley's figures, in Arkansas high school football, teams tend to average a touchdown on one of every three possessions. By punting away the ball three times when he didn't have to, he'd essentially be giving the opponents a touchdown each game.

By the time Pulaski played Central Arkansas Christian in September 2009, it had been more than two years since one of his teams had attempted a punt—and that was a gesture of sportsmanship to prevent running up the score. (Still more proof that no good deed goes unpunished, it was returned for a touchdown,

cementing Kelley's belief that punting is a flawed strategy.) Again, Kelley and his numbers: "The average punt in high school nets you around 30 yards, but especially when you convert around half your fourth downs, it doesn't make sense to give up the ball," he says. "Honestly, I don't believe in punting and really can't ever see doing it again."

He means *ever*. What about the most extreme scenario, say, when the offense is consigned to fourth and long, pinned near its own end zone? It's still better not to punt? "Yup," he says, arms folded across his thick belly. Huh?

According to Kelley's statistics, when a team punts from that deep, the opponent will take possession inside the 40-yard line and, from such a favorable distance, will score a touchdown 77 percent of the time. Meanwhile, if the fourth-down attempt is unsuccessful and the opponent recovers on downs inside the 10-yard line, it will score a touchdown 92 percent of the time. "So [forsaking] a punt you give your offense a chance to stay on the field. And if you miss, the odds of the other team scoring a touchdown only increase 15 percent."

The onside kicks? According to Kelley's figures, after a conventional kickoff, the receiving team, on average, takes over at its own 33-yard line. After an unsuccessful onside kick, it assumes possession at its own 48. Through the years, Pulaski has recovered between one-quarter and one-third of its onside kicks. "So you're giving up 15 yards for a one-in-three chance to get the ball back," says Kelley. "I'll take that every time!"

The decision not to return punts? In high school, punts seldom travel more than 30 yards. And at least for a small, private high school where speed demons are in short supply, Pulaski's return team seldom runs back punts for touchdowns. A far more likely outcome for the return team is a penalty or a fumble. So Kelley—the same man who will go for it on fourth and 20—instructs his team to avoid returning punts altogether. "It's just not worth the risk," he explains.

A folksy, exceedingly likable man in his mid-forties whose wife, kids, and elderly mom come to every Pulaski home game, Kelley

makes no pretenses about his academic credentials. "I just like to quantify it all together," he says. "But I'm not like an astrophysicist or a real math whiz."

The real math whizzes, however, confirm much of Kelley's analysis. David Romer, a prominent Cal-Berkeley economist and member of the National Bureau of Economic Research—whose wife, Christina, chaired President Obama's Council of Economic Advisers for two years—published a 2005 study titled "Do Firms Maximize? Evidence from Pro Football." Taking data from the first quarter of NFL games, Romer concluded that in many fourth-down situations, statistically, teams are far better off forgoing a punt or field goal and keeping the offense on the field for another down. His paper is filled with the kind of jargon that would induce narcolepsy among most football fans. He also looked only at first-quarter results because he figured his data would be skewed by obvious fourth-down attempts, for example, when a team is down by seven points late in the game and everyone knows it has to go for it. But, greatly simplified, here are his conclusions:

- *Inside the opponent's 45-yard line, facing anything less than fourth and eight, teams are better off going for it than punting.*
- *Inside the opponent's 33-yard line, they are better off going for it on anything less than fourth and 11.**
- *Regardless of field position, on anything less than fourth and five, teams are always better off going for it.*

Other mathematicians and game theory experts have reached similar conclusions. Frank Frigo and Chuck Bower—a former backgammon world champion and an Indiana University astrophysicist—created a computer modeling program for football called ZEUS that takes any football situation and furnishes the statistically optimal strategy. The results often suggest going for it when the conventional football wisdom says to punt.

* The exception: if little time remains and a field goal would decide the game.

Kelley believes that the "quant jocks" don't go far enough to validate the no-punting worldview and, more generally, the virtues of risk-taking. "The math guys, the astrophysicist guys, they just do the raw numbers and they don't figure emotion into it—and that's the biggest thing of all," he says. "The built-in emotion involved in football is unbelievable, and that's where the benefits really pay off." What he means is this: A defense that stops an opponent on third down is usually ecstatic. They've done their job. The punting unit comes on, and the offense takes over. When that defense instead gives up a fourth-down conversion, it has a hugely deflating effect. At Pulaski's games, you can see the shoulders of the opposing defensive players slump and their eyes look down when they fail to stop the Bruins on fourth down.

Conversely, Kelley is convinced that fourth-down success has a galvanizing effect on the offense. "It was do or die and they did," he says. "I don't think it's a coincidence that on more than half of our touchdown drives, we converted a fourth down."

Similarly, according to Kelley's statistics, when an Arkansas high school team recovers a turnover, it is almost twice as likely to score a touchdown as it is when it receives a punt at the same yard line. He cites this as another argument in support of onside kicking and the refusal to risk fumbling a punt return.

The benefits of Kelley's unique system don't stop there. Because the formations and play-calling are so out of the ordinary, Pulaski tends to induce an inordinate number of penalties from the opposing team. Since Pulaski's ways are so thoroughly unique, in the week before playing the Bruins, opponents depart from their normal preparation routine. They devote hours to practicing all manner of onside kick returns and defending trick plays and installing dime packages on fourth down. There's that much less time to spend practicing their own plays.

Especially in high school, when off-season practice time is limited—and you're dealing with teenage attention spans—those lost hours can be critical. In the run-up to the Pulaski game, Central Arkansas Christian's coach, Tommy Shoemaker, estimated that he spent half his practices worrying about the Bruins'

schemes. How much time did his team usually spend on the opposition? "Maybe twenty percent." Then again, he added wryly, at least his boys didn't have to spend time worrying about punt returns or field goal blocks. Turning serious, he added: "Keep in mind, we play these guys every year. I couldn't imagine what it'd be like getting ready if you didn't have any history."

Still another abstract benefit of playing for Pulaski: The experience is so different from traditional high school football that the Bruins' players feel as though they're part of something unique, an elite unit amid regular cadets. The team bonds have solidified; the offensive and defensive players consider themselves kindred spirits, bracketed together by their singular coach. And there are so many trick plays and intricate formations that players, by necessity, are alert at all times.

Happy as Kelley is to unleash his empirical evidence, these are the numbers that matter most to him: In the years since he took over as head coach, Pulaski is 77-17-1 through 2009, winning 82 percent of its games, and has been to the state championship three times, winning twice. All this despite drawing talent from only a small pool of private school adolescents. "I'm telling you," says Kelley. "It works."



It's up for debate whether Kelley's operating principles would work in all cases, for all teams, on all levels—for the record, he thinks they would—but his success at Pulaski is beyond dispute. With that record, you'd think other coaches would try to implement some form of Kelley-ball, but although he has become a minor celebrity in coaching circles and speaks at various banquets and conferences, he has not been flattered sincerely by imitation. Other coaches have cribbed the West Coast offense from Bill Walsh, the former Stanford and San Francisco 49ers coach, or the spread formation from Mike Leach, late of Texas Tech, but Kelley draws little more than a curious eye. "If there's another team out there that don't ever punt," he says with a shrug, "I haven't heard of 'em."

Several years ago, a prominent college coach paid a visit to Kelley's office at Pulaski, a nondescript box off to the side of the basketball court. The coach—Kelley doesn't want to name him for fear it might hurt the future recruitment of Pulaski players—asked for a primer on "that no punting stuff." Kelley happily obliged, explaining his philosophy and showing off his charts. "He wrote all sorts of stuff down in this big old binder and I'm thinking, 'Finally someone else sees the light.'" But when Kelley watched the coach's team play the next season, he saw no evidence that he had a disciple. Even armed with the knowledge that he was disadvantaging his team by his decision to punt, the coach routinely ordered the ball booted on fourth down.

That mirrors David Romer's experience. In his paper, Romer, the Berkeley economist, argued that the play-calling of NFL teams shows "systematic and clear cut" departures from the decisions that would maximize their chances of winning. Based on data from more than 700 NFL games, Romer identified 1,068 fourth-down situations in which, statistically speaking, the right call would have been to go for it. The NFL teams punted 959 times. In other words, nearly 90 percent of the time, NFL coaches made the sub-optimal choice.

Inasmuch as an academic paper can become a cult hit, Romer's made the rounds in NFL executive offices, but most NFL coaches seemed to dismiss his findings as the handiwork of an egghead, polluting art with science. Plenty admit to being familiar with Romer's work; few have put his discoveries into practice.

It all lays bare an abiding irony of football. Here are these modern-day gladiators, big, strong Leviathans. It's a brutal, unforgiving game filled with testosterone and bravado. Players collide off each other so violently that there might as well be those cartoon bubbles "Pow" and "Bam." The NFL touts itself as the baddest league of all. Yet when it comes to decision-making, it's remarkably, well, wimpy.

There's not just an aversion to risk and confrontation; coaches often make the *wrong* choice. In other words, they're just like . . . the rest of us.

Time and again, we let the fear of loss overpower rational decision-making and often make ourselves worse off just to avoid a potential loss. Psychologists call this loss aversion, and it means we often tend to prefer avoiding losses at the expense of acquiring gains. The psychologists Daniel Kahneman and Amos Tversky are credited with discovering this phenomenon. (Kahneman won the Nobel Prize for this work in 2002; Tversky died in 1996 before being recognized.) As the late baseball manager Sparky Anderson put it: "Losing hurts twice as bad as winning feels good."

For most of us, the pain of losing a dollar is far more powerful than the pleasure of winning a dollar. In a frequently cited psychology experiment, subjects are offered two gambles that have identical payoffs but are framed differently. In the first gamble, a coin is flipped, and if it lands heads, you get \$100; if tails, you get nothing. In the second gamble you are given \$100 first and then flip the coin. If the coin lands heads, you owe nothing; if tails, you pay back the \$100. Subjects dislike the second experiment much more than the first even though the actual gains and losses are identical.*

Marketing and advertising execs cater to this bias. Would you rather get a \$5 discount or avoid a \$5 surcharge? The same change in price framed differently has a significant effect on consumer behavior. A study of insurance policies, for instance, found that consumers switch companies twice as often when their carrier raises rates, as opposed to when the competition decreases its rates by the same amount. In everyday life, loss aversion causes people to make suboptimal choices. Many home owners looking to sell their houses right now would rather keep them on the market for an extra year than drop the price to \$5,000 less than they paid, even though keeping the home for an extra year will surely cost them more than

* Research even shows that the brain processes losses differently from gains. In experiments offering individuals different gambles with the same payoff, but with one framed in terms of gains and the other in terms of losses, researchers at UCLA—Sabrina M. Tom, Craig R. Fox, Christopher Trepel, and Russell Poldrack—found that a number of areas in the brain showed increasing activity as potential gains increased, whereas potential losses showed decreasing activity in these same areas, even though the actual dollars won and lost were the same.

\$5,000. A study of home sales by two economics professors, David Genesove and Christopher Mayer, then at the University of Pennsylvania's Wharton School of Business, showed this pattern. Home owners were reluctant to reduce the sale price below what they paid for the house even when continuing to own it meant incurring carrying costs—mortgage, utilities, maintenance—far exceeding the reduction in price needed to sell it. The idea of a loss was just too painful for them. In contrast, home owners facing a gain on a house often sold too early and for too little. The gain didn't matter as much as long as there wasn't a loss.

On Wall Street, fear of loss is often behind dubious investment strategies. Mutual fund managers, for example, will hold well-known or recognizable companies instead of obscure companies that are expected to deliver much better performance. The rationale: If you lose money by buying Walmart or Microsoft—recognizable blue chip companies—no one will blame you. You won't get fired; they'll chalk it up to "bad luck." Even though a small, obscure company might be a better bet, on the off chance that it doesn't pay off, you risk losing the client. So it is that many mutual fund managers will choose good companies over good investments.

On the television reality show *The Biggest Loser*, obese contestants compete to lose weight. The more they lose, the more they are rewarded. Two Yale professors, Ian Ayres, an expert in contract law, and Dean Karlan, a behavioral economist, were desperate to lose weight. Like the *Biggest Loser* contestants, they tried to find motivation in rewards. It didn't work, and so they flipped the *Biggest Loser* concept around and tried to motivate themselves with loss aversion. They entered a weight-loss bet with each other, and each one committed to pay the other \$1,000 a week if he didn't lose the required weight. In addition, once the weight was lost, it couldn't be gained back without incurring the \$1,000 penalty.

Two years later, neither professor has seen a dime of the other's money—and they've lost almost 80 pounds between them. They launched a company, stickK.com, to help people facilitate personal commitment contracts for weight loss and other personal goals by using loss aversion. If you don't live up to your end of the

contract, they give your money to charity or a designated beneficiary. (In another variation, the losers have to donate the money to a cause that runs counter to their political sensibilities: gun haters contributing to the NRA, pro-lifers contributing to Planned Parenthood.)

This same loss aversion affects coaches. They behave much like the shortsighted mutual fund manager who forgoes long-term gains to avoid short-term losses and the amply girthed professors who could lose weight only when faced with a loss rather than a reward. The coaches are motivated less by potential gain (a touchdown) than by fear of a concrete loss (the relative certainty of points from a field goal).

More broadly, many coaches ultimately are motivated less by the potential of a Super Bowl ring than by the potential loss of something valuable they possess: their job. And in sports, there are few faster ways to lose your employment than by bucking conventional thinking, by trying something radical, and failing. A coach ordering his team to punt on fourth and three—even when it's statistically inadvisable—faces little backlash. He is the money manager who plays it safe and loses with Walmart. If he goes for it and is unsuccessful, there's hell to pay. He is then the money manager who loses on that unknown tech stock and now risks losing the entire account.

It makes for an odd dynamic in which the incentives and objectives of coaches aren't perfectly aligned with those of the owners or the fans. All want to win, but since the owners and fans can't be fired, they want to win at all cost. Give a coach truth serum and then ask what he'd prefer: go 8–8 and keep your job or go 9–7 and, because of what's perceived to be your reckless, unconventional play-calling, lose your job?



It's not just football coaches who make the wrong choices rather than appear extreme. In basketball, for instance, prevailing wisdom dictates that coaches remove a player with five fouls, particularly a star, rather than risk having him foul out of the game. But does this make sense?

We can start by measuring how long a player sits on the bench once he receives a fifth foul. We analyzed almost 5,000 NBA games from the 2006–2007 to 2009–2010 seasons and found that when a player receives his fifth foul, on average, there is 4:11 left to play in the game. He's benched for about 3:05 of that remaining time, leaving only 1:06 of actual playing time with five fouls. Stars are treated a little differently.* On average, they don't receive their fifth foul until there is 3:44 left, and coaches bench them for a little more than two minutes.

The strategy of sitting a player down with five fouls and waiting until the end of the game to put him back in presumes that players, particularly stars, are more valuable at the end of the game than at other times. But this is seldom the case.

Statistical analysts in basketball have created “plus-minus,” or an “adjusted plus-minus,” a metric for determining a player's worth when he is on the floor. Simply put, it measures what happens to the score when any particular player is on the court. When a player is plus five, that means his team scored five more points than the opponent when he was on the floor. Thus, this measure takes into account not only the individual's direct influence on the game from his own actions but also the indirect influence he has on his teammates and his opponents. It measures his net impact on the game.

As often as we hear about “clutch players,” for the average NBA player, his contribution to the game, measured by plus-minus, is actually almost two points *lower* in the fourth quarter than in the first quarter. This is also true for star players and is even the case in the last five minutes of the game. Thus, the strategy of sitting a player down with five fouls to save him for the end of the game seems to be based on a faulty premise—he is no more valuable at the end of the game.

Now consider who replaces the player when he sits on the bench. The average substitute summoned in the fourth quarter to

* Stars are defined as players receiving votes for MVP that season or All-Star players.

replace the teammate in foul trouble, not surprisingly, has an even smaller impact. Replacing the star player in foul trouble with a sub has the net effect of reducing the team's points by about 0.17 for every minute the star is on the bench. This is a heavy price to pay. (We considered that a star player in foul trouble might compete conservatively, so maybe the difference between a sub and a star who plays conservatively with five fouls isn't all that great. But no, it turns out that's not true. If anything, star players have an even *higher* plus-minus than normal when they are in foul trouble.)

Leave a player with five fouls in the game and what happens? The average player with five fouls will pick up his sixth and foul out of the game only 21 percent of the time. A star is even less likely to pick up a sixth foul (only 16 percent of the time once he receives his fifth foul; remember "Whistle Swallowing"?). Thus, leaving a player in the game with five fouls hardly guarantees that he'll foul out.

Bottom line: An NBA coach is much better off leaving a star player with five fouls in a game. By our numbers, coaches are routinely giving up about 0.5 points per game by sitting a star player in foul trouble (and that doesn't include the minutes he might have sat on the bench with three fouls in the first half). That may not seem like much, but in a close game, in which these situations often occur, it could mean the difference between winning and losing. We estimate that leaving a player in with five fouls instead of benching him improves the chances of winning by about 12 percent. Over the course of a season, this can mean an extra couple of wins. Yes, a player may foul out of a game, but benching the player *ensures* that he's out of the game. As Jeff Van Gundy, former coach of the Houston Rockets and New York Knicks and current television announcer, once put it on the air, "I think *coaches* sometimes foul their players out."

So why don't NBA coaches let their players—particularly their stars—keep playing when they have a lot of fouls? Again, loss aversion and incentives. If you lose the game by following convention and sitting your player down, you escape the blame. But if you play him and he happens to foul out and the team loses, you

guarantee yourself a heaping ration of grief on sports talk radio, in columns, and over the blogosphere even though the numbers strongly argue in favor of leaving the player in the game. As with punting on fourth down, coaches are willing to give up significant gains to mitigate the small chance of personal losses. Presented with this evidence, one NBA coach maintained that he was still going to remove a player when he picked up his fifth foul late in the game. Why? "Because," he said, "my kids go to school here!"

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Another example of loss aversion is seen in baseball. Game after game, the same scene plays out with almost numbing familiarity: It's the ninth inning, the manager for the winning team summons the liveliest arm in the bullpen, the PA system cranks up ominous music—Metallica's "Enter Sandman" more often than not—and out trots Mariano Rivera, the Yankees' peerless relief pitcher, or his equivalent, to record the save. Why? Because conventional baseball wisdom dictates that managers use their best relief pitchers at the *end* of games to preserve victories. The presumption: This is the most important part of the game, with the greatest impact on the outcome. Not for nothing are these pitchers called closers.

But where is it written that a closer must close? What if the most important moment in the game, when the outcome is most likely to be affected, occurs earlier? Might it not make more sense to summon Rivera or Boston Red Sox closer Jonathan Papelbon when the game is tied in the sixth inning and there are runners on base? Wouldn't they be more valuable at this juncture than they are when they usually report to work: the ninth inning when their team is ahead?

Yet you almost never see a manager use his bullpen ace before the eighth inning. Why? Because, again, what manager wants to subject himself to the inevitable roasting if this strategy fails? If your closer isn't available to seal the game and you happen to lose . . . well, managers have been fired for lesser offenses. (Keep in mind, too, that closers like to accumulate "saves"—which occur

if they are the last one pitching—since saves translate into dollars in the free agent market.)

Even in hockey, one can see loss aversion affecting coaching strategy. “Pulling the goalie” and putting another potential goal scorer on the ice near the end of a game when your team is losing decidedly improves your chances of scoring a goal and tying the game, but it also increases the risk that with the net empty, an opponent will score first and put the game out of reach. We found that NHL teams pull their goalies too late (on average with only 1:08 left in the game when down by one goal and with 1:30 left when down by two goals). By our calculations, pulling the goalie one minute or even two minutes earlier would increase the chances of tying the game from 11.6 percent to 17.6 percent. Over the course of a season that would mean almost an extra win per year. Why do teams wait so long to pull the goalie? Coaches are so averse to the potential loss of an empty-net goal—and the ridicule and potential job loss that accompany it—that they wait until the last possible moment, which actually reduces their chances of winning.

When *do* we see coaches take risks? Well, when do we take risks in everyday life? Usually when there’s little or nothing to lose. You’re less likely to be loss-averse when you *expect* to lose. Think of your buddy in Vegas who’s getting crushed at the tables. Already down \$1,000, he’ll take uncharacteristic risks, doubling down when he might otherwise fold, in hopes of winning it back. How many times have you gotten lost driving the back roads and taken a few turns based on intuition rather than consult your map or GPS? “Hey, why not? I’m lost already.” For that matter, how many schlubs have overreached around the time of last call, figuring that if they get shot down, they’re no worse for it?

Coaches are subject to the same thinking: In the face of desperation, or a nearly certain loss, they’ll adopt an unconventional strategy. They’ll go for it on fourth down when their team is trailing late in the game. They’ll pull the goalie with a minute left. They’ll break the rotation and use their ace pitcher in the seventh game of a World Series. Why not?

Consider how the forward pass became a part of football. It was

legalized in 1906 but hardly ever deployed until 1913, seven years later, when a small, obscure Midwestern school, Notre Dame, had to travel east to face mighty Army, a heavily favored powerhouse. With little to lose, the Fighting Irish coach, Jesse Harper, decided to employ this risky, newfangled strategy by using his quarterback, Charlie “Gus” Dorais, and his end, a kid named Knute Rockne. The summer before, Dorais and Rockne had been lifeguards on a Lake Erie beach near Sandusky, Ohio, who passed the time throwing a football back and forth. The Army players were stunned as the Irish threw for 243 yards, which was unheard of at the time. Notre Dame won easily, 35–13. After that, the Irish no longer resided in college football obscurity, Dorais and Rockne became one of the first and best passing tandems of all time, and the forward pass was here to stay. Dorais and Rockne would both go on to become revered Hall of Fame coaches, in large part because they continued deploying their passing tactics at the coaching level.



In the rare instances when coaches in sports embrace risk systematically—not in the face of desperation but as a rule—there is a common characteristic. It has nothing to do with birth order or brain type or level of education. Rather, those coaches are secure in their employment. If the experiment combusts, they have little to lose (i.e., their jobs).

Is it coincidence that New England Patriots coach Bill Belichick opts to go for it on fourth down more often than any of his colleagues do? True, Belichick is a cerebral sort who understands risk aversion and probability as well as anyone, but he’s also won three Super Bowls since 2001 and has more job security than any other coach in the NFL. We noticed that before he became a coaching star, Belichick approached the game quite differently. In his first head coaching stint in the NFL, with Cleveland, Belichick amassed an unimpressive 45 percent winning percentage and had only one winning season in five years. In Cleveland, he never exhibited the penchant for risk-taking that he shows with the Patriots. Back when he commanded the Browns, he went for it on fourth down

only about one out of seven times. Since taking the helm at New England in 2000, Belichick has gone for it on fourth down a little more than one in four times.

But this tells only part of the story. In Cleveland, Belichick's team trailed more often, and so many of the fourth downs he went for were in desperate situations—trailing near the end of the game. In New England, he had better teams and hence was ahead much more frequently, facing fewer “desperate” fourth-down situations. Looking only at fourth-down situations in the first three quarters with his team trailing by less than two touchdowns, we found that in Cleveland he went for it on fourth down only about one in nine times, but in New England he went for it about one out of four times in the same situations. Belichick was almost three times more likely to go for it on fourth down in New England than he was in Cleveland.

One could argue that having a better team in New England meant he was more likely to convert more fourth downs, which is why he chose to go for it more often. True, his Patriots converted more of their fourth-down attempts than his Browns did, but the differences weren't big (59 percent versus 51 percent), certainly not three times larger. Plus, in Cleveland, since he attempted more “desperate” fourth downs, sometimes with more than ten yards to go, you'd expect the success rate to be lower. Controlling for the *same* yardage, Belichick's Patriots were only slightly better than his Browns at succeeding on fourth down.

So what changed his appetite for risk? Belichick didn't have great job security in Cleveland, as evidenced by his eventual dismissal in 1996. Even in New England the first couple of years, when his job was less certain, he remained conservative. Only after his teams had won multiple Super Bowls and he was hailed as “the smartest coach in football” did his risk-taking increase. His job security at that point wasn't an issue.

But even a secure coach bucks convention at his own peril. In November 2009, the Indianapolis Colts, undefeated at the time, hosted the New England Patriots. The latest installment in the NFL's most textured rivalry, it was a Sunday night affair televised

on NBC. New England led comfortably for most of the game, but in the fourth quarter the wires of the Colts' offense started to connect. Indianapolis scored a late touchdown to close the score to 34–28. The crowd noise at Lucas Oil Stadium reached earsplitting levels.

On the Patriots' next possession, they moved the ball with deliberate slowness and faced fourth and two on their own 28-yard line. It was a compelling test case for risk management in the NFL. If the Patriots punted, it was a virtual certainty that Indianapolis would get the ball back, leaving Peyton Manning slightly more than two minutes and two time-outs (one of their own and one from the two-minute warning) to move the ball 65 or 70 yards to score a touchdown—a feat he had achieved on many occasions, including the last time the two teams had met in Indianapolis.

If the Patriots went for it and converted, the game's outcome would effectively be sealed. However, if the Patriots went for it and failed, they would give the Colts the ball inside their 30-yard line. So going for it would either end the game or—worst-case scenario—give the ball back to Manning and the Colts' offense 35 to 40 yards closer than punting the ball would. If the Colts scored a touchdown quickly from that shorter distance, there might still be time for the Patriots to kick a game-winning field goal. There were other factors as well. The Patriots' defense was visibly exhausted, and, thanks to injuries, two starters were missing from New England's defensive secondary, another factor militating against punting. Watching the game at home in Arkansas, Kevin Kelley shouted at his television, hoping Belichick would have the “guts” (his word) to forsake punting.

Beyond gut intuition, the analytics also supported going for it. Crunching the numbers, the average NFL team converts on fourth and two about 60 percent of the time. If successful, the Patriots would almost assuredly win the game. If they failed and the Colts took over on the Pats' 30-yard line with two minutes left and down by six points, the Patriots were still 67 percent likely to win the game. In other words, the Colts had only a one in three chance of actually scoring a touchdown from the Patriots' 30, so

it was hardly as if the Patriots were conceding a touchdown if the fourth-down attempt failed. Alternatively, punting the ball would put the Colts at roughly their own 30, which gave the Patriots about a 79 percent chance of winning. There was, then, only a 12 percent difference in the probability of winning the game if the Patriots failed on fourth down versus if they punted the ball. And if they converted (which was 60 percent likely), the game would effectively be over. Adding everything up, going for it gave the Patriots an 81 percent chance to win the game versus a 72 percent chance if they punted.* Even tweaking these numbers by using different assumptions, you'd be hard-pressed to favor punting. At best, you could say it was a close call between punting and going for it; at worst, going for it dominated.

NFL fans probably will recall what happened next. Belichick ordered his offense to stay on the field. "We thought we could win the game on that play," he said afterward. New England's quarterback, Tom Brady, had thrown for nearly 400 yards that evening but couldn't pick up the crucial 72 inches on fourth down. He zipped a quick pass to Kevin Faulk. Like a man smushing out a cigarette in an ashtray, Colts safety Melvin Bullitt ground Faulk into the turf a few feet shy of the line.

By then, the fates had already written the script. As condemnation of Belichick's "cowboy tactic" and "needless gamble" was beginning to crackle in the broadcast booth and on the blogosphere, the Colts marched methodically, inevitably, to the end

* These numbers are based on league averages for the probability of scoring a touchdown from a specific field position and the probability of converting a fourth and two. It turns out the Patriots are much more likely than the average team to convert fourth and two (70 percent versus 60 percent) and the Colts, with Peyton Manning, are much more likely to score a touchdown than the average team from most positions on the field. But these two effects probably cancel each other out. One other thing to consider, however, that would also favor going for it over punting is the fact that the Patriots probably would adopt a more conservative defensive strategy or "prevent" defense to guard against the deep ball if the Colts started on their own end of the field. This probably would allow Peyton Manning to march quickly down to the Patriots' end of the field in less time than usual, making the decision to punt even less valuable.

zone. With seconds to play, Indianapolis scored a touchdown on a one-yard pass to win the game 35-34.

Belichick may have been the most highly regarded coach in the NFL and may have made what was, statistically anyway, the correct call, but out came the knives. The reviews from the salon were brutal:

- *"You have to punt the ball in that situation. As much as you may respect Peyton Manning and his ability, as much as you may doubt your defense, you have to play the percentages and punt the ball. . . . You have got to play the percentages and punt the ball."* —NBC analyst Tony Dungy, the Colts' former coach
- *"It was a really bad coaching decision by Coach Belichick. I have all the respect in the world for him, but he has to punt the ball. The message you send in the locker room is, 'I have no confidence in my young guys on defense.'"*—former Patriots safety and current NBC analyst Rodney Harrison
- *"Ghastly. . . . Too smart for his own good this time. The sin of hubris."*—Boston Globe columnist Dan Shaughnessy
- *"Is there an insanity defense for football coaches?"*—Boston Herald columnist Ron Borges
- *"I hated the call. It smacked of 'I'm-smarter-than-they-are' hubris. This felt too cheap."*—Peter King, *SI.com*
- *"My vocabulary is not big enough to describe the insanity of this decision."*—former NFL quarterback and ESPN analyst Trent Dilfer
- *"Fourth-and-jackass. That's our name for a now-infamous play in New England Patriots' history."*—Pete Prisco, *CBSSports.com*
- *"So what was more satisfying Sunday night, watching good guy Peyton Manning rally the Colts or bad guy Bill Belichick choke as a tactician?"*—Jeff Gordon, *St. Louis Post-Dispatch*

Of course none of these criticisms mentioned that punting was statistically inferior or at best a close call relative to going for it. In fact, they claimed the opposite, that punting was the superior strategy. It wasn't.



It wasn't just that the Patriots had lost. It was that Belichick had dared to depart from the status quo. He was the geek with the pocket protector, and damn if it didn't feel good when he was too smart for his own good. It had all the ring of the cool kids in school celebrating when the know-it-all flunked the test.

Unless blessed with clairvoyance, you make a decision before you know the outcome. The decision to go for it was the *right* decision. That it didn't work out doesn't change the soundness of the decision. Yet people seldom see it this way. They have what psychologists call hindsight bias. If you did the right thing but failed because of bad luck, you're stupid. If you did the wrong thing but succeeded because of good fortune, you're a genius. Of course, it's often the opposite. If your buddy is playing blackjack at the card table and takes a hit (an extra card) when he has 19 and the dealer is showing 4, you should call him a moron. The statistics tell you to stick (decline a card) because the most probable event is that the dealer will bust (get more than 21) or have less than 19. If your buddy takes a card anyway and gets a 2, giving him 21, and wins, should he be hailed as a genius? No, he's still a moron—just a lucky moron. The same holds for any decision we make in the face of uncertainty. Luck doesn't make us smarter or dumber, only lucky or unlucky.

The very next week the Patriots hosted their division rivals, the New York Jets, who had beaten the Pats a few weeks earlier. On their second drive, New England faced fourth down and one on the Jets' 38-yard line. Despite the beating he'd taken in the media, among fans, and even from former Patriots players, Belichick again went for it, which is exactly what the numbers tell you to do. In the broadcast booth, the announcers were leery, already questioning the coach's tactics, "especially after what happened the previous week!" they intoned. This time, however, Laurence Maroney, the Pats' bruising running back, busted over the left tackle for two yards. First down. The announcers said little. Belichick was not

praised for this strategic success commensurately with how he'd been blasted the previous week.

Again, this is Bill Belichick. If the most secure coach in the league, whose cerebral analysis is thought to be unmatched, could be subjected to such a severe beating over a well-calculated risk, imagine how a rookie coach or a coach on the hot seat is going to be treated.

And it's not just football coaches who face a difficult time departing from convention. In 1993, Tony La Russa was managing the Oakland A's and was dismayed as his team was last in the division. Pitching was particularly problematic. Oakland's earned run average (ERA) had swollen to more than 5.00. After a particularly brutal weekend series during which the A's gave up 32 runs, La Russa and his longtime pitching coach, Dave Duncan, asked themselves, "Who made the rule that teams need four starters who throw 100 or so pitches, followed by a middle reliever and a closer?"

La Russa seized on an idea: Why not take his nine pitchers and establish three-man pitching "units" in which each pitcher would throw only 50 tosses, usually within three innings? The thinking was simple: The pitchers would take the mound every three games but would be fresher since they'd throw fewer pitches per outing. Also, the opposing batters would be unable to establish much comfort, since they might well face a different pitcher every time they came to the plate. It turns out that baseball statistics back this up. Major League batters hit about 27 points lower the first time they face a pitcher in a game. Their on-base percentage is about 27 points lower and their slugging percentage is 58 points lower the first time they face a pitcher. This could be because the pitcher's arm is fresher or because the hitter needs to see him more than once to figure him out. Either way, La Russa's idea would capitalize on this effect.

There were other potential advantages, too. By having essentially all your pitchers available to you each game, you have more options to choose from in any situation. In addition, the most expensive pitchers tend to be starters who go deep into the game,

pitching seven or more innings and throwing 120-plus pitches per game. Turns out the key difference between star pitchers and other pitchers is the stars' ability to pitch effectively for longer. In the first couple of innings, the differences between star and non-star pitchers are much smaller. In La Russa's experiment, for the first three innings he might get comparably effective results from journeyman pitchers who came at a fraction of the cost of the star pitchers, thus leaving extra money to spend on other players—or, in the case of the Oakland A's, allowing them to remain competitive despite a much smaller budget than some of the big-market teams, such as the New York Yankees.

It was a radical strategy, but La Russa had the status and standing to try to pull it off. He'd been the Oakland manager since 1986 and had taken the team to the World Series in 1988, 1989, and 1990. In 1992, the previous season, he had been named manager of the year. With his accumulated goodwill (and his team in last place), he wasn't risking much by departing from conventional wisdom.

Unfortunately for La Russa, his chemistry experiment fizzled. Why? The starting pitchers hated it. Publicly they claimed they had a hard time finding a rhythm and settling into a groove. Privately they complained that the 50-pitch limit precluded them from working the requisite five innings to get a win, yet they were still eligible for a loss. (Because future contracts were tied to wins and losses, their manager was potentially costing them real money.) After five games, four of them losses, and a lot of grumbling from the pitchers, La Russa cut bait and returned to the traditional four-man, deeper-pitch-count rotation. It was a reminder: You may have a better strategy, but if the athletes don't buy in, it's probably not worth deploying.

Here is a cautionary tale of what happens to a risk-taking coach on shaky employment footing. Paul Westhead, coach of the Los Angeles Lakers, was fired 11 games into the 1981–1982 season, in part because the team's point guard, Magic Johnson, thought the coach was, of all things, too rigid and restrictive. "This team

is not as exciting as it should be," the Lakers' owner, Dr. Jerry Buss, said at Westhead's firing. By the end of the eighties, Westhead, a Shakespeare scholar who looked the part of a professor, was coaching at the college level, at Loyola Marymount. There he deployed a strategy based on many of the same principles that Kevin Kelley uses in Arkansas: The more offensive opportunities and attempts, the better. The statistics support attempting lots of "big plays"—three-pointers in basketball. The unconventional approach upsets the opponents' preparation routines and displaces them from their comfort zone.

In the 1989–1990 season, tiny Loyola Marymount was the toast of college basketball, the up-tempo team averaging a whopping 122 points a game, running other teams to exhaustion, and coming within a game of reaching the Final Four. (That the team's star player, Hank Gathers, died during the season added a sad layer of drama and exposure.)

Intrigued by Westhead's unique philosophy, his willingness to take ordinary "running and gunning" to a new level, the NBA's Denver Nuggets poached him from the college game to be head coach for the 1990–1991 season. He stated that his methods would be even more effective a mile above sea level, as opponents would tire even more quickly. Westhead encouraged his players to play at a breakneck pace, shoot once every seven seconds—twice the league average—and take plenty of three-pointers. He reckoned that not only would shooting 35 percent on three-pointers yield more points than shooting 50 percent on two-pointers, but longer shots would lead to more offensive rebounds: When the Nuggets missed, they stood a better chance of retaining possession. On defense, the team played at the same methamphetamine speed, using constant backcourt pressure and trapping. "The idea is to play ultrafast on offense and ultrafast on defense, so it becomes a double hit," Westhead explained to *Sports Illustrated*. "And when it works, it's not like one and one is two. It's like one and one is seven."

Except that it wasn't. At the pro level, Westhead's experiment

failed spectacularly. Opposing players took advantage of the Nuggets' chaos and the irregular spacing. The Nuggets' strategy of shooting early and often led to easy baskets on the other end. As it turned out, it was the Denver players who were often huffing and puffing—and on injured reserve—from the relentless running. (One Denver player complained that his arm hurt from throwing so many outlet passes.) Games came to resemble the Harlem Globetrotters clowning on the Washington Generals. In one game, the Phoenix Suns scored 107 points, most on dunks and layups, in the *first half*, which still stands as an NBA record. The Nuggets started the season 1–14 and finished a league-worst 20–62. They scored 120 points a game but surrendered more than 130 and were mocked as the Enver Nuggets, a nod to their absence of “D.” Westhead grudgingly slowed down the pace the next season but was fired nevertheless.

You might say it was a valiant effort by Westhead. Hey, at least he tried something different. And if his nonconformist ways failed in Denver, they sure worked at Loyola Marymount. Maybe it was just a question of personnel and circumstance. Barely a decade later, the Phoenix Suns, blessed with better players than Westhead's Nuggets, were borrowing many of his ideas and principles, racking up wins with a celebrated breakneck, shoot-first-ask-questions-later offense nicknamed “seven seconds or less.”

But Westhead was hardly cast as an innovator. He was considered an “eccentric,” one of the more damning labels in sports. Mavericks are seldom tolerated in the coaching ranks. A mad professor without tenure, Westhead—unlike so many who fail conventionally—never got another NBA head coaching opportunity. His next job was with a modest college program at George Mason University. From there, he caromed to the Japanese League and the WNBA, where he coached the Phoenix Mercury to a title. He returned briefly to the NBA as an assistant, but that was short-lived. At this writing, Westhead is the head women's basketball coach at the University of Oregon, coaching a mediocre team that scores prolifically.

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Pulaski's Kevin Kelley is an innovative thinker, but he is also exquisitely well placed to install his unconventional strategies. In addition to coaching the football team, Kelley doubles as the athletic director for Pulaski Academy. He is his own immediate supervisor. He draws his players from a small pool of affluent kids whose parents can afford parochial school tuition and probably place football a distant third behind academics and violin lessons. When Kelley's choices fail, there aren't many boos from the stands or angry fans calling the local sports talk show or starting websites dedicated to his firing. Since he coaches high school kids, he doesn't face the threat of player (and agent) revolt the way Tony La Russa did with the Oakland A's pitching staff.

That Thursday night game at Pulaski spanned nearly three hours, mostly because of incomplete passes and penalties that stopped the game clock. But it showcased how Kelley's savvy and well-considered, if unconventional, approach led a decidedly smaller, slower, and younger Pulaski team to victory, 33–20. Afterward, in the postgame breakdown, Kelley said flatly, “The system won that game.” As the players shook hands near midfield, one of the Mustangs sought out the Bruins' quarterback, Wil Nicks, and told him, “I wish we played like y'all.”

Pulaski went all the way to the Class 5A state championship game in 2008. In that tournament run, Kelley stayed true to his philosophy. In the semifinal game against Greenwood—the school that had knocked them out of the tournament two years in a row, including a 56–55 heartbreaker in the state championship in 2006—Pulaski started the game with an onside kick, recovered it, and drove all the way down to Greenwood's six-yard line before turning the ball over after failing to convert on fourth down. That might have discouraged most coaches, especially against a team they've had trouble beating. Not Kelley. He continued to go for it on every fourth down, eventually winning the game 54–24 and amassing 747 yards of total offense in the process.

In the championship game against West Helena Central—a team with eight future Division I players to Pulaski's one—Kelley again refused to punt or kick. In the waning minutes, the Bruins

had possession and clung to a slim 35–32 lead. Faced with three fourth downs early in the drive, they went for it each time and made it. With less than 1:30 left on the clock, they faced yet another fourth down at midfield. The conventional strategy was to punt the ball, pin your opponent deep in their own end, and force them to drive 60 to 70 yards in less than a minute and a half to get into field goal range. If you go for it and fail, you leave Helena just 20 yards away from field goal range and give them a chance to tie the game. What do the statistics tell you to do? Go for it. That is what Kelley did. The Pulaski quarterback plunged over the right side for a couple of yards, converting yet another fourth down on what would be the final drive of the game as Pulaski ran out the clock and captured its second state championship. Asked if he ever thought about punting on that final drive with so much at stake, Kelley responded without hesitation: “*Never.*”

For kindred spirits in the coaching ranks who are tempted to topple conventional sports wisdom, Kelley has the same advice he gives his teams on fourth down: Go for it. Until they do, at least players have a response at the ready the next time their coaches accuse them of being soft or making boneheaded decisions or failing to do everything they can to help the team win. “Sorry, Coach, but I’m just following the example you set with your play-calling.”

HOW COMPETITIVE ARE COMPETITIVE SPORTS?

Why are the Pittsburgh Steelers so successful and the Pittsburgh Pirates so unsuccessful?

The noise level and the sun rose in tandem. A couple of nights earlier the New York Yankees had won the 2009 World Series, and now, on this chilly November morning, it was time for their parade. Fans had been lining the streets of lower Manhattan since the infomercial hours. By 7:00 A.M. the crowd was five deep. An hour later the inevitable “Let’s go Yankees, tap-tap-taptaptap” cheers began. Kids pulled from school sat regally on their parents’ shoulders. The New York cops, their spirits buoyed by the overtime they were racking up, were uncommonly friendly. Wall Street traders and analysts and bankers peered from their offices overhead and smiled for one of the few times all year. The motorcade wouldn’t crawl past until noon, but in a congenitally impatient city where no self-respecting pedestrian waits for the light to change, this was the rare occasion when millions of New Yorkers stood happily along Broadway for hours.

The 2009 World Series parade attracted more than 3 million fans—a greater mass of humanity than the entire *market* of some MLB teams. Among the crowd: former mayor Rudy Giuliani, Spike Lee, and Jay-Z, who performed the civic anthem at the time,