Catcher of the Fly

BY JEFFREY KLUGER

BASEBALL, IF YOU'LL RECALL, WAS A GAME INVENTED to give schoolchildren something to do in the long summer months, soldiers something to do in the long days between maneuvers, and George Will something to write about besides economic reform in Tajikistan. Recently, however, the relationship between the sport and its spectators has grown more and more dysfunctional. And this past season, though teams have come up with increasingly imaginative ways to keep the fans in the stands ("The '95 Mets: No Pending Indictments!"), millions simply decided to give the whole nasty business a pass. ■ Grim tidings at the turnstiles, of course, do not necessarily translate into equally gloomy news on the field, and at stadiums around the country, excellent—if unwitnessed—baseball continues to be played. Batters are still hitting balls into adjacent time zones, pitchers are still throwing fastballs at speeds great enough to make their mass increase, and outfielders are still snatching fly balls from the air with the nonchalance of a chef plucking a can from a kitchen shelf.

Of all the skills a ballplayer needs to make it in the major leagues, this ability to intercept a fly ball might be the most remarkable. How do outfielders regularly manage such a feat of speed, grace, and coordination? What is the subtle interplay of timing, eye tracking, and navigational calculus that allows them to do the job with such balletic ease? Why do they always pat each other in unpattable places after they do?

Tracking a flying object? No need for radar when you've got a Robinson or a Ruth.

The answers to at least the first two questions were provided this year by psychologists Michael McBeath and Dennis Schaffer of Kent State University in Ohio, and Mary Kaiser of NASA's Ames Research Center in Moffett Field, California. Working with nothing more complicated than a couple of volunteer ballplayers and a few video cameras, the researchers believe they have finally discovered just how it is outfielders do what they do, at last explaining a skill that made Reggie Jackson more famous than Andrew Jackson, gave the magnificent Mays so many magnificent Mays, and made America—if only for a while—a safe place to be named Mookie.

The first step in learning about McBeath, Schaffer, and Kaiser's work, of course, was not to talk to McBeath, Schaffer, and Kaiser themselves but to spend some time in a major-league stadium talking to the athletes for whom catching fly balls is both calling and career. For me, the nearest big-league venue was the New York Mets' Shea Stadium. All major-league teams have suffered a serious decline in attendance this year, but the Mets, it appears, have suffered more than most. Earlier in the season it was reported that Fan Appreciation Day had to be canceled when the Mets' fan—an 18- to 24-year-old Caucasian male believed to answer to the name Bob—could not be located in time for the ceremony.

The day I visited, despite the forlorn state of the stands, the Mets themselves seemed enthusiastic, going through their pregame workout with playoff-caliber intensity. One of the hardest at work was Brett Butler, a senior member of the major league's outfielding corps, and after he finished his fielding drills I took a moment to ask him about his singular craft.

"A lot of variables go into fielding a fly ball," he said. "The time of day is one of the most important. If the game is at night, it's relatively easy to see the white

ILLUSTRATIONS BY MICHAEL WITTE

ball against the black sky. If it's during the day, it's surprisingly easy to see it pop out against the blue. The only truly hard time to see the ball is twilight, perhaps because your eyes have a difficult time adjusting to such in-between lighting. Another factor in tracking a fly can be wind. Willie Mays, who used to play at Candlestick Park in San Francisco, taught me to study the outfield fences before I took the field. If there was a lot of trash blown up against the fence, it meant the wind was blowing out. If there wasn't much, it meant it was blowing in."

Just as important as the wind and lighting, at least the way I'd always heard it told, is the ability of the fielder to gauge the likely trajectory of the ball the instant it leaves the bat. Some players appear to break in the direction of the ball's flight from the very moment it's hit, while only a few seem to wait until almost the last possible second before they begin to move. During my brief flirtation with organized high school sports, I adopted this more leisurely approach, often not sprinting off in the direction of a fly ball until I had taken the time to tap my glove, adjust my hat, and bake a Bundt cake to welcome its arrival. Former Met and Dodger and now Yankee Darryl Strawberry took this languid fielding style further still, and even today can sometimes be seen loping off in the general direction of a fly ball hit during the 1986 World Series. Surprisingly, according to Butler, such nonchalance may not be such a bad thing.

"It's important to get a good jump on the ball," he says. "But you do have at least a little time before committing yourself. Sometimes it helps to count a full 'one one-thousand' after a ball is hit in order to get a clear idea of which way it's going to go. A second is a long time in a baseball game, but it takes a lot longer than that for the ball to get to you."

But if patience, a sharp eye, and little wind help explain how an outfielder manages to hie himself over to a fly ball's general vicinity, they still don't explain how he positions himself so precisely that he can snare the tiny three-inch-diameter sphere of horsehide in his ten-inch pocket of cowhide with a reliability bordering on 100 percent. When it came to explaining that degree of fielding precision, Butler—as well as some of his teammates—seemed to be as mystified as I.

"You just get a sense of where it's going to fall," he said.

"You trust your instincts," Chris Jones, a rookie outfielder, offered.

"Beats me," said veteran Oriole and then-Met David Segui.

If this was the best the players could do, I knew science would have to carry the ball the rest of the way.

The puzzle of just how a fly ball is tracked and caught had been explored before—as long ago as the 1960s—by a professor of aeronautics at the Cornell Aeronautical Laboratory in Buffalo, New York, who had come up with a theory known as the Optical Acceleration Cancellation model, or OAC. According to OAC adherents, an outfielder preparing to catch a fly runs along a path that cancels the apparent acceleration of the ball as gravity pulls it toward Earth. If the ball seems to be accelerating as it approaches, that means it's following a path that will take it over his head. If it appears to be slowing, that means it will drop to the ground somewhere in front of him. Instantly—and unconsciously—the fielder gauges this apparent change in velocity and begins pedaling forward or backward in an attempt to neutralize it, so that he will be standing in exactly the right position to pluck the ball out of the air when it at last completes its plummet.

Would an MVP agree with the theories of a Ph.D.? Would a man concerned with RBIs give a second thought to OACs?

The OAC theory had one little problem: for trying to gauge how quickly something (other than your own body) is moving, your brain is a lousy accelerometer. Though nature has endowed some animals with an acute ability to track fast-moving prey, that gift is generally limited to creatures like hawks, falcons, pumas, and other high-speed hunters. Human beings, who these days do most of their hunting in the Lean Cuisine frozen entrée section, have no need for such perceptual precision.

"We've conducted tracking tests in laboratories in which subjects follow moving images across computer screens," says psychologist McBeath, "and we've found that until the velocity of the target changes by as much as 60 to 70 percent, people don't notice that it's speeding up or slowing down at all."

TO DETERMINE WHETHER THERE WAS anything besides acceleration that might be cuing outfielders to the path of the ball, McBeath and his colleagues decided to run a two-part experiment. In the first part, they mounted a video camera on a 60-foot tower in the outfield of a Kent State stadium and recruited two students to spend the day shagging flies. When the researchers played the tapes, they quickly saw that fielders were following a curious route to reach the ball, inscribing a sort of crescent-moon arc from the point at which they began their run to the point at which they caught the fly. If they were trying to intercept the path of the ball the way the OAC model predicted, they were evidently changing planes in Atlanta along the way.

"The OAC model was a good one," McBeath says, "but it was always more of a thought experiment than anything else. The moment we put it to the test, we saw that it was flawed."

The revelation that fielders were running a curving path to pursue an essentially straight fly, however, did not explain *why* they were doing it. To learn that, McBeath and his fellow researchers had to determine exactly how the players were seeing the approaching horsehide as they were running toward it and how they were using this visual information to determine their route. The obvious way to do this, of course, was to ask them, but the obvious way is not always the best way. Baseball players—even amateur baseball players—are not always the most expressive souls, and if you've watched the locker-room broadcasts following even a single game, you know that practically any question asked of practically any player can usually be answered with one of only three all-purpose responses: a) I'm just happy to be able to help the team, b) We came here to play baseball today and I think that's what we did, and c) I categorically deny all the charges.

To come up with more-illuminating answers, McBeath and his colleagues decided as the second part of their experiment to equip their subject outfielders with portable video cameras so that the researchers could see for themselves precisely what the players were seeing. The camera would be carried as unobtrusively as possible, mounted on a shoulder bracket so that it could move as the player's upper body moved, pointing in whatever direction he faced at a particular moment.

Positioning the fielders about 150 feet from the center of the infield, McBeath and his colleagues launched dozens of fly balls, each of which was tracked by a fielder's camera as he chased it down. When the tapes were examined, they once again yielded the unexpected.

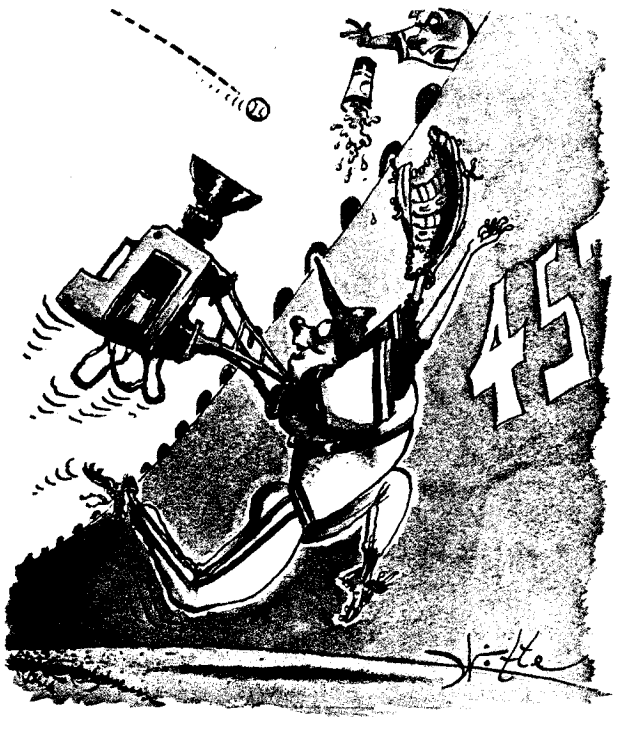
"For virtually all the trials," McBeath says, "the trajectory of the ball as seen by the fielders was the same. Starting on the ground in roughly the center of the image, it appeared to rise more or less straight up, tilting to the right or left by no more than five degrees. Unlike a fly you see from the stands, however—which inscribes an arc on the way up and on the way down—the balls in our camera frame never came down, continuing to travel up into the air until they were caught at the very top of their flight."

A fly ball that flies forever without descending is, of course, an impossibility—at least without the aid of an *extremely* corked bat—and McBeath's fly balls were obviously doing no such thing. Instead, he explains, the unusual trajectory was the result of a common optical effect in which moving objects appear to rise as they approach the observer and fall as they retreat. The same phenomenon, McBeath explains, can be re-created with a simple saluting gesture.

"If you touch your fingertips to your forehead above one eye and then extend your arm straight out," he says, "your hand will appear to descend toward the center of your field of vision. If you bring it back to the saluting position, it will appear to rise. A fly ball growing larger and closer in a fielder's field of vision appears to rise constantly, too, even though it spends the entire second half of its flight moving in the opposite direction."

As long as a ball keeps rising in his field of vision, then, a fielder knows it's getting closer. The curved path the player follows as he races toward the fly appears to add to his accuracy in maintaining visual control. Viewed from the side, a ball that is going to fall short of the player doesn't appear merely to move slower—as it does all-but-undetectably in the OAC model—but actually curves unmistakably downward. If it's going to fall behind him, it curves up. According to McBeath and his colleagues, as long as the player keeps the trajectory of the ball's image moving in a straight, climbing line—"nulling out" its curvature by means of his sidelong route—he is guaranteed to be in the proper position when it falls.

I COULDN'T HELP WONDERING whether the players themselves would see things the same way as McBeath. Would an MVP agree with the theories of a Ph.D.? Would a man concerned with RBIs give a second thought to OACs? Frank Robinson, for one, doesn't. Robinson, a former outfielder for the Cincinnati Reds and the Baltimore Orioles, was elected to the Hall of Fame in 1982.



During his playing days he was widely respected as one of those rare, versatile players who could drive in runs, hit for average, steal bases, field flawlessly, and on occasion perform arthroscopic surgery on the odd ailing teammate. With such a dazzling baseball pedigree, any doubt Robinson cast on McBeath's fly ball theories would weigh pretty heavily—and cast doubt he does.

"I always thought the way you catch a ball is just by watching it come down and being there when it lands," he says. "If you try to make the ball look like it's going straight up the whole time it's in the air, you're going to find yourself doing a lot of backpedaling, and backpedaling is a real no-no; you just can't get where you need to get fast enough. As far as approaching the ball from the side is concerned, that's only something you do if the ball is hit in the gap and you're off to the side of it to begin with. If it's hit in front of you, you've got to charge it in a straight line to reach it as fast as possible. If it's hit behind you, you've got to turn around and charge where it's going. The truly great fielders had the ability to turn their backs on the ball completely and run to where they knew it was going to land. Most others at least peek over their shoulder as they run so they can keep an eye on it. But going out of your way to approach from the side? No, you just wouldn't do it."

To be sure, Robinson's skepticism doesn't settle the question, and McBeath's tapes do suggest that *something* more complex is going on as fielders pursue fly balls—even if the fielders don't realize it. But McBeath has no intention of pursuing the question, and with good reason. In a sport as complicated as baseball, there is no shortage of other mysteries that cry out to be demystified. How do architects keep windswept Candlestick Park from blowing into San Francisco Bay—and why do they bother? Is there a physiological limit to the quantity of spit a nine-man team can generate in a nine-inning game—and could they be paid to reach it already? Would it be possible for Lenny Dykstra to chew a plug of tobacco *smaller* than a Plymouth? Until these lingering riddles are answered, McBeath knows, his work will remain incomplete. Scientists may have figured out nine-tenths of the game, but as no less an authority than Yogi could tell you, that doesn't mean they understand the *other* half. ◻