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"Jonah Lehrer proves once again that he's a master storyteller and one of the best guides to the practical lessons from new neuroscience."

— CHRIS ANDERSON

# How We Decide



JONAH LEHRER

AUTHOR OF *Proust Was a Neuroscientist*

The first book to use the  
unexpected discoveries of neuroscience to  
help us make the best decisions

Since Plato, philosophers have described the decision-making process as either rational or emotional: we carefully deliberate, or we “blink” and go with our gut.

But as scientists break open the mind’s black box with the latest tools of neuroscience, they’re discovering that this is not how the mind works. Our best decisions are a finely tuned blend of both feeling and reason—and the precise mix depends on the situation. When buying a house, for example, it’s best to let our unconscious mull over the many variables. But when we’re picking a stock, intuition often leads us astray. The trick is to determine when to use the different parts of the brain, and to do this, we need to think harder (and smarter) about how we think.

Jonah Lehrer arms us with the tools we need, drawing on cutting-edge research as well as the real-world experiences of a wide range of “deciders”—from airplane pilots and hedge fund investors to serial killers and poker players.

Lehrer shows how people are taking advantage of the new science to make better television shows, win more football games, and improve military intelligence. His goal is to answer two questions that are of interest to just about anyone, from CEOs to firefighters: How does the human mind make decisions? And how can we make those decisions better?

"An inviting, high-velocity ride through our most treasured mental act—deciding. This is truly one of the most accessible and richly informed books on human choice. It's a must-read for anyone interested in the human mind and how cutting-edge research changes the way we think about ourselves. A marvelous success."

—READ MONTAGUE, Brown Foundation Professor of Neuroscience, Baylor College of Medicine



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**JONAH LEHRER** is editor at large for *Seed* magazine and the author of *Proust Was a Neuroscientist*. A graduate of Columbia University and a Rhodes scholar, Lehrer has worked in the lab of the Nobel Prize-winning neuroscientist Eric Kandel and has written for *The New Yorker*, the *Washington Post*, and the *Boston Globe*. He edits the Mind Matters blog for *Scientific American* and writes his own highly regarded blog, *The Frontal Cortex*.

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PRAISE FOR Jonah Lehrer and **How We Decide**

“Jonah Lehrer is a brilliant young writer. His clear and vivid writing—incisive and thoughtful, yet sensitive and modest—is a special pleasure.”

—OLIVER SACKS

“Cash or credit? Punt or go for first down? Deal or no deal? Life is filled with puzzling choices. Reporting from the frontiers of neuroscience and armed with riveting case studies of how pilots, quarterbacks, and others act under fire, Jonah Lehrer presents a dazzlingly authoritative and accessible account of how we make decisions, what’s happening in our heads as we do so, and how we might all become better ‘deciders.’ Luckily, this one’s a no-brainer: Read this book.”

—TOM VANDERBILT,

author of *Traffic: Why We Drive the Way We Do (and What It Says About Us)*

“Over the past two decades, research in neuroscience and behavioral economics has revolutionized our understanding of human decision-making. Jonah Lehrer brings it all together in this insightful and enjoyable book, giving readers the information they need to make the smartest decisions.”

—ANTONIO DAMASIO,

author of *Descartes’ Error* and *Looking for Spinoza*

“Jonah Lehrer ingeniously weaves neuroscience, sports, war, psychology, and politics into a fascinating tale of human decision-making. In the process, he makes us much wiser.”

—DAN ARIELY,

author of *Predictably Irrational*

“Should we go with instinct or analysis? The answer, Lehrer explains in this smart and delightfully readable book, is that it depends on the situation. Knowing which method works best in which case is not just useful but fascinating. Lehrer proves once again that he’s a master storyteller and one of the best guides to the practical lessons from new neuroscience.”

—CHRIS ANDERSON,

editor in chief of *Wired* and author of *The Long Tail*

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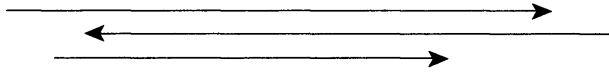
Books by Jonah Lehrer

*Proust Was a Neuroscientist*

*How We Decide*

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*How We*  
**DECIDE**



Jonah Lehrer



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To my siblings,  
*Eli, Rachel, and Leah*



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Who knows what I want to do? Who knows what anyone wants to do? How can you be sure about something like that? Isn't it all a question of brain chemistry, signals going back and forth, electrical energy in the cortex? How do you know whether something is really what you want to do or just some kind of nerve impulse in the brain? Some minor little activity takes place somewhere in this unimportant place in one of the brain hemispheres and suddenly I want to go to Montana or I don't want to go to Montana.

—DON DELILLO, *White Noise*



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## *Introduction*

I was flying a Boeing 737 into Tokyo Narita International Airport when the left engine caught on fire. We were at seven thousand feet, with the runway dead ahead and the skyscrapers shimmering in the distance. Within seconds, bells and horns were blaring inside the cockpit, warning me of multiple system failures. Red lights flashed all over the place. I tried to suppress my panic by focusing on the automated engine-fire checklist, which told me to cut off fuel and power to the affected areas. Then the plane began a steep bank. The evening sky turned sideways. I struggled to steer the plane straight.

But I couldn't. The plane was impossible to fly. It swayed one way, I tried to pull her back to center, and then it swayed the other way. It was like wrestling with the atmosphere. Suddenly, I felt the shudder of a stall: the air was moving too slowly over the wings. The metal frame started to shriek and groan, the awful sound of steel giving way to physics. If I didn't find a way to increase my speed immediately, the plane would quickly surrender to the downward tug of gravity and I'd plunge into the city below.

I didn't know what to do. If I increased the throttle, I might be able to gain altitude and speed, and then I could circle around the runway and try to stabilize the plane. But could my only remaining engine handle the climb by itself? Or would it fail under the strain?

The other option was to steepen my descent in a desperate attempt to pick up speed; I'd fake a nosedive in order to avoid a real one. The downward momentum might let me avert the stall and steer the plane. Of course, I might instead be accelerating toward disaster. If I couldn't regain control, then the plane would fall into what pilots call a graveyard spiral. The g force would become so intense that the plane would disintegrate before it even hit the ground.

It was a hellish moment of indecision. Nervous sweat stung my eyes. My hands quivered with fear. I felt the blood pulse in my temples. I tried to think, but there wasn't time. The stall was getting worse. If I didn't act at that moment, the plane would fall out of the sky.

That's when I made up my mind: I would save the plane by taking her down. I tilted the yoke forward and prayed for speed. Immediately, I started to go faster. The problem was that I was heading straight into a suburb of Tokyo. But as my altimeter wound toward zero, the extra velocity kicked in and allowed me to steer. For the first time since the engine had caught fire, I could keep the plane on a steady course. I was still dropping like a stone, but at least I was flying in a straight line. I waited until the plane had sunk below two thousand feet and then pulled back on the yoke and advanced the throttle. The ride was sickeningly rough, but my descent remained on target. I lowered the landing gear and focused on keeping the plane under control, with the lights of the runway in the center of the windshield. My copilot called out the altitude: "One hundred feet! Fifty! Twenty!" Right before we hit the ground, I made a final plea for the center and waited for the comforting speed bump of solid earth. It was an



ugly landing—I had to slam on the brakes and swerve at high speed—but we made it down safely.

It was only when the plane was parked at the airport gate that I noticed the pixels. I had been staring at a wraparound television screen, not looking through a cockpit window. The landscape below was just a quilt of satellite imagery. Although my hands were still shaking, nothing had really been at stake. There were no passengers sitting in the cabin. The Boeing 737 was just an artificial reality generated by a sixteen-million-dollar CAE Tropos 5000 flight simulator in a cavernous industrial hangar outside Montreal. My flight instructor had pressed a button and triggered the engine fire. (He'd also made my life more difficult by adding some fierce crosswinds.) But the flight had felt real. By the time the ride was over, my veins were full of adrenaline. A part of my brain was still convinced that I'd almost crashed into the city of Tokyo.

The virtue of a flight simulator is that you can investigate your own decisions. Had I been right to continue the descent? Or should I have tried to regain altitude? Would that have given me a smoother, safer landing? I wanted to know, so I asked the instructor if I could redo the simulated scenario and once again try to land without an engine. He flicked a few switches, and, before my heartbeat could recover, the 737 was reincarnated on the runway. I heard the voice of air-traffic control crackle on the radio, clearing me for takeoff. I advanced the throttle and sped down the tarmac. Everything went faster and faster until the aerodynamics took over and I was in the quiet of the evening's blue sky.

We climbed to ten thousand feet. I was just beginning to enjoy the tranquil view of Tokyo Bay when air-traffic control told me to prepare for landing. The scenario repeated itself like a familiar horror movie. I saw the same skyscrapers in the distance and flew through the same low clouds. I traced the same route across the same suburbs. I descended to nine thousand

feet, then eight thousand, then seven thousand. And then it happened. The left engine erupted in flames. Once again, I struggled to keep the plane steady. Once again, there was the shudder warning me of a stall. This time, though, I aimed for the heavens. I increased the throttle, tilted the plane up, and carefully watched the readout from my one remaining engine. It soon became clear that I couldn't climb. There just wasn't enough engine power. The shudder spread across the skeleton of the plane. I heard the sickening sound of wings losing flight, a low resonant drone that filled the cockpit. The plane plunged left. A female voice calmly narrated the disaster, telling me what I already knew: I was falling out of the sky. The last thing I saw was a blink of city lights, just above the horizon. The screen froze when I hit the ground.

In the end, the difference between my landing the plane in one piece and my dying in a fiery crash came down to a single decision made in the panicked moments after the engine fire. It had all happened so fast, and I couldn't help but think about the lives that would have been at stake had this been a real flight. One decision led to a safe landing; the other to a fatal stall.

This book is about how we make decisions. It is about what happened inside my brain after the engine fire. It is about how the human mind—the most complicated object in the known universe—chooses what to do. It's about airplane pilots, NFL quarterbacks, television directors, poker players, professional investors, and serial killers, and the decisions they make every day. From the perspective of the brain, there's a thin line between a good decision and a bad decision, between trying to descend and trying to gain altitude. This book is about that line.

As long as people have made decisions, they've thought about how they make decisions. For centuries, they constructed elaborate theories on decision-making by observing human behavior from the outside. Since the mind was inaccessible—the brain

was just a black box—these thinkers were forced to rely on untestable assumptions about what was actually happening inside the head.

Ever since the ancient Greeks, these assumptions have revolved around a single theme: humans are rational. When we make decisions, we are supposed to consciously analyze the alternatives and carefully weigh the pros and cons. In other words, we are deliberate and logical creatures. This simple idea underlies the philosophy of Plato and Descartes; it forms the foundation of modern economics; it drove decades of research in cognitive science. Over time, our rationality came to define us. It was, simply put, what made us human.

There's only one problem with this assumption of human rationality: it's wrong. It's not how the brain works. Look, for example, at my decisions in the cockpit. They were made in the heat of the moment, a visceral reaction to difficult events. I didn't carefully reflect on the best course of action or contemplate the aerodynamics of an engine fire. I couldn't reason my way to safety.

So how did I make a decision? What factors influenced my choices after the engine fire? For the first time in human history, these questions can be answered. We can look inside the brain and see how humans think: the black box has been broken open. It turns out that we weren't designed to be rational creatures. Instead, the mind is composed of a messy network of different areas, many of which are involved with the production of emotion. Whenever someone makes a decision, the brain is awash in feeling, driven by its inexplicable passions. Even when a person tries to be reasonable and restrained, these emotional impulses secretly influence judgment. When I was in the cockpit desperately trying to figure out how to save my life—and the lives of thousands of Japanese suburbanites—these emotions drove the patterns of mental activity that made me crash and helped me land.

But this doesn't mean that our brains come preprogrammed for good decision-making. Despite the claims of many self-help books, intuition isn't a miraculous cure-all. Sometimes feelings can lead us astray and cause us to make all sorts of predictable mistakes. The human brain has a big cortex for a reason.

The simple truth of the matter is that making good decisions requires us to use both sides of the mind. For too long, we've treated human nature as an either/or situation. We are either rational or irrational. We either rely on statistics or trust our gut instincts. There's Apollonian logic versus Dionysian feeling; the id against the ego; the reptilian brain fighting the frontal lobes.

Not only are these dichotomies false, they're destructive. There is no universal solution to the problem of decision-making. The real world is just too complex. As a result, natural selection endowed us with a brain that is enthusiastically pluralist. Sometimes we need to reason through our options and carefully analyze the possibilities. And sometimes we need to listen to our emotions. The secret is knowing when to use these different styles of thought. We always need to be thinking about how we think.

This is what pilots learn in the flight simulator. The benefit of experiencing various cockpit scenarios—like an engine fire over Tokyo or a blizzard in Topeka—is that pilots develop better senses of which modes of thought to lean on in particular situations. “We never want pilots to act without thinking,” says Jeff Roberts, the president of civil training at CAE, the largest manufacturer of flight simulators. “Pilots aren't robots, and that's a good thing. But we do want them to make decisions that rely on the wealth of judgment they've built up over time. You always need to think, but sometimes your feelings can help you think. A good pilot knows how to use his head.”

At first, it might seem a little strange to look at decisions from the vantage point of the mind's inner workings. We aren't used to understanding choices in terms of competing brain regions or

the firing rates of neurons. And yet, this new way of knowing ourselves—trying to understand human behavior from the inside—reveals many surprising things. In this book, you will learn how those three pounds of flesh inside the skull determine all of your decisions, from the most mundane choices in the supermarket to the weightiest of moral dilemmas. The mind inspires many myths—such as the fiction of pure rationality—but it’s really just a powerful biological machine, complete with limitations and imperfections. Knowing how the machine works is useful knowledge, since it shows us how to get the most out of the machine.

But the brain doesn’t exist in a vacuum; all decisions are made in the context of the real world. Herbert Simon, the Nobel Prize-winning psychologist, famously compared the human mind to a pair of scissors. One blade was the brain, he said, while the other blade was the specific environment in which the brain was operating.

If you want to understand the function of scissors, then you have to look at both blades simultaneously. To that end, we are going to venture out of the lab and into the real world so that we can see the scissors at work. I’ll show you how the fluctuations of a few dopamine neurons saved a battleship during the Gulf War, and how the fevered activity of a single brain region led to the subprime housing bubble. We’ll learn how firefighters handle dangerous blazes, and we’ll visit the card tables of the World Series of Poker. We’ll meet scientists who are using brain-imaging technology in order to understand how people make investment decisions and choose political candidates. I’ll show you how some people are taking advantage of this new knowledge to make better television shows, win more football games, improve medical care, and enhance military intelligence. The goal of this book is to answer two questions that are of interest to just about everybody, from corporate CEOs to academic philosophers, from economists to airline pilots: How does the human mind make decisions? And how can we make those decisions better?



## The Quarterback in the Pocket

There is a minute and twenty-one seconds left on the clock in the 2002 Super Bowl, and the score is tied. The New England Patriots have the ball on their own 17-yard line. They are playing against the heavily favored St. Louis Rams. They have no time-outs left. Everyone assumes that the Patriots will kneel down and take the game into overtime. That, after all, is the prudent thing to do. “You don’t want to have a turnover,” says John Madden, one of the television broadcast’s commentators. “They should just let time expire.”

The game was never supposed to be this close. The Rams had been favored by fourteen points over the Patriots, which made this the most lopsided Super Bowl ever played. The potent Rams offense—nicknamed the “Greatest Show on Turf”—led the league in eighteen different statistical categories and outscored their opponents 503 to 273 during the regular season. Quarterback Kurt Warner was named the NFL’s Most Valuable Player, and running back Marshall Faulk had won the NFL Offensive Player of the Year award. The Patriots, meanwhile, had been hamstrung by injuries, losing both Drew Bledsoe, their star quar-

terback, and Terry Glenn, their leading wide receiver. Everyone was expecting a rout.

But now, with just a minute remaining, Tom Brady—the second-string quarterback for the Patriots—has a chance to win the game. Over on the Patriots’ sidelines, he huddles in conversation with Bill Belichick, the Patriots’ head coach, and Charlie Weis, the offensive coordinator. “It was a ten-second conversation,” Weis remembered later. “What we said is we would start the drive, and, if anything bad happened, we’d just run out the clock.” The coaches were confident that their young quarterback wouldn’t make a mistake.

Brady jogs back to his teammates on the field. You can see through his facemask that he’s smiling, and it’s not a nervous smile. It’s a confident smile. There are seventy thousand spectators inside the Superdome, and most of them are rooting for the Rams, but Brady doesn’t seem to notice. After a short huddle, the Patriots clap their hands in unison and saunter toward the line of scrimmage.

Tom Brady wasn’t supposed to be here. He was the 199th pick in the 2000 draft. Although Brady had broken passing records at the University of Michigan, most team scouts thought he was too fragile to play with the big boys. The predraft report on Brady by *Pro Football Weekly* summarized the conventional wisdom: “Poor build. Very skinny and narrow. Ended the ’99 season weighing 195 pounds, and still looks like a rail at 211. Lacks great physical stature and strength. Can get pushed down more easily than you’d like.” The report devoted only a few words to Brady’s positive attribute: “decision-making.”

Belichick was one of the few coaches who had grasped Brady’s potential. “Our vision wasn’t that Tom was our franchise quarterback,” Belichick said later, “but that Tom had been in situations—both in playing-time and game-management situations, tight games against good competition—and he’d handled all of them pretty well.” Brady, in other words, had poise. He



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