The Brain by Carl Zimmer

When Derek Jeter scoops up a ground ball and makes the double play, his body is hard at work, but his brain is actually taking it easy. That is the true payoff of years of practice.

The qualities that set a great athlete apart from the rest of us lie not just in the muscles and the lungs but also between the ears. That's because athletes need to make complicated decisions in a flash. One of the most spectacular examples of the athletic brain operating at top speed came in 2001, when the Yankees were in an American League playoff game with the Oakland Athletics. Shortstop Derek Jeter managed to grab an errant throw coming in from right field and then gently tossed the ball to catcher Jorge Posada, who tagged the base runner at home plate. Jeter's quick decision saved the game—and the series—for the Yankees. To make the play, Jeter had to master both conscious decisions, such as whether to intercept the throw, and unconscious ones. These are the kinds of unthinking thoughts he must make in every second of every game: how much weight to put on a foot, how fast to rotate his wrist as he releases a ball, and so on.

In recent years neuroscientists have begun to catalog some fascinating differences between average brains and the brains of great athletes. By understanding what goes on in athletic heads, researchers hope to understand more about the workings of all brains—those of sports legends and couch potatoes alike.

As Jeter's example shows, an athlete's actions are much more than a set of automatic responses; they are part of a dynamic strategy to deal with an ever-changing mix of intricate challenges. Even a sport as seemingly straightforward as pistol shooting is surprisingly complex. A marksman just points his weapon and fires, and yet each shot calls for many rapid decisions, such as how much to bend the elbow and how tightly to contract the shoulder muscles. Since the shooter doesn't have perfect control over his body, a slight wobble in one part of the arm may require many quick adjustments in other parts. Each time he raises his gun, he has to make a new calculation of what movements are required for an accurate shot, combining previous experience with whatever variations he is experiencing at the moment.

To explain how brains make these on-the-fly decisions, Reza Shadmehr of Johns Hopkins University and John Krakauer of Columbia University two years ago reviewed studies in which the brains of healthy people and of brain-damaged patients who have trouble controlling their movements were scanned. They found that several regions of the brain collaborate to make the computations needed for detailed motor actions. The brain begins by setting a goal—*pick up the fork,* say, or *deliver the tennis serve*—and calculates the best course of action to reach it. As the brain starts issuing commands, it also begins to make predictions about what sort of sensations should come back from the body if it achieves the goal. If those predictions don't match the actual sensations, the brain then revises its plan to reduce error. Shadmehr and Krakauer's work demonstrates that the brain does not merely issue rigid commands; it also continually updates its solution to the problem of how to move the body. Athletes may perform better than the rest of us because their brains can find better solutions than ours do.

To understand how athletes arrive at these better solutions, other neuroscientists have run experiments in which athletes and nonathletes perform the same task. This past January Claudio Del Percio of Sapienza University in Rome and his colleagues reported the results of a study in which they measured the brain waves of karate champions and ordinary people, at rest with their eyes closed, and compared them. The athletes, it turned out, emitted stronger alpha waves, which indicate a restful state. This finding suggests that an athlete's brain is like a race car idling in neutral, ready to spring into action.

Del Percio's team has also measured brain waves of athletes and nonathletes in action. In one experiment the researchers observed pistol shooters as they fired 120 times. In another experiment Del Percio had fencers balance on one foot. In both cases the scientists arrived at the same surprising results: The athletes' brains were

Derek Jeter's double play requires conscious and unconscious decisions.

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