

(PERFORMANCE)

*HOW TO BUILD THE PERFECT BATTER

Since the beginning of baseball, scouts and managers have regarded the hunt for great sluggers as *an almost mystical search*. But it's just dawning on the game that the future Ruths and Bonds and Pujolses will be discovered by rational scientists—and soon even steroids will seem quaint *by Nate Penn*



ON A SWELTERING summer afternoon in 1921, Babe Ruth belted a home run deep into the bleachers at the Polo Grounds, then took a car down Broadway to a laboratory at Columbia University, where two grad students in the department of psychology prodded and poked at him for three hours in an attempt to figure out why he could hit so many more home runs than any other person on the planet. >>>

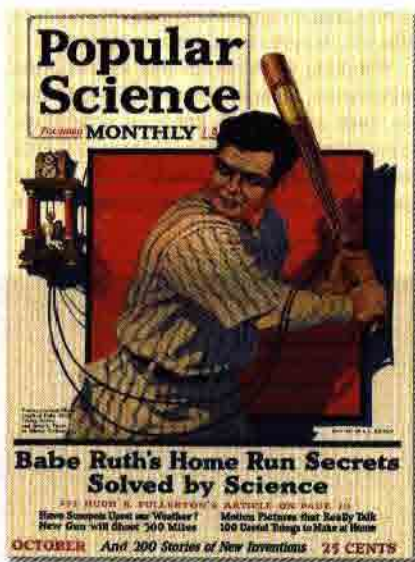
* The perfect swings: *top row*, Mickey Mantle, Barry Bonds, Reggie Jackson, Carl Yastrzemski; *bottom row*, Willie Mays, Mike Schmidt, Albert Pujols, Hank Aaron.

The researchers' equipment was state-of-the-art, circa 1921: a Hipp chronoscope, which they attached to the Babe's bat to calculate its speed; a kymograph, which they connected to tubing strung on his torso in order to record the rate of his breathing; and a tachistoscope (a sort of slide projector with a shutter like a camera's), with which they measured how fast his eyes reacted to stimuli. In all, they ran the Babe through eight tests on six different scientific apparatuses, and the results, published in *Popular Science*, were "a revelation" that showed Ruth's "coordination of eye, brain, nerve system, and muscle [to be] practically perfect." Even *The New York Times* got in on the excitement, touting the Ruth experiments on its front page of September 11, 1921: RUTH SUPERNORMAL, SO HE HITS HOMERS.

Today the *Popular Science* account reads as a slightly laughable mixture of hero worship, hype, and sham science. But the magazine did make one suggestion that, eighty-five years later, is more relevant than ever. "If baseball-club owners...submit candidates to the comprehensive tests undergone by Ruth," the author wrote, "[they can] discover whether or not other Ruths exist."

It's a future baseball has yet to embrace, but for reasons both of public relations and economics, the game can't really wait much longer. The PR issue is obvious. Baseball needs its sluggers, but it needs them to hit home runs that aren't steroid fueled. And the economic rationale, while it lacks the tawdry intrigue of ballplayers sticking needles in their asses, is more compelling still. Even now, in the post-*Moneyball* era of general managing, baseball teams are fairly astonishing in their ability—and willingness—to squander huge piles of cash. Major league clubs collectively pay out about \$160 million annually on amateur players and an additional \$550 million, or \$18.33 million per team, on development. More than half of the priciest picks fizzle out—*more than half*—but this, for most teams, is just the cost of doing business. Syd Thrift, the pioneering former general manager of the Baltimore Orioles and Pittsburgh Pirates, holds back nothing in his assessment of modern-day baseball executives: "Everybody thinks they're ahead," he says, "and they're so far behind it's pitiful. They say, 'Everything's under control.' You have a \$200 million payroll under control?"

Baseball needs to adopt an unsentimental, scientific approach to player evaluation and training. But this is the very thing that so many baseball guys, faithful to the stale myths of divining talent, have rejected for years. "Many people in baseball get drafted out of high school, become players, then



★ The October 1921 issue of *Popular Science*.

become scouts and coaches," says Brad Kullman, until recently the assistant GM of the Cincinnati Reds. "There tends to be a closed-mindedness to new information. That's what keeps you stuck on the treadmill of mediocrity."

Marcus Elliott, a Harvard M.D. who trains pro athletes at P3: Peak Performance Project in Santa Barbara, California, puts it even more bluntly: "In terms of testing and conditioning, baseball today is in the Dark Ages. In fact, the Babe Ruth testing was more appropriate and more intensive than anything any professional team is doing right now."

This is the story of an approach to talent evaluation that, like "moneyball," offers a way for smart but poor teams to gain ground on rich and complacent ones—a story of a new approach to the game facing enormous resistance from entrenched front-office

powers. The question that a few people in and outside of the game are asking is: Can we create lab tests to assess an amateur ballplayer's innate abilities—his power, his eyesight, his reaction time, his psychological fitness—and predict whether or not he'll succeed in the majors? And the answer is yeah, without a doubt. So how much longer before the rest of baseball catches on?



IN THE 240-MILLISECOND interval between the pitcher's release of a ninety-mile-per-hour fastball and the batter's initiation of his swing, a lot has to happen. The batter must see the pitch (one hundred milliseconds), process its trajectory and velocity (seventy-five milliseconds), decide whether and how to swing (fifty milliseconds), and initiate that swing (fifteen milliseconds). The hoped-for result of this sequence of fleeting neurological and physical impulses is the striking of a 7.3-centimeter-wide spinning ball 2.65 centimeters below dead center at an upward angle of 9.1329472543885321 degrees—these being the optimal parameters for hitting a home run, according to a 2003 paper published in the *American Journal of Physics*.

And here's a further complication: The ball loses 5 percent of its velocity as it approaches the plate. And one more: "The rate of slowing down is not uniform," says Mont Hubbard, director of the Sports Biomechanics Laboratory at UC-Davis. Due to a physical phenomenon called the drag crisis, the ball, released from the pitcher's hand, initially escapes drag for about a tenth of a second. "So it looks like it's coming at you really fast," Hubbard explains to me, "and then like it runs into some honey. That's going to throw the batter off."

So why are some batters so much less thrown off than others? The first and easiest part of the explanation has to do with hitting mechanics. "Take Ichiro Suzuki and Mickey Mantle," Don Slaught, the Detroit Tigers' hitting coach, says to me over the phone. To illustrate the point he's about to make, Slaught connects his computer in Detroit to mine in New York and clicks his mouse. Suddenly, the two men appear side by side on my screen: the slugger Mantle in his wide, flat-footed stance, powerful and balanced, and the burner Ichiro, knock-kneed, bat at his ear, his weight resting on his back leg so that only his front toe touches the ground. For years Slaught has been stockpiling footage, all captured from the same angle, of virtually every great hitter in the game. I sit staring at my computer as, in increments of seventeen milliseconds, Ichiro and Mantle initiate their swings. It's astonishing and a little eerie: Over a series of steps that lasts only a quarter of a second and is normally invisible to the naked eye, the swing mechanics of the two men—the positioning of their feet, legs, hips, trunks, shoulders, arms,

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heads—are revealed to be identical. “What do all the best hitters do that makes them better than the rest of us?” Slaughter asks, and then answers his own question. “Everyone prepares differently,” he says, “but they all swing virtually the same way.”

I bring up the subject of Albert Pujols, who at this point in the summer, just before an injury sidelined him, was threatening Barry Bonds's single-season home-run record. Surely Pujols must personify the qualities that make a hitter great. And what are those, anyway? Does Pujols in fact have the fastest bat in the game, as *The Sporting News* has suggested? “No,” says Slaughter. “Just about everyone's about the same.”

In a separate *GQ* study in a St. Louis laboratory, a small group of star-struck researchers will calculate Pujols's bat speed to be 86.99 miles per hour (see box). Performance coach Craig Pippin, who has done bat-speed studies at Motion DNA, a Scottsdale, Arizona, biomechanics firm, says that these results place Pujols at the low end of the pro-player spectrum. Which I can't believe. If the greatest power hitter in the game has average bat speed, then whose bat is fast? Kevin Reese's, that's whose. Reese is a seven-year minor league veteran currently in the Yankees system whose cut was clocked by Pippin at ninety-eight miles per hour. But his lameness as a hitter suggests

that bat speed alone, despite what many analysts tend to say, tells us pretty much nothing about performance.

In Detroit, Slaughter clicks his mouse again and suddenly, in four quadrants of my computer screen, I'm watching video of, respectively, Pujols, Alex Rodriguez, Vladimir Guerrero, and Ivan Rodriguez. As the players move their bats forward, four pitches enter the various frames. Slaughter freezes the image of Pujols and draws a green line from the ball to the heart of the catcher's mitt. He then traces the inverted arc of Pujols's bat in red. On the other end of the phone, Slaughter laughs in disbelief. “He's on plane for about *five feet!*”

What he means is this: The portion of the green line (the ball's path) marked by the two ends of the curving red line (the sweep of the bat) is Pujols's “big zone,” the span of time and space during which the sweet spot of his bat remains on the same plane as the ball. In fact, Slaughter observes, the sweet spot of Pujols's bat stays inside the “big zone” for so long that even if he mistimes the pitch, he will still, in most cases, make contact with it.

Watching the video in tiny slow-motion increments, I can see that Pujols's mechanics, even among this group of superstars, are uniquely spectacular: His head is nearly motionless, which is a function, I'm told, of his efficient no-stride swing. (Among active

players, probably only Barry Bonds's head moves less.) As the pitcher goes into his windup, the majority of hitters raise their front leg, using it as a sort of fulcrum and planting it just before contact in order to transfer energy to the ball. But Pujols, without raising his front leg, achieves the same end.

How he does it hinges on the latest developments in the young field of baseball biomechanics. Baseball, says Marcus Elliott, is unusual among the major sports for its emphasis on what he calls angular momentum: “You have to figure out how to apply force against the ground in a way that's going to allow your body to develop rotational power,” he says. When I mention Pujols, Elliott says that of late he's been using him as Exhibit A when explaining these concepts to ballplayers. “Pujols does this probably better than anybody in baseball, and he does it early: He sets up these really big ground-reaction angles. Look how far both knees are inside of his feet when he sets up at the plate. He's practically pigeon-toed.”

By angling your back knee inside your foot, you redirect horizontally the vertical energy produced when you push off the ground. But Elliott tells me that most hitters don't start their swing from this position, which is why they stride: to bring the back knee forward. “But Pujols just starts there,” Elliott says. “He doesn't need to go



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anywhere." Elliott has installed several hundred thousand dollars' worth of force plates at his facility to assess the "vector coordinates" of an athlete's application of energy to the ground. The plates calculate the power, speed, and direction of a hitter's angular momentum. Elliott hopes eventually to derive a sort of ideal force profile for hitters of every height, weight, and physique. What he's told me is that Pujols, swinging his bat at the unimpressive speed of 86.99 miles per hour, actually generates considerably more force than the paltry Kevin Reese does at ninety-eight miles per hour.



BUT BASEBALL IS FILLED with sweet-swinging players whose names we'll never remember. And the likely reason is that those guys simply can't see the ball in the way that the great hitters do. Which is why I've come to a Residence Inn in Arlington, Virginia. Astout middle-aged man in a black polo shirt is standing in front of me, holding a small rectangle of cardboard a few feet from my eyes. It's imprinted with two identical scenes, bisected by a narrow white line, of a rock-strewn beach. William Harrison, an ex-college ballplayer turned optometrist turned performance coach, instructs me to stare at a point between, above, and beyond

the two pictures until a duplicate third picture starts to materialize. And after a few moments, the ghost image appears briefly for me, followed by a headache.

For thirty-five years, Harrison has helped teams like the Washington Nationals, Cincinnati Reds, and Atlanta Braves evaluate the athletes they draft and trade for, but most major league clubs are still skeptical of his methods. In as little as fifteen minutes, Harrison tells me, using no more equipment

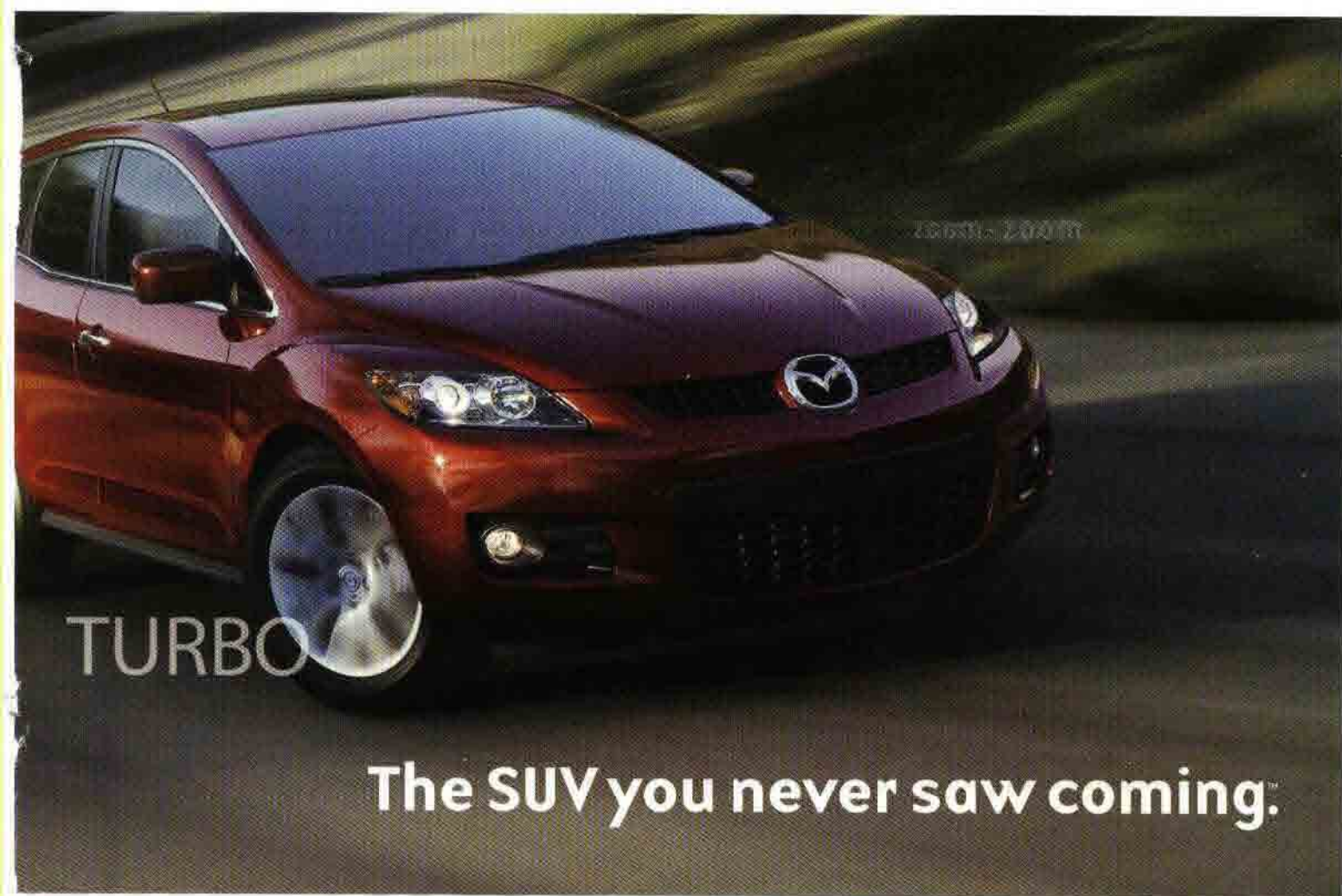
tells me, Bowden first consulted Harrison while serving as GM in Cincinnati. "When I drafted Adam Dunn," Bowden says, "Harrison told us he had Barry Bonds's eyes. With the other information I had, that gave me a pretty good idea that he had a chance to hit a bunch of home runs in the big leagues—maybe even forty or fifty a year." It's panned out okay for the Reds; Dunn, 26, has hit forty or more homers in each of the past two seasons and is on pace to top fifty this year.

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than fits in a duffel bag, he can render an opinion as to which players will succeed in the majors and which will bomb.

On the day I visit him, the baseball draft is just forty-eight hours away, and Harrison is here in D.C. to assess several prospects the Nationals are interested in. "We've learned that there's a very close relationship between depth perception and a player's performance," Jim Bowden, the Nationals' GM,

Over the next week, Harrison, Bowden, and others will convince me that highly developed binocularity—the coordinated functioning of the eyes, particularly while they track a moving object—ought to be considered baseball's "sixth tool." (Scouts have traditionally emphasized five tools: the abilities to hit for average, to hit for power, to run, to throw the ball, and to field it.) That's how predictive binocularity is of a



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hitter's success, and that's what the beach-scene eye-card test measures.

Can you bear with me for a brief Bill Nye moment? Here goes: Your ability to perceive depth is made possible by the spacing of your eyes, which take in from two slightly different perspectives two separate images of whatever you're looking at. When those images meet in the brain, they form a single three-dimensional picture in which you can read both the placement and movement of objects in space. But your eyes have only that one point of stereoscopic focus. Outside of it, they see everything in twos, though your brain has learned to suppress this. In effect, the eye card assesses how broad your point of stereoscopic focus is, and among the tiny, self-selected population of world-class ballplayers, it can be amazingly broad indeed. Some guys literally cut the eye card in half, Harrison tells me, and free-fuse it at twelve to eighteen inches. Bonds, whose vision is the best among the "thousands and thousands" of players Harrison has tested, can do so at a distance of four feet. Which is outrageous, and which has nothing to do, by the way, with BALCO. But still, why is binocularity important in baseball?

"With less-than-perfect binocularity, the brain will suppress the simple vision of one eye," Harrison says. "One eye alone is sufficient to see the seams on the ball or its trajectory. But a one-eyed hitter has no depth perception." Don Slaught describes a test he conducted with a group of hitters: While a pitching machine delivered the baseball at a consistent speed, the players, each wearing a patch over one eye, hit as well as usual. Once the machine began varying speeds, however, they started whiffing.

"The change of velocity really kills 'em," Harrison says. "They can't read it. It's a bigger factor than velocity itself." If you misjudge the speed of a ninety-mile-per-hour pitch by five miles per hour, he says, your bat position will be off by two feet. Misjudge the speed by 2.5 miles per hour and you'll miss the ball by one foot. Misjudge it by one mile per hour and you're four inches shy of the target. Says Bowden, "The year we drafted Dunn, there was another player of equal ability in the draft. Bill Harrison said, 'This guy's got no depth perception. He's not gonna be able to recognize differences in velocity.' The Reds passed, Bowden says, "and it played out exactly as Bill told us it would."

A batter must decide whether or not to swing when the ball has traveled 48 percent of the distance to the plate—that is, when it's twenty-six feet away. To locate it as near to the point of release as possible, he must, until the last possible moment, maintain his eyes in a state of what Harrison calls "soft focus." If a hitter doesn't pick up a pitch right away, he has to make a series of jerky and abrupt eye movements—called saccades—to catch up to it. And here is where the chance arises



★ALBERT VS. THE BABE (VS. PENN)

This spring, *GQ* persuaded Albert Pujols, reigning National League MVP and the game's most dominant slugger, to take time off from an epic home-run tear and reenact, at Washington University in St. Louis, the 1921 Babe Ruth tests. Even if Pujols held himself back a bit ("Psych tests are nice, but Albert just cares about baseball," says his agent, Dan Lozano of the Beverly Hills Sports Council), he made history that day.

TEST #1 BAT SPEED AND POWER

This one is straightforward enough: How fast can the greatest hitter in the game swing his bat? In 1921, the Babe swung his Flintstone-esque fifty-four-ouncer at seventy-five miles per hour, creating enough energy to fleetingly power a 2003 Prius. At Wash. U., using a 31.5-ounce bat, Pujols reached 86.99 miles per hour, generating the equivalent of nineteen horsepower—sufficient to run, vary briefly, a John Deere lawn tractor. I swung a comparable bat at 50.78 miles per hour, not even enough horsepower to rev up Tara Reid.

TEST #2 LETTER CROSS-OUT

The test rates aspects of the brain's ability to process visual information, and *Popular Science* reported that the Babe scored "one and a half times the average." But we have no idea what that means, because the test, says Wash. U. psychology professor Desiree White, wasn't "well-normed." Pujols was given a sheet of jumbled text and told to cross out all the A's as rapidly as possible, which he did in sixty-one seconds (seven seconds faster than my time). White says that in eighteen years of administering this test, she's never seen anyone else adopt Pujols's "visual-search strategy." "Most people will scan for everything in an area before they move on," she says, but Pujols's eyes swept the page like searchlights, tracing a repeating S-shaped path. It's a result suggestive of extraordinary binocularity (see story).

TEST #3 PEGBOARD

The test assesses fine motor control and speed and involves inserting as quickly as possible twenty-five steel pegs into holes punched in a plain metal box. In 1921, on a comparable piece of equipment, Babe Ruth scored 132 hits with

his dominant left hand in sixty seconds. *Popular Science* indicates that the average score on this test was 82. Pujols took fifty-six seconds to complete the pegboard test with his dominant right hand, which places him in the seventy-ninth percentile ("high average"). His speed startled White. "There's no question that his are the largest hands ever to have worked with my pegboard."

TEST #4 DIGIT/SYMBOL SUBSTITUTION

On a 1921 version of this test, which requires you to convert weird symbols into numbers—as many as possible in one minute—Babe Ruth achieved a score that *Popular Science* cited as "the average of all who have tried it." Pujols's score, 67, was also average. Mine, 101, put me in the 95th percentile. Take that, Pro-hole! But not so fast. On a separate part of the test, in which you simply copy the symbols, I did 112. Pujols, though, completed a mind-bending 133. White says that Pujols's score—yet another testament to his spectacular motor skills—falls beyond the range for which the testmaker presents any diagnostic interpretation. It's literally off the charts.

TEST #5 FINGER TAPPING

With your index finger, you depress a tapper as many times as possible in ten seconds. In 1921, on a different apparatus that measured gross motor speed differently, Babe Ruth scored "better than 499 persons out of 500." Of all the tests we'd be taking, this one undoubtedly represented my best chance to hold my own against Pujols and the Babe (I type 120 words per minute), but Pujols got into my kitchen instantly. "With his dominant right hand, he was 2.4 standard deviations faster than most people," says White. Pujols's score ranked in the ninety-ninth percentile, meaning that if one hundred people were to take this test, only one "would even have a shot" at matching his score. "He actually tapped faster in later trials," she says. "Most people don't." We also witnessed the formidable power of the Pujols digit: At one point he struck the tapper so hard that he knocked a screw loose. His score compared favorably to Ruth's—and he destroyed me with both his right and left hands. My conclusion: Albert Pujols has more athletic talent in his right index finger than I have in my entire body. —N.P.

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for what Harrison calls micromistakes. "The pitcher hides the ball and throws a hundred miles per hour, and you don't even know where the damn thing's coming from," he says. "I'll tell you one thing, you're gonna have a fast saccadic trying to find it." (At Peak Performance Project, Marcus Elliott has used a laser-based apparatus worn on the head to both assess and train the efficiency of players' eye movements. "We can measure small perturbations in linear tracking of the eyeball," he says. "If the eye is bouncing around, your brain has to make these additional calculations.")

William Harrison confides he knows of a highly touted catcher who's likely to be chosen early in the draft. "He sees only with one eye," Harrison says. "He'll never make it as a hitter."

Given his considerable success over three decades, why isn't Harrison getting calls for his services from every front office in the league? "I think he's had a tremendous impact on individual players," says John Farrell, farm director of the Cleveland Indians, "but the empirical evidence is limited. There isn't a large database that says this person went through these drills and this is where he ended up." Bowden disagrees. "We've seen guys like Jose Guillen, who had below-average depth perception when he first started working with Dr. Harrison, become stars," he says. Harrison says his techniques can boost a hitter's average by as many as fifty points.

If teams don't hire Harrison—and twenty-seven of them don't—then who are they hiring? The answer in some cases is nobody. How else can we understand the fact that Atlanta Braves left fielder Matt Diaz, struggling for seven years in the minors, had never been told prior to spring training 2006 that he needed vision correction? ("On defense, I would misread balls all the time," Diaz says. "Dr. Harrison said, 'That's because you have no depth perception past about eighty feet!'") Diaz's case isn't all that exceptional. Harrison tells me he knows of a highly touted catcher who's likely to be chosen early in the draft. The diagnosis is simple: "He sees only with one eye," Harrison says. "He'll never make it as a hitter." Two days after our conversation, the kid is selected by an NL club, and less than a week later, he signs.



EVERY SPRING, 500 or so amateur players receive an e-mail from the Winslow Research Institute of Discovery Bay, California. "They're told that the Major League Scouting Bureau has requested we contact them," says William Winslow, the company's

president, "because several baseball teams have expressed interest in them, and the teams will not consider drafting a player unless they have a report on his personality and attitude." For thirty-eight years, WRI has produced and analyzed that report—called the Athletic Success Profile—and some 70,000 amateur players have completed it. Their responses form the database against which WRI ranks prospective draftees in eleven Athletic Success Traits, from drive to leadership to emotional control to coachability. WRI's calculation of their scores is a Gobi-dry actuarial process

featuring stuff like norm tables, frequency distributions, and bell curves, and its end result is a six-page report that predicts whether or not a kid will fulfill his athletic talent. "What we frequently see," Winslow says, sounding not unlike a parochial-school nun, "is an athlete with fantastic God-given gifts who never reaches his potential because he does not have the proper mental attitude and personality."

A player taking the WRI assessment must select the most appropriate multiple-choice response (e.g., "true," "somewhat true," "false") to 190 athlete-themed statements, such as "To really be successful in my sport, I believe you must obey all the rules," "When my opponents beat me, I willingly congratulate them after the contest," and "After my coach strongly criticizes me, it bothers me for days." Winslow says the profile takes forty-five minutes to complete and includes a variety of control questions designed to ensure that a player responds honestly and also that he's paying attention.

He won't tell me how many major league teams subscribe to the profiles, but he does acknowledge that San Diego, Minnesota, Texas, and Baltimore have been particularly active of late. In Baltimore, he says, Dave Ritterpusch, the Orioles' former director of baseball information systems, "knows more than anyone on earth about the mental attitudes of ballplayers."

Ritterpusch is the William S. Burroughs of baseball junkies. While working for the Orioles, he back-engineered three decades' worth of profiles to determine which "trait packages" distinguish successful players. Hundreds of the questionnaires reside in cardboard boxes in his house in the Baltimore suburbs, and periodically, he tells me, he gets out of bed in the middle of the night and pores over his profiles. On

one such night, he discovered his "Type B Failure Cluster" for pitchers. "It's very, very subtle," he remarks, which is his way of saying he's not going to elaborate. (Again and again during hours of conversation, Ritterpusch breaks off in mid-sentence: "I don't want to say too much," he declares repeatedly. "I'm in a guarded situation with the proprietary nature of this.") Still, he talks and talks and talks, partly because he loves this stuff and partly, I think, because for so long so few colleagues willingly listened to him. "It's been a fairly unique experience for me to speak at length with anyone involved in the game and not have snickers and people looking away," he says.

A former military analyst at the Pentagon (he was also an assistant secretary of labor), Ritterpusch has worked in bureaucracies all his life, and he uses psychometrics much in the way the federal government and Fortune 500 companies do: to evaluate the emotional suitability of prospective employees for certain specialized functions. In this case, those functions are: infield, outfield, starter, setup man, and closer. For each one, Ritterpusch uses the profiles to arrive at a variably weighted "key trait coefficient," which in turn is translated into a percentile score, then scaled from 1 to 5 according to how well a player meets the psychological criteria for his respective function. "Five-pluses" are guys in the ninetieth to ninety-ninth percentile. "If you have outstanding physical ability and you get a five, you're gonna be a star," Ritterpusch says. "Period." He assembles a five-plus infield for me (Helton, Biggio, Jeter, Rolen, Varitek), along with a five-plus rotation (Clemens, Halladay, Beckett, Mussina, and Oswalt, with closers Ray and Papelbon). Foreign stars like Pedro and Mariano aren't included here, since significantly fewer Latin players take the test, and the WRI hasn't yet produced a Japanese or Korean edition.

Within each function, Ritterpusch says, there's no differentiation psychologically. Right field and left field are the same, as are first base and shortstop. The outfield is where you stash your Mannys and Sheffields—guys who score low on traits like "emotional control" or "mental toughness." The infield, on the other hand, is the purview of the hard-nosed. And setup men are in effect the outfielders of pitchers, unsuited emotionally for starting or closing.

Over the years, Ritterpusch has identified "trait clusters" that predict failure either by their presence or absence. "These seem to be largely unrecognized in the industry," he says, "and this is one of the things that keeps leading to the repetition, year in and year out, of preventable mistakes." By way of example, he cites four Oriole first-round picks (he won't name them) between 1997 and 2002.

"They were \$8 million worth of predictable failures," he says, adding that two of the four have already been released. Ritterpusch is speaking rapidly and loudly now. "The average first-rounder gets a \$2 million bonus!" he says. "Half of those guys flop. It blows my mind, but they keep chasing their tail!"

He alludes to Branch Rickey and the days when talent was cheap; as Brooklyn's GM, Rickey accumulated no fewer than twenty-seven minor league clubs. "That was before agents, before high-cost signings, before these huge research-and-development costs," he says. "But operational people today are familiar and comfortable with this high-overhead, low-return way of doing things. It's all they know. They don't expect baseball operations to be more productive. It's just the way things are. It's always gonna be this way." The whole process operates on principles antithetical to science, he says; scouting is "emotional" and "irrational." In Baltimore, he experienced considerable resistance from scouts whose physically gifted prospects he'd rejected because

least when it comes to baseball. According to his regression analysis of 10,000 profiles, neither "coachability" nor "drive" are crucial to a prospect's chances of success or failure. In other words, respect and ambition are superfluous in the brain of a ballplayer. Baseball simply "doesn't reward the character traits that our society and church teach us to prize," Ritterpusch says. "Baseball isn't a microcosm of life. That's bullshit."



ON A GORGEOUS afternoon in early summer, I visit the general manager's box at RFK Stadium during the first inning of a game between the Nationals and the Dodgers. As Jae Seo goes into his windup on the field below us, a publicist whispers to Jim Bowden, who's seated at the far end of the room in front of an enormous window. Bowden looks up at me with vague irritation, as if he's been awakened from a dream: The most rabid fan's absorption in his local team is nothing compared to its general manager's. Without taking his eyes off the field, Bowden walks me to an

The whole scouting process is "emotional" and "irrational," Dave Ritterpusch says. "The average first-rounder gets a \$2 million bonus. Half of those guys flop. It blows my mind!"

of weak trait scores. "Scouts and the organizations fall in love with these kids," he says. "They draft them high. They pay them huge sums of money. They incur this overhead cost, and then later, when it's too late, they discover they have little or no value." A scout usually covers a circumscribed area of the country, Ritterpusch explains, and has only one or two promising amateur players to recommend in a given year; if you eliminate those kids from consideration, the scout will feel "he didn't get a player in the draft. But it would be better if you just gave him \$50,000 and told him to keep plugging rather than waste your millions on his ballplayer." Ideally, he says, if you crunch your numbers early enough in the process, you can "limit your coverage and have your scouts focus in depth on the right people." Then he mentions Delmon Young, the number one pick in the 2003 draft, who was suspended for fifty games this spring for throwing a bat at an umpire. Young never took the profile. "Even if a guy has great physical ability, if you don't have a profile on him, don't draft him!" Ritterpusch says.

In an e-mail he sends me after our last conversation, Ritterpusch tells me that certain traits we tend to think of as vital in professional athletes don't matter in the

aluminum bar table in the middle of the room. Throughout our conversation, he leans from one side to the other, constantly angling for a view of the action below us.

Bowden is one of baseball's most progressive-minded GMs, and within moments he's alluding to the Nationals' work with sabermetrics, with vision testing, with psychometrics and IQ tests and neuroscience. "The more information you have," he says, "the better chance you have of making the right call on a player."

Another paradigm shift, one even more transformative than sabermetrics, is in store for baseball. People may debate whether on-base percentage tells you more about a player's abilities than batting average does, but scientific data is fixed and inarguable—and guys like Bowden know that they stand to benefit hugely from it.

Marcus Elliott tells me, "I look at baseball and I see how many things they do that don't make players better—how much low-lying fruit there is." He says that "the conditioning in baseball is so backwards, and in ways that are so ridiculously silly, that we're gonna look back in five years and it's gonna be like we were talking about turn-of-the-century methods." What coaches don't understand, he goes on, is that the game is power- and not strength-based. Its



▲ MICKEY MANTLE



▲ ALBERT PUJOLS



▲ ICHIRO SUZUKI



▲ ALEX RODRIGUEZ

★ From Don Slaught's copious files, footage showing that every great batter, regardless of his initial stance, looks virtually the same.

critical movements occur over fractions of a second, "and then you get to rest for quite a while." In a soon-to-be-published paper, Elliott and his coauthor demonstrate that "slow, continuous exercise specifically compromises" power development. Endurance training, he says, "interferes with strength and power gains unequivocally." But baseball continues to advocate mile runs and seventy-pound biceps curls, and every spring we see pictures of groups of ballplayers lumbering through their train-

Steroids represent the deepest incursion science has yet made into baseball, and the ambivalence with which so many baseball people view them—are performance-enhancing drugs a form of cheating or not? do we or don't we want to know who's using them?—seems to reflect the game's ambivalence about science itself: Steroids are science embraced, but only in the most furtive and unsophisticated way. Elliott believes the prevalence of drug use in baseball is both an indictment of obsolete training

weight gain. Just then, just as his vision of baseball's brave new world is coming into full bloom before my eyes, hundreds of people in red Nationals T-shirts jump to their feet in the stands. Bowden stops himself in midsentence and strains on tiptoe to see the figures on the field.

Why is it that the game has rejected the challenge of the Babe Ruth tests for eighty-five years? It's not because science won't help clubs find and develop players; it's not because science won't save teams huge sums of money; and it's not because science won't enhance slugging and pitching power legally. Baseball men love gambling, it seems—hunches, gut feelings, instincts, superstitions. They love the romance of luck in a game premised on randomness and failure. But Bowden's anxious attention to the men on the field at RFK—men whose psychologies and physiologies he knows intimately—proves that no matter how much we discover about its players, the game retains its unpredictability and mystery. The more we discover about baseball, the more we recognize the truth of one of its oldest and dumbest sayings. You hear it every April when some TV analyst is telling you that the Detroit Tigers, currently the best team in baseball, are two years away from contending or that the Cincinnati Reds, who lead the National League wild-card race, are hopeless. The saying is: They still have to play the games. As the Nationals publicist escorts me out of the general manager's box, I turn to see Bowden, no longer craning his neck, seated finally, watching the future unfold.

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"We're going to look back on baseball in five years," says Dr. Marcus Elliott, "and it's going to be like we were talking about turn-of-the-century methods."

ing sessions. "Show me your fastest mile runners in baseball," says Elliott, "and I'll show you athletes who have the worst metabolic and muscle physiology for the game." Then, in case I really don't get the picture of how screwy most baseball players' training is, he tells me to think of the research this way: "During the off-season, one guy goes home and eats Pringles and plays Xbox and goes out twice a week and takes a few hacks. Another kid, who's really motivated, goes out and runs five miles a day. Come spring training, the first guy is gonna be more powerful. There's no doubt of it." Bad training, Elliott says, accounts for the endless recurrence of one particular baseball phenomenon wherein a kid who throws ninety-two in high school tops out, after a year in a minor league conditioning program, at eighty-seven.

regimens and a catalyst for changing them. "Most of the best power hitters in baseball in the last eight or ten years have been on juice," he says matter-of-factly. "And this makes the case for better training in power development." In the coming years, sluggers will need to keep hitting as though they're juicing, even if they're not. "There's no doubt that smart training beats mediocre training and steroids," Elliott says. "Baseball players always ask about drugs, and I make this case to them." What if they ask about smart training and drugs? "Then you have to just shrug your shoulders and walk away."

In his box at RFK Stadium, Bowden is talking about the future, too, about the day when blood and saliva tests will tell GMs everything about a player—how well he sees, how well he handles pressure, how extroverted he is, even how prone he is to