Other Books by Cathy N. Davidson

The Future of Thinking: Learning Institutions in a Digital Age
(with David Theo Goldberg)

Closing: The Life and Death of an American Factory
(with photographer Bill Bamberger)

Oxford Companion to Women's Writing in the United States
(co-edited with Linda Wagner-Martin)

Thirty-six Views of Mt. Fuji: On Finding Myself in Japan

Reading in America: Literature and Social History

Revolution and the Word: The Rise of the Novel in America

NOW YOU SEE IT

How the Brain Science of Attention Will Transform the Way We Live, Work, and Learn

Cathy N. Davidson

VIKING
Introduction

I’ll Count—You Take Care of the Gorilla

Five or six years ago, I attended a lecture on the science of attention that was part of a luncheon series designed to showcase cutting-edge research by the best and brightest at my university. A philosopher who conducts research over in the medical school was talking about attention blindness, the basic feature of the human brain that, when we concentrate intensely on one task, causes us to miss just about everything else. Because we can’t see what we can’t see, our lecturer was determined to catch us in the act. He had us watch a video of six people tossing basketballs back and forth, three in white shirts and three in black, and our task was to keep track only of the tosses between the people in white. I hadn’t seen the video back then, although it’s now a classic, featured on punked-style TV shows or YouTube versions enacted at frat houses under less than lucid conditions. The tape rolled, and everyone began counting.

Everyone except me. I’m dyslexic, and the moment I saw that grainy tape with the confusing basketball tossers, I knew I wouldn’t be able to keep track of their movements, so I let my mind wander. My curiosity was piqued, though, when about thirty seconds into the tape, a gorilla sauntered in among the players. She (we later learned a female student was in the gorilla suit) stared at the camera, thumped her chest, and then strode away while they continued passing the balls.

When the tape stopped, the philosopher asked how many people had counted at least a dozen basketball tosses. Hands went up all over. He then asked who had counted thirteen, fourteen even, and congratulated those who’d scored the perfect fifteen. Then he asked, “And who saw the gorilla?”

I raised my hand and was surprised to discover I was the only person
at my table and one of only three or four others in the large room to do so. Around me, others were asking, “Gorilla? What gorilla?” Some people were getting annoyed. Several muttered that they'd been “tricked.” Instead of answering them, the philosopher rewound the tape and had us watch again. This time everyone saw the gorilla.

He’d set us up, trapping us in our own attention blindness, priming us for his lecture. Yes, there had been a trick, but he wasn’t the one who had played it on us. By concentrating so hard on the confusing counting task, we had managed to miss the main event: the gorilla in the midst. In a brief experiment that had required us simply to pay attention, it was our own minds that had deceived us.

Except I hadn’t been deceived. I’d seen the gorilla, not because I’m better at this than anyone else—I’ve taken enough attention tests since that day to know I’m not—but precisely because I wasn’t paying attention to counting basketballs. That’s how the visual cortex is structured. We think we see the whole world, but we actually see a very particular part of it. For a lot of neuroscientists, that’s the cautionary message of the gorilla experiment: We’re not nearly as smart as we think we are.¹

In a very real sense, this book began that day. Attention blindness is the fundamental structuring principle of the brain, and I believe that it presents us with a tremendous opportunity. My take is different from that of many neuroscientists: Where they perceive the shortcomings of the individual, I sense opportunity for collaboration. If we see selectively but we don’t all select the same things to see, that also means we don’t all miss the same things. If some of us can accurately count basketballs in a confusing situation and some can see the gorilla, we can pool our insights and together see the whole picture. That’s significant. The gorilla experiment isn’t just a lesson in brain biology but a plan for thriving in a complicated world.

Without focus, the world is chaos; there’s simply too much to see, hear, and understand, and focus lets us drill down to the input we believe is most useful to us. Because focus means selection, though, it leaves us with blind spots, and we need methods for working around them. Fortunately, given the interactive nature of most of our lives in the digital age, we have the tools to harness our different forms of attention and take advantage of them.

But there’s an important first step, and if we pass over it, we’ll never be able to capitalize on the benefits of our interactive world. It’s not easy to acknowledge that everything we’ve learned about how to pay attention means that we’ve been missing everything else—including the gorilla. It’s not easy for us rational, competent, confident types to admit that the very key to our success—our ability to pinpoint a problem and solve it, an achievement honed in all those years in school and beyond—may be exactly what limits us. For over a hundred years, we’ve been training people to see in a particularly individual, deliberative way. No one ever told us that our way of seeing excluded everything else. It’s hard for us to believe we’re not seeing all there is to see.

But here’s the kicker: Unless we’re willing to take attention blindness personally, we’re going to either flub the basketball count or miss the gorilla every single time. We can’t even develop a method for solving the dilemma until we admit there’s a gorilla in the room and we’re too preoccupied counting basketballs to see it.

A great cognitive experiment is like a fantastic magic trick performed by an exceptionally skilled magician. It makes us see things about ourselves that we don’t normally see and helps us to believe what might otherwise be impossible to accept about the world we live in. An experiment allows us to see the imperfect and idiosyncratic way our own brain works. That’s a key difference between magic tricks and scientific experiments. Scientists don’t contrive experiments to trick, surprise, embarrass, or entertain us. They devise experiments so they can learn more about what makes humans tick.

When they were just starting their careers, the young Harvard psychologists Christopher Chabris and Daniel Simons first performed the now-famous gorilla experiment, or what they’ve come to call the invisible gorilla.² It was 1999, and they were determined to come up with a convincing way to illustrate the cognitive principle of selective attention that had been identified way back in the 1970s but that people simply refused to believe.³ A colleague down the hall was doing a study on fear and happened to have a gorilla suit handy. The rest is history.

Under normal testing conditions, over half of the participants miss the gorilla. Add peer pressure and that figure goes way up. In a live reenactment of this experiment performed in London, with four hundred very social college students packed into an auditorium, only 10 percent noticed the gorilla stride across the stage.⁴ We didn’t keep an exact count at our event, but our numbers must have rivaled those of the college kids in London. In our case, the most likely reason so few saw the gorilla was that academics like to do well on tests.
And that’s the annoying lesson of attention blindness. The more you concentrate, the more other things you miss.

In one amusing experiment you can view on YouTube, a man and a woman perform a familiar card trick. While the man fans a deck of cards out before her, the woman selects a card at random from a deck, shows it to the viewing audience, and slips it back into the pack. And as is to be expected, the man then “magically” pulls the right card out of the deck. In this case, however, he reveals his secret to the audience: While we were looking at the card the woman chose, he switched to another deck of a different color so that when she replaced the card, he could spot it instantly. But it turns out that’s only the beginning of what we’ve missed. While we’ve been keeping our eyes on the cards, the man and woman have changed into different clothes, the color of the backdrop has been altered, and even the tablecloth on which the cards were spread has been changed to one of a dramatically different color. Throughout all of this frantic activity a person in a gorilla suit sits onstage, in homage to the Chabris and Simons experiment.

The scariest attention blindness experiment I know is used to train apprentice airplane pilots. You can imagine where this is going. Trainees using a flight simulator are told they will be evaluated on how well they land their plane in the center of a very narrow runway. They have to factor in numerous atmospheric variables, such as wind gusts and the like. But just as the plane is about to land, after the pilot has navigated all the treacherous obstacles, the simulator reveals an enormous commercial airliner parked crossways in the middle of the runway. Pilot trainees are so focused on landing their planes accurately that only about half of them see the airliner parked where it shouldn’t be. When they see a tape of the simulation, they are made aware that they have landed smack on top of another plane. It’s a good lesson to learn in a simulator.

Attention blindness is key to everything we do as individuals, from how we work in groups to what we value in our institutions, in our classrooms, at work, and in ourselves. It plays a part in our interactions with inanimate objects like car keys or computer screens and in how we value—and often devalue—the intelligence of children, people with disabilities, those from other cultures, or even ourselves as we age. It plays a part in interpersonal relations at home and in the office, in cultural misunderstandings, and even in dangerous global political confrontations.

For the last decade, I’ve been exploring effective ways that we can make use of one another’s blind spots so that, collectively, we have the best chance of success. Because of attention blindness, we often arrive at a standoff when it comes to tackling important issues, not because the other side is wrong but because both sides are precisely right in what they see but neither can see what the other does. Each side becomes more and more urgent in one direction, oblivious to what is causing such consternation in another. In normal conditions, neither knows the other perspective exists. We saw this in the summer of 2010 when an explosion on the BP Deepwater Horizon drilling rig sent nearly 5 million barrels of crude oil gushing into the Gulf of Mexico. Some people reacted to the environmental disaster by wanting all offshore oil drilling banned forever. Others protested about the loss of jobs for oil workers in the area when the president of the United States declared a six-month moratorium on oil drilling to investigate what had gone so disastrously wrong. It was as if neither side could see the other.

But it doesn’t have to be that way. If we can learn how to share our perspectives, we can see the whole picture. That may sound easy, but as a practical matter, it involves figuring a way out of our own minds, which as the gorilla experiment so perfectly demonstrates, is a pretty powerful thing to have standing in the way. Yet with practice and the right methods, we can learn to see the way in which attention limits our perspectives. After all, we learned how to pay attention in the first place. We learned the patterns that convinced us to see in a certain way. That means we can also unlearn those patterns. Once we do, we’ll have the freedom to learn new, collective ways that serve us and lead to our success.

What does it mean to say that we learn to pay attention? It means no one is born with innate knowledge of how to focus or what to focus on. Infants track just about anything and everything and have no idea that one thing counts as more worthy of attention than another. They eventually learn because we teach them, from the day they are born, what we consider to be important enough to focus on. That baby rattle that captivates their attention in the first weeks after they’re born isn’t particularly interesting to them when they’re two or twenty or fifty because they’ve learned that rattles aren’t that important to anyone but a baby. Everything works like that. Learning is the constant disruption of an old pattern, a breakthrough that substitutes something new for something old. And then the process starts again.
This book offers a positive, practical, and even hopeful story about attention in our digital age. It uses research in brain science, education, and workplace psychology to find the best ways to learn and change in challenging times. It showcases inventive educators who are using gaming strategy and other collaborative methods to transform how kids learn in the digital age, and it highlights a number of successful innovators who have discarded worn-out business practices in order to make the most of the possibilities difference and disruption afford in a new, interconnected world.

We need these lessons now more than ever. Because of attention blindness, the practices of our educational institutions and workplace are what we see as “school” and “work,” and many of the tensions we feel about kids in the digital age and our own attention at work are the result of a mismatch between the age we live in and the institutions we have built for the last 120 years. The twentieth century has taught us that completing one task before starting another one is the route to success. Everything about twentieth-century education and the workplace is designed to reinforce our attention to regular, systematic tasks that we take to completion. Attention to task is at the heart of industrial labor management, from the assembly line to the modern office, and of educational philosophy, from grade school to graduate school. Setting clear goals is key. But having clear goals means that we’re constantly missing gorillas.

In this book, I want to suggest a different way of seeing, one that’s based on multitasking our attention—not by seeing it all alone but by distributing various parts of the task among others dedicated to the same end. For most of us, this is a new pattern of attention. Multitasking is the ideal mode of the twenty-first century, not just because of our information overload but because our digital age was structured without anything like a central node broadcasting one stream of information that we pay attention to at a given moment. On the Internet, everything links to everything and all of it is available all the time, at any time. The Internet is an interconnected network of networks, billions of computers and cables that provide the infrastructure of our online communication. The World Wide Web lies on top of the Internet and is, in effect, all the information conveyed on the Internet. It is the brilliant invention largely of one person, Sir Tim Berners-Lee, who developed a way that the documents, videos, and sound files—all the information uploaded to the Internet—would have addresses (URLs) that allowed them to be instantaneously transferred anywhere around the billions of computers and networks worldwide without everything going through one, central switching point and without requiring management by one centralized broadcast system.8

Neither the Internet nor the World Wide Web has a center, an authority, a hierarchy, or even much of a filter on the largest structural level. That allows for tremendous freedom and also, in some circumstances, risk. Instead of reinforcing an idea of sustained attention the way by comparison, television programming might, with the Internet we have no schedule to keep us on track from the beginning to the ending of a sixty-minute show. If I’m reading along and decide to click on a link, I can suddenly be in an entirely different universe of content. There’s no guidebook. There are very few partitions. Everything is linked to everything, each network is a node on another network, and it’s all part of one vast web. We blink and what seemed peripheral or even invisible a minute ago suddenly looms central. Gorillas everywhere!

Internet and web are great metaphors for the world we live in, too. The domino-like collapsing of markets around the world has brought home a truth we should have seen coming long ago: Like it or not, we are connected. We can no longer be living in an “us versus them” world because our fate and theirs (whoever “we” and “they” are) depend on each other. We are all inextricably interwoven. The flip side is that we also have infinite opportunities for making our interconnections as productive as possible. The Internet offers us the communication means that we need to thrive in a diverse and interdependent world.

By one recent accounting, in the last decade we’ve gone from 12 billion e-mails sent each day to 247 billion e-mails, from 400,000 text messages to 4.5 billion, from 2.7 hours a week spent online to 18 hours a week online. That’s an incredible change in the amount and extent of the information taking over our time? If life once seemed calmer and more certain (and I’m not sure it ever really did), that wasn’t reality but a feature of a tunnel vision carefully crafted and cultivated for a twentieth-century view of the world. If we’re frustrated at the information overload, at not being able to manage it all, it may well be that we have begun to see the problems around us in a twenty-first-century multifaceted way, but we’re still acting with the individualistic, product-oriented, task-specific rules of the twentieth. No wonder we’re so obsessed with multitasking and attention! You can’t take on twenty-first-century tasks with twentieth-century tools and hope to get the job done.

Here’s the real-life benefit of the gorilla story: If attention blindness is a
I wasn't always dyslexic. I'm old enough that "learning disabilities" didn't exist as a category when I was a kid. Back then, there wasn’t any particular diagnosis for my unusual way of seeing the world. I was already a twenty-seven-year-old professor at Michigan State University when I first heard myself described as "a severe dyslexic with tendencies to attention deficit disorder." Before that, the diagnosis was simpler: I was simply "obstinate."

One evening, a friend invited me to dinner. When I walked into her living room, I saw her sharp-as-a-tack daughter, who was six or seven at the time, lying on her side reading, with a dark blue cover pulled over her head.

"That's how I read too," I told her mother.

When my friend explained that she was about to take her daughter for some experimental testing because she was exceptionally bright but was falling behind in school, I decided to go along. I was fascinated by what I saw at the testing office and arranged to come back and take the tests for dyslexia myself. It was the first standardized exam on which I'd ever made a perfect score.

In school, I had managed to frustrate just about every teacher I had ever had. According to family lore, I could solve equations with two unknowns in my head before I started school, but I could barely count. One summer, I won a competition that earned me a scholarship to math camp. Two or three of my fellow campers there were going straight from grammar school to MIT without benefit of first passing through puberty. I loved calculus but had never been able to add and spent practically every day of fourth grade (or so I recall) in after-school detention writing endless multiplication tables on the blackboard.

I didn't fare so well at reading and writing either. I loved perusing thick books where the small print ran from margin to margin, but I found picture books confusing and couldn't read anything out loud. I still can't. I happen to be in a profession where it's common to write out an entire talk in long, complex sentences and then stand up and read it word for word to your audience. Though I try to avoid these occasions, when I must, I practice reading the text maybe fifteen or twenty times, until familiarity with the rhythm of the words and phrases somehow helps me stay on track.

Because my learning disability was diagnosed a few years after I'd already earned a PhD, it was pretty easy to feel the relief of the diagnosis ("So that's what was going on all along!") without being burdened with a lifelong label of inferiority, disability, disorder, or deficiency that I see being used to describe many of my students today, including some of my smartest. There's no way of knowing if school would have been better or worse had I worn the label "dyslexic" instead of "obstinate," and no way of knowing if my career path would have taken a different turn. All I know is that succeeding against odds and not being afraid to veer off in a direction that no one else seems to be taking have become second nature to me. Tell a kid enough times that she's obstinate and she begins to believe you. Where would I be if the world had been whispering, all those years, that I was disabled?

I don't know, but I do know that I'm not alone. If you are a successful entrepreneur in the United States, you are three times more likely than the general population to have been diagnosed with a learning or attention disorder.¹⁰

Incidentally, my friend's young daughter has done quite well for herself. She, too, has a PhD now. I'm convinced the key to her success wasn't the label or the special classes or the drugs for her attention deficit disorder, but a mom who fought tirelessly for her daughter's unique and important way of being in the world.

I'll never forget the day my high school principal called me into his office, this time with something good to tell me. He had received a lengthy, typed letter from whoever is at the other end of ACT scores, telling him that he needed to sit down with me and explain that this was a multiple-choice test and I was doing myself a disservice with the long essays I had handwritten on the reverse. I had addressed all the questions that were either ambiguously worded or where all of the answers offered were incorrect. Those essays had wasted valuable time, which partly accounted, this person insisted, for my low test score. My principal had had me in his office more than once before, but I'll be eternally grateful to him for reading me that letter. For all its exhortatory tone and cautions, it ended by saying that the principal should tell me that the ACT committee had gone
over all of my comments—there were fifteen or maybe twenty of them—and they wanted me to know that I’d been right in every case.

All these years later, this book is my way of paying back that anonymous ACT grader. I suspect he or she must have been a very fine teacher who knew this would be a good exercise not only for me but also for my principal.

Who pays attention to the reverse side of a test? Not many people, but sometimes the right answers are there, where we don’t see them, on the other side. I’m convinced that’s the case now. For all the pudnity about the “dumbest generation” and so forth, I believe that many kids today are doing a better job preparing themselves for their futures than we have done providing them with the institutions to help them. We’re more likely to label them with a disability when they can’t be categorized by our present system, but how we think about disability is actually a window onto how attention blindness keeps us tethered to a system that isn’t working. When we assess others against a standard without acknowledging that a standard is hardly objective but rather a shifting construct based on a local set of values, we risk missing people’s strengths. We don’t see them, even when they’re in plain view. The implications for this are broader than you might expect. It means more than discouraging a few potential great novelists or professors or artists (though even that can be a huge loss; imagine a world without Warhol or Einstein); it means that we risk losing broad contributions from the people who are supposed to take us into the future.

This book is designed as a field guide and a survival manual for the digital age. I have focused on the science of attention because it offers us clear principles that, once we see them, can be useful in thinking about why we do things the way we do them and in figuring out what we can do differently and better. The age we live in presents us with unique challenges to our attention. It requires a new form of attention and a different style of focus that necessitates both a new approach to learning and a redesign of the classroom and the workplace.

Many of these changes are already well under way. In our individual lives, we’ve gone through astonishing transformations in a little over a decade. A recent survey found that 84 percent of those polled said they could not accomplish their day’s work if the computers were down at their office. That’s pretty remarkable given that the Internet has been prevalent in the modern office only since around 1995.

Because we’re in a transitional moment, most of us aren’t aware of how structurally different our life has become because of the Internet. We don’t see how radical the changes of the last decade or so have been. It’s a bit like growing up poor. If everyone is, you don’t know you are. But to step back and look at the digital age from the long view of human history is to see that this is one of those rare times when change concatenates: A change in one place makes a series of other changes in others. With the Internet, we have seen dramatic rearrangements, in a little over a decade, in the most basic aspects of how we communicate, interact, gather knowledge of the world, develop and recognize our social networks and our communities, do business and exchange goods, understand what is true, and know what counts and is worthy of attention.

The eminent historian Robert Darnton puts our information age into perspective for us. He argues that, in all human history, there have been only four times when the very terms of human interaction and communication have been switched so fundamentally that there was no going back. When he says our digital shake-up is major, he’s comparing it to all of human history. For the first great information age of humanity, Darnton goes back to ancient Mesopotamia, around 4000 B.C., and the invention of writing. He counts movable type as responsible for the dawning of a second information age. That happened in tenth-century China and in Europe in the fifteenth century with Gutenberg. The third information age, he says, came with the invention of mass printing and machine-produced paper and ink that made cheap books and newspapers and all other forms of print available to the middle and lower classes for the first time in history. That began at the end of the eighteenth century, in the Enlightenment. And then there’s now, our very own information age, the fastest and most global of all the four great epochs in the history of human communication. It’s a bit startling and perhaps humbling to consider that one of the greatest transformations in human interaction is playing out across our everyday lives.

Yet as we’ve gone through enormous changes in our modes of social interaction and communication, in our attention and in the tasks we now set ourselves, our most important institutions of school and work haven’t changed much at all. That’s to be expected, perhaps. As Internet analyst Clay Shirky notes succinctly, “Institutions will try to preserve the problem to which they are the solution.” We rival the Cradle of Civilization (remember that?) in
momentousness, and many of our institutions still look as if there’s been no digital revolution at all.

Think about our kids’ schools. My grandmother came to this country in steerage, by steamship, but when I look at the photograph of her standing tall and proud in her eighth-grade class in Chicago, surrounded by immigrants from other places, the schoolroom itself looks entirely familiar. Her classroom could be plopped down almost unchanged in any large, urban public school today. What’s more, many features of that classroom and what she learned there were structured to help her adjust to the new industrial, manufacturing-based economy she was entering. That economy, as we all know, has been transformed irrevocably by globalization and the changes wrought by the information age. If kids must face the challenges of this new, global, distributed information economy, what are we doing to structure the classroom of the twenty-first century to help them? In this time of massive change, we’re giving our kids the tests and lesson plans designed for their great-great-grandparents.

The workplace isn’t much different. Unless you happen to be employed at the famous Googoplex, the Day-Glo Google campus in Mountain View, California, your office might still look like something out of a Charles Dickens novel—or a Dilbert cartoon, which is to say the same thing. Small cubicles or offices all in a row are another feature of the industrial age and the workplace of the late nineteenth and twentieth centuries. Is this really the most effective way to work in the twenty-first?

Is it possible for a whole society to have attention blindness? I think it is. We seem to be absorbed right now in counting the equivalent of digital basketballs: fretting about multitasking, worrying over distraction, barking about all the things our kids don’t know. We’re missing the gorilla in the room. We are missing the significance of the information age that is standing right in the midst of our lives, defiantly thumping her chest. It’s not that we haven’t noticed the change. Actually, we’re pretty obsessed with it. What we haven’t done yet is rethink how we need to be organizing our institutions—our schools, our offices—to maximize the opportunities of our digital era.

We’re so busy attending to multitasking, information overload, privacy, our children’s security online, or just learning the new software program and trying to figure out if we can really live without Twitter or Four Square, that we haven’t rethought the institutions that should be preparing us for more changes ahead. Politically, on the right and on the left, we’ve got a lot to say about whether the globalized workforce of the twenty-first century is good or bad, but in some ways the politics of globalization are beside the point. The digital age is not going anywhere. It’s not going to end and it’s not going away. So it’s long past due that we turn our attention to the institutions of school and work to see how we can remake them so they help us, rather than hold us back.

In other great moments of technological change, we’ve used education as the way to meet new challenges. After the Russians launched Sputnik 1 on October 4, 1957, at the height of the Cold War, Americans got busy and devoted enormous energy, resources, and innovation to improving schools so our kids could compete in the future. Not every educational experiment from the time worked, but educators were determined to try to find new ways relevant to the moment. Yet the information age has so far failed to produce the kind of whole-cloth rethinking of policy and institution building necessary to meet the challenge, so as we sally forth into the fourth great information revolution in the history of humanity, we’re armed with No Child Left Behind, a national “standards-based” educational policy based on standardized tests and standardized thinking, which trumpets tradition and looks steadfastly backward more than a hundred years for its vision of the future. We haven’t done much better with many of our workplaces. A cubicle in a modern, global office is rather like the proverbial fish with a bicycle. It’s hard to imagine anything less relevant.

Keep in mind that we had over a hundred years to perfect our institutions of school and work for the industrial age. The chief purpose of those institutions was to make the divisions of labor central to industrialization seem natural to twentieth-century workers. We had to be trained to inhabit the twentieth century comfortably and productively. Everything about school and work in the twentieth century was designed to create and reinforce separate subjects, separate cultures, separate grades, separate functions, separate spaces for personal life, work, private life, public life, and all the other divisions.

Then the Internet came along. Now work increasingly means the desktop computer. Fifteen years into the digital revolution, one machine has reconnected the very things—personal life, social life, work life, and even sexual life—that we’d spent the last hundred years putting into neatly separated categories, cordonned off in their separate spaces, with as little overlap as possible, except maybe at the annual company picnic.

Home and work? One click of the mouse and I’ve moved from the office
Now You See It

phone from things I've learned through our game play and social networking as we travel the city, separate but connected.

The brain is similar. How we use our brain (what we pay attention to) changes our brain. Those things that most capture our attention—our learning and our work, our passions and our activities—change our actual brain biology. In this way the iPhone brain also corresponds nicely with recent advances in what we know about neural plasticity, the theory that the brain adapts physically to the sensory stimuli it receives, or what psychiatrist Norman Doidge calls “the brain that changes itself.” This model was given real biological heft in the 1990s, when stem cells were discovered in different parts of the adult human brain. Stem cells can regenerate. They can also take on new functions—new apps—that have been lost due to damage to other parts of the brain.

This is exciting news. The first great era of brain science, the late nineteenth century, coincided with the industrial age, and it’s not surprising that brains back then had distinctive parts and hardwired functions. Early brain scientists surveyed our lobes and nodes like explorers on the frontier, creating topographical maps distinguishing this region from that and describing what natural resources could be found there. Like gold rush mining towns, parts of the brain were named after the pioneers who planted a flag there first, so to speak, such as Broca’s area, after Paul Pierre Broca, who first labeled the inferior frontal gyrus as the center of speech production. German neurologist Korbinian Brodmann identified fifty-two of these distinctive functional regions of the brain, still known as the Brodmann areas. In this view, each area has a specific function within a hierarchy, from the higher-level intellectual ordering and “executive functions” of the prefrontal cortex down to the base, emotional, “reptilian” amygdala.

The brain’s development was also thought to be linear too. It was thought that the brain’s capacities grew until about age twenty-five, plateaued for five or ten years, and then began to decline, first slowly, then more rapidly. It was all a bit mechanical, and that is no accident, for the image of the linear, orderly, machinelike brain hardwired with fixed capacities changing in a clear developmental pattern came into being about the same time as the assembly line and mass production.

Contemporary neuroscience insists that nothing about our brain is quite so fixed or static, including its progress and its decline. Rather, we’re constantly learning, and our mental software is being updated all the time. As we get older,
we can become obsessed with what we think we may have lost, but new brain science reveals that in healthy individuals the loss is far less than what was once believed. We stay smarter longer and our capacities expand in more interesting ways than was previously thought possible. There are even productive ways (including culture shock) to force this late-learning process, in much the same way that tulips can be forced to bloom indoors in winter. As we will see, a major factor reshaping the brain is technology.

How we perceive the world, what we pay attention to, and whether we pay attention with delight or alarm are often a function of the tools that extend our capabilities or intensify our interactions with the world. That expansion of human capacities can be scary. Albert Einstein famously observed that technological change is like an ax in the hands of a pathological criminal. It can wreak a lot of havoc. If you read newspapers published at the time of Broca and Brod- mann, you find anxiety about new technologies of the day. A chief concern is speed. Trains, bicycles, and especially the automobile (the “horseless carriage”) all seemed to push humans beyond their natural, God-given, biological limits. Early critics of the car, for example, simply refused to believe they could be safe because, after all, human attention and reflexes were not created to handle so much information flying past the windshield. That debate reached a crescendo in 1904, when the Hollywood film director Harry Myers received the world's first speeding ticket, when he was clocked rushing down the streets of Dayton, Ohio, at the death-defying speed of twelve miles per hour.  

It's commonplace in the history of technology for people to insist that “human biology” or the “human brain” simply cannot cope with the new technology or that our minds and bodies have been put at risk by that technology. Probably people said that about the wheel. What this line of argument overlooks is that the brain is not static. It is built for learning and is changed by what it encounters and what operations it performs. Retooled by the tools we use, our brain adjusts and adapts.

Right now, we’re in a transitional moment. We are both adopting new information technologies all the time and being alarmed by them, even wondering if they are causing us harm, exceeding our human capacities. Fifteen years is a very brief time in the history of a major new technology. Basically, the Internet is still in its adolescence and so are we as users. We've grown up fast, but we still have much to learn. There's a lot of room for improvement. We are experiencing growing pains.

Because we learn to pay attention differently depending on the world we see, when the world changes, there is a lot we’re suddenly seeing for the first time and even more we suspect we’re missing. So that’s a key question: How can we focus on what we do best without missing new opportunities to do better?

The starting place is recognizing the brain’s habits, really taking in what these habits mean, and then working (by ourselves and with others) to find ways to break the old patterns that no longer serve us. A friend of mine has cultivated the habit of always putting her watch on the wrong wrist when she wants to remind herself later to remember something. She says when she gets home from the office and goes to take off the watch, that moment of awareness that the watch is on the wrong wrist forces her to think, “What was it that was so important today that I was sure I would forget it later and changed my watch to remind me?” She then takes an inventory and inevitably remembers. It's her device, her way of interrupting her habits to refocus her attention. The trick works and has application, as we will see, in individual and group situations in both everyday life and the workplace.

If attention suddenly has our attention, it's because we live in a time when everything is changing so radically and so quickly that our mental software is in constant need of updating. We have heard many times that the contemporary era's distractions are bad for us, but are they? All we really know is that our digital age demands a different form of attention than we've needed before. If a certain kind of attention made sense in a world where all the news came through one of three television channels, then what form of attention do you need when your primary information source is Google, where a search for information about “attention” turns up 371 million entries, and there's no librarian in sight?

When Tim Berners-Lee invented the World Wide Web, he anticipated a new form of thinking based on process, not product: synthesizing the vast and diverse forms of information, contributing and commenting, customizing, and remixing. Do we even know how to assess this form of interactive, collaborative intelligence? Is it possible we're still measuring our new forms of associational, interactive digital thinking with an analog stopwatch? What if kids' test scores are declining because the tests they take were devised for an industrial world and are irrelevant to the forms of learning and knowing more vital to our own world?
By one estimate, 65 percent of children entering grade school this year will end up working in careers that haven't even been invented yet. Take one of the “top ten” career opportunities of 2010: genetic counseling. Every hospital now needs this hybrid medical professional-social worker to advise on family planning, prenatal testing, and treatment protocols. The shortage of genetic counselors is considered a matter of national urgency. Before 2000, when the human genome was sequenced, such a career would have seemed the stuff of science fiction.

Nor is it just kids who face uncertain changes in their careers. My friend Sim Sitkin recently invited me to have lunch with some of his students in the Weekend Executive MBA Program at Duke's Fuqua School of Business. This is a program for executives who have been in the workforce at least five years and are seeking to retool. They commit to a nineteen-month intensive program that meets every other Friday and Saturday. Tuition is over $100,000. You have to need something badly to make that kind of professional and financial commitment. About seventy students at a time are admitted to this top-ranked program. Sim says they come from every imaginable profession.

We were joined at our table that Saturday by five executives: a twenty-eight-year-old middle manager for an international pharmaceutical firm, a forty-year-old sales rep at an international business equipment manufacturer, a software developer originally from China, a financial analyst now managing accounts handled offshore, and a distinguished physician whose job increasingly relies on telemedicine. All told me about different ways their occupations have changed in the last five years. The words context, global, cross-cultural, multidisciplinary, and distributed came up over and over. One person noted that his firm was bought out by a multinational corporation headquartered in India and that's where his boss lives and works. Learning how to communicate across cultural, linguistic, and geographical barriers by Skype is no small challenge. The physician compared his medical practice to the hub system in the airlines, with general practitioners across the region referring their most serious problems to his staff at a large research hospital, where they were counseled virtually in preparation for a possible actual visit. He was getting his MBA because medical school hadn't prepared him to be a traffic controller, bringing in patients from all over, some with major problems and some minor, some referred by highly skilled generalists and others by doctors or nurse practitioners with only rudimentary knowledge. His job was to land all patients safely within an enormous hospital system, making sure that they were not only well cared for, but that their procedures were carefully synchronized across the testing, diagnostic, and financial sectors of the hospital. He hoped the executive MBA would help him navigate this bewildering new world, one that bore little relationship to the medical specialization he'd mastered fifteen years before.

Futurist Alvin Toffler insists that, if you scratch beneath the surface of anyone's life in the twenty-first century, you will find the kinds of enormous change these executive MBA candidates experienced. Because change is our generation's byword, he believes we need to add new literacy skills to the old three Rs of reading, writing, and arithmetic. He insists that the key literacy skill of the twenty-first century is the ability to learn, unlearn, and relearn. Unlearning is required when the world or your circumstances in that world have changed so completely that your old habits now hold you back. You can't just resolve to change. You need to break a pattern, to free yourself from old ways before you can adopt the new. That means admitting the gorilla is there, even if you're the only person in the room who does (or doesn't) see it. It means putting the watch on your other arm. It means becoming a student again because your training doesn't comprehend the task before you. You have to, first, see your present patterns, then, second, you have to learn how to break them. Only then do you have a chance of seeing what you're missing.

As the attention blindness experiments suggest, learning, unlearning, and relearning require cultivated distraction, because as long as we focus on the object we know, we will miss the new one we need to see. The process of unlearning in order to relearn demands a new concept of knowledge not as a thing but as a process, not as a noun but as a verb, not as a grade-point average or a test score but as a continuum. It requires refreshing your mental browser. And it means, always, relying on others to help in a process that is almost impossible to accomplish on your own.

That's where this book comes in. It offers a systematic way of looking at our old twentieth-century habits so that we can break them. It proposes simple methods for seeing what we're missing and for finding the strategies that work best for the digital age. This book starts from some core questions:

Where do our patterns of attention come from?
How can what we know about attention help us change how we teach and learn?
How can the science of attention alter our ideas about how we test and what we measure?
How can we work better with others with different skills and expertise in order to see what we're missing in a complicated and interdependent world?
How does attention change as we age, and how can understanding the science of attention actually help us along the way?

These are the central questions this book will address, and I hope that by its end we'll have something even better than answers: We'll have new skills and new insights that will help us address problems as they arise in our everyday life in this digital age.

As we will see, the brain is designed to learn, unlearn, and relearn, and nothing limits our capabilities more profoundly than our own attitudes toward them. It's time to rethink everything, from our approach to school and work to how we measure progress, if we are going to meet the challenges and reap the benefits of the digital world.

We can do this, but we can't do it by ourselves. Whether prepping for a college interview, walking into a board meeting when a hostile takeover is in the air, interviewing a new manager for a key position in the firm, or, on a personal level, going for a follow-up test after a cancer diagnosis, the best thing we can do to ensure the most successful outcome is to have a partner accompany us. But as we'll see, it's not enough to just have someone be there. We need a strategy for working in tandem—a method I call "collaboration by difference." We have to talk through the situation in advance and delegate how each of us watches for certain things or keeps an eye on certain people. If we can trust our partner to focus in one direction, we can keep our attention in another, and together we can have more options than we ever imagined before: "I'll count—you take care of that gorilla!"

Our ultimate metric is our success in the world. And that world has changed—but we have not changed our schools, our ways of training for that world, in anything like a suitable way. By working together, by rethinking how we structure the ways we live, work, and learn, we can rise to meet the exciting opportunities presented by the information age.

That's the challenge this book addresses. Let's get started.
Learning from the Distraction Experts

The slim, attractive father in the T-shirt and the loose fitting “dad jeans” twirls his eight-year-old daughter around their living room as an infant slumbers nearby. His home is neat, modest, comfortable. Here’s a good provider, a loving and reliable family man. Leafy afternoon light casts a golden glow as soothing classical music plays gently in the background. Well-being and being well infuse the scene. I know what will happen next; I’ve witnessed this scene a hundred times before. The music swells, we’re building to the happy-ever-after ending. This story will turn out fine.

Especially if I can convince my doctor to order me some Cymbalta.

That’s the move that drug manufacturer Eli Lilly and Company wants me to make, extrapolating from the contented man in the ad to myself, moving from my couch in front of the television to my doctor’s office where I will request Cymbalta. We’ve seen this man at the beginning of the commercial leaning his head back against a wall, his face etched in despair in a bleak hallway. By the end of the commercial, there he is, dancing with his daughter before the drug’s logo appears and the words “depression hurts” fade in and the voice-over reassures us, “Cymbalta can help.” The space between “before” and “after” is where the magic happens.¹

Not by coincidence, that same space is occupied by the familiar voice-over required by the Food and Drug Administration warning of possible side effects. Thanks to FDA regulations, Eli Lilly can’t advertise on television without listing for me the possible negative consequences of taking their drug, which most of us would probably agree is a good thing, at least for consumers. For Eli Lilly, who’s in the business of selling as many pills as possible, those regulations are more of a nuisance, which is why presenting the negative side effects of a drug
in the least damaging manner falls to the advertising companies who help the drug makers design their commercials. Draftfcb Healthcare, the advertising firm that holds the Cymbalta account, has the job of fulfilling the FDA requirements for stating side effects clearly while somehow distracting my attention from the mandatory but scary warnings about liver damage, suicidal thoughts, and fatality.

It turns out that Draftfcb performs this task marvelously. Its ads for Cymbalta comprise the single most successful prescription drug campaign on television, the gold standard in the competitive direct-to-consumer marketing industry. After this ad campaign began, Cymbalta’s first-quarter sales rose 88 percent, with Draftfcb credited with securing that dominance of market share. So, then, they are the distraction experts.

It should come as no surprise that advertisers spend millions of dollars each year studying the science of attention, both through empirical research and testing with target audiences. Draftfcb’s motto is “6.5 seconds.” That motto is based on their research indicating that a typical viewer really pays attention to only 6.5 seconds of any TV ad. Their goal is to “capture the consumer’s attention and motivate them to act” in that brief time. They want to ensure that we spend our 6.5 seconds of attention on “Cymbalta can help” and not on “liver damage.”

How do they do that? How do they know what will motivate us to disregard the frightening side effects and believe in the twirling promises of happiness ever after? We are rational human beings, and, more than this, we’re seasoned consumers, growing ever more skeptical of advertising in general. Yet these ads work. They convince us, even against our better judgment. How is that possible? What do the makers of the Cymbalta ad know about us that we don’t know about ourselves?

You can find lots of parodies of the Cymbalta ad on YouTube. Comedians, too, poke fun at happy ads that minimize the potent side effects, but it turns out that even this knowing attitude doesn’t make us as wary as one might expect. A study of direct-to-consumer pharmaceutical ads presented as part of testimony to Congress found that viewers were more likely to remember hearing positive rather than negative claims in the ads by a margin of nearly two to one. Among those viewers who recalled hearing any recitation of the side effects at all, twice as many could recall the content and substance (the message) of the positive information over the negative.

This is an alarming figure, given that the FDA maintains an entire division dedicated to monitoring and screening these ads for balance and accuracy. We have to wonder what we're doing with the side-effect information on the screen. Are we tuning it out? Are we laughing at the obviousness and silliness of the positive parts of the ads and still being convinced by them? Or do the makers of drugs like Cymbalta understand our own patterns of attention and distraction so well that it's easy for them to hide the negative right there, in plain sight?

We'll be looking, in this chapter, at how distraction is used to persuade us to choose differently, how attention is shaped by our emotions, and how what we value focuses what we notice in our world. By looking closely at how Draftfcb assesses the components of our attention and distraction, we can begin to see ourselves better. If they know enough about our cognitive patterns to fit them to their own goals, surely we can learn how to manipulate those processes for our own success.

The Cymbalta ad runs for 75 seconds, not 6.5 seconds. Draftfcb’s job is to carefully craft the ad so our attention is hooked by the right 10 percent. Entitled “No One,” the commercial begins with the viewer placed in the position of the lonely outsider to his or her own life. The first scenes make us feel as if we’re watching home movies taken during some happy time in the recent past. The home video tape has a date on it: 10/17/06, roughly three years before the release of the commercial. In this narrative, happiness existed not so long ago; the proof is in the pudding of this home video with its jumpy, amateur footage, intimate and fun, its brightly colored scenes of couples and families romping together on a camping trip, acting goofy for the camera.

But all is not well. The edges of the home-video images are seared in ominous black that threatens to engulf the happy scene. The voice-over begins almost immediately, with a concerned female asking in a maternal Alto rich with sympathy, “When you're depressed, where do you want to go?” She speaks the answer—“nowhere”—as the word appears on screen, typed in white lowercase letters on a black card, as in an old silent movie. The same soothing female voice next asks, “Who do you feel like seeing?” and “no one” appears in white letters against the black background.

It's at this point that the images begin to change. As the voice begins to
spell out the symptoms of depression, we see its victims. A middle-class African American man (a subgroup statistically underrepresented in commercials but more likely to suffer from depression than white men), probably in his thirties, leans his head against a wall at a workplace, perhaps a hospital or a modern office. He looks very much a victim of depression, rooted nowhere, attached to no one. Next we see an attractive (but not too attractive) young woman in her twenties with flat black eyes and olive-toned skin. She doesn’t meet the camera’s gaze. All around her is deep black. Then a pale white woman, this one in her fifties or sixties, somewhat dowdy, sits nervous and alone at a kitchen table, fingers to her lips, her eyes wandering and anxious. It’s a broad enough spectrum of age, race, and gender to invite in almost any potential sufferer.

“Depression hurts . . . in so many ways,” that sympathetic female voice-over is saying, with pauses between the hard words: “Sadness. Loss of interest. Anxiety.” And then, with a hopeful rising inflection, the punch line: “Cymbalta can help.” Suddenly, the images of the sad and anxious individuals come to a halt. In their place is the vibrant Cymbalta logo, the antithesis and antidote to depression. It’s a whirl of innocent, exuberant energy, an almost childlike doodle of turquoise and lime green, a bit of stylistic whimsy to relieve the grimness.

If the narrative spun by the commercial seems obvious, that’s part of the point. We already know the story of this ad from a lifetime of happy tales, beginning with bedtime stories, children’s books, fairy tales, myths, and adventure stories, all the optimistic fables we were raised on. Cymbalta to the rescue! This ad is carefully crafted as a transformation story, with scenes of peril and punishment rewarded by a happy ending. We know Cymbalta will fulfill our expectations for the psychological version of the rags-to-riches plot.

And it is just then, with the happy logo promising redemption, that, with no break in the cadence of her speech, no pause or even shift in the sympathetic tone of her mother-voice, that the voice-over actress starts to list the side-effects. Why here? Because this is the best place to take advantage of our mind’s training in following the very type of narrative this commercial is plying. The advertiser understands the power of associations built up over a lifetime, the cues that will help us make a leap to the way this story ends. The side-effects roll call comes at the place in the commercial where we are least likely to pay attention because our mind already knows the end to the story.

That doesn’t mean that Draftfcb isn’t going to do everything it can to lead us along, even if we already know the path. Every aspect of this Cymbalta ad is rooted in the science of attention. Not much is left to chance in a multi-billion-dollar industry.

Music helps keep us on our way. The Cymbalta ad has a sound track, an adaptation of a poignant piece by Robert Schumann, Kinderszenen, opus 15, no. 1, the same music played in a dramatic moment of memory at the piano in the movie Sophie’s Choice, starring Meryl Streep. In this ad, the evocative music plays as a woman’s voice murmurs the side effects of Cymbalta sotto voce.

The maternal-sounding voice is carefully planned too. Like narrative, characteristics of voice come with cultural expectations and preconceptions that help to persuade or dissuade us during our 6.5 seconds of attention. We think we listen to what people are saying, but it turns out we’re a little like dogs in that we sometimes hear the tone of voice and don’t even pay attention to what that voice is actually saying. How we hear, how we listen, and how we comprehend (three very different topics, it turns out) are all relevant to the side-effect voice-over. In ordinary conversation, Americans speak about 165 words per minute. For New Yorkers, it’s closer to 200. News announcer Walter Cronkite famously trained himself to speak more slowly, at around 125 words per minute, to encourage people to pay more attention to the news. Since Cronkite, it is the convention of American newscasters to articulate slowly, especially for the most important part of a story. In general, in the American English speech pattern, our voice drops to a deeper pitch the more slowly we speak. Test audiences associate both slowness and a deeper sound with truthfulness, importance, and calm.

In the voice-over acting business, drug commercials are their own specialty niche. They require special training. For side effects, you need to speak clearly enough to pass FDA muster but you want to make sure you avoid anything that will actually capture listeners’ attention. The most common method involves using a nonconventional speaking pattern in which the voice drops, not rises, as you speed up your delivery. Standard acting classes teach you how to hit the beginnings and endings of words (think of just about anyone trained in traditional methods of British stage acting doing the “To be or not to be” speech in Hamlet). By contrast, voice-over classes help you master selective mumbling. When you deliver the news about potential liver damage, you soften consonants and end sounds, so you are speaking in a murmur as soothing and inconsequential as a parent’s babble to a baby. When you introduce the product at the beginning of the commercial and when you deliver the punch line at the end, your diction is much slower and your words are carefully e-nun-ci-a-ted.
If viewers remember the positive but not the negative content of the ad, it is because highly skilled professionals have worked hard to make the conditions for distraction possible, even probable. They have researched other technical matters, such as camera angles and speeds, cutting techniques, the science of color, and on and on. Things that we nonprofessionals think of as “incidental” have typically been tried on test audiences and are anything but. I know someone who participated in a study in which two ads were shown, one with the side effects recited with a little cartoon of a bee flying across the TV screen, another identical but for the bee. The audience was half as likely to remember the negative side effects if they watched the version with the distracting bee.

This speaks to the power of the images in focusing our attention, and the Cymbalta ad proves a fine example of this power. As the soothing alto voice recites potential side effects, the images transform from tragic to happy: The attractive young woman isolated against the black background now smiles sweetly from the window, despite the rain; there’s more camping with couples and kids and dogs; the anxious older woman has left the kitchen table and now tenderly holds hands with an older man, presumably her loving husband, in another window, this one full of sunlight. And there’s that man, the one who had leaned his head against the wall in despair, now twirling his young daughter, nuzzling his baby. Liver damage? Suicidal thoughts? Not here! It’s all happening, the happy ending is nigh. With Cymbalta, relief is on the way.

Of course none of these techniques designed to manipulate our attention would matter if the message weren’t the one we already wanted to believe in. From infancy on, our sense of ourselves has gone hand-in-hand with our need to think of ourselves as in control (even when we’re not). Growing up in Western culture is almost synonymous with being in control, and everything about the ad plays upon that message. It is Draftfcb Healthcare’s challenge to play into these deep-seated cultural values of self-worth. The Cymbalta ad moves seamlessly across all the realms of work, home, friends, loved ones, and family. Failure at one is failure at all; the man who is in despair at work is playing with his daughter after help comes his way. Success at one is key to success at all, which means that, without Cymbalta, everything is in jeopardy.

It is a brilliant commercial, no matter what you think about the ethics of direct-to-consumer pharmaceutical advertising. In seventy-five seconds, the panoply of our culture’s values is condensed into a powerful and compelling narrative, all supported by the most sophisticated tricks of the trade. For the commercial to work, we have to be able to identify so closely with the people—at once, of course—that we see their pain as our pain, their solution as ours. If they can get past all the shameful feelings required in admitting one’s weakness and getting help, we can too. Surely you’ve seen the commercial in which the guy’s reflection in a store window speaks to him and tells him he shouldn’t be embarrassed about talking to his doctor about his erectile dysfunction. The guy listens to his reflection and walks out of his doctor’s office a taller, more potent man.

By deconstructing the seventy-five-second Cymbalta ad, we can make ourselves aware of how unnatural persuasion is. All the components in this ad have been researched, planned, constructed, tested, edited, tried out in front of studio audiences, discussed in focus groups, re-edited, and tested yet again. Those seventy-five seconds distill hundreds of research studies, experiments, insights, acting lessons, film production classes, and more.

But what is it that all these tests are reaching for? In this case, advertisers are seeking out the very fabric of our attention, the patterns and values that we have come to see as so natural that we really don’t even see them anymore. We know what the series of images in this narrative means, so we don’t really have to think about it. We have internalized the voice cues, the swelling music, so deeply that we hear the meaning without having to hear the words. By plugging into the unconscious patterns of our attention, the only thing that really needs to disrupt our attention—the added element to the narrative we’re meant to see anew—is the drug itself. Everything else is constructed so as to be as unobtrusive as possible. And it works.

At least this ad does, here in the United States. Part of the trick is that we can be wooed by the logic of the admen only if we are part of the cultural script it writes for us and writes us into. I learned this for myself when I went to teach in Japan for the first time in the 1980s. I hadn’t intended to go, and it would be hard to be less prepared than I was for the trip. I’d been to Canada but not much of anywhere else in the world, and in a matter of weeks, I suddenly found myself living in a tiny apartment outside of Osaka, in a lovely town with only one or two other gaijin, “foreigners.” Having had barely enough time to sublet my apartment back in Michigan and pack my bags, I arrived with no Japanese and quickly
enrolled in a local language school. My teacher was sure that, if I watched television commercials, I'd pick up the language quickly, because commercials often use simple language and repetition to make their point.

I admit I'm terrible at learning languages, so that may have had something to do with my confusion. But I also found that commercials were a perfect shorthand to cultural values—and upon first arriving in Japan, I had no idea what those were. So much in the commercial was unspoken, or wrapped up in euphemism, or so steeped in cultural references I didn't know that I often missed the sales pitch entirely. I could reduce my bilingual Japanese friends and students to tears with my guesses, which more often than not were miles off the mark. Was that gray-haired man in the traditional men's haori robe pitching ramen, funeral services, or a cure for constipation? You'd think you'd be able to tell which was which, but I was so decisively wrong so often that it became almost a shibboleth, a cross-cultural icebreaker, during my first stint in Japan for me to narrate what I thought was going on, which invariably wasn't at all.

The experience of finding TV ads in Japan indecipherable made me see how attention is rooted in cultural values embedded so deeply that we can barely see them.

As such, not only is attention learned behavior, but it is shaped by what we value, and values are a key part of cultural transmission, one generation to another. The absorption of those values into our habitual behavior is also biological. We change brain pathways, and we make neural efficiencies when we learn. That is the physiology of attention blindness. Of course those values change with time and circumstances. We are constantly disrupting previous patterns and forming new ones, which puts ad agencies like Draftfcb in a position not just to reinforce those patterns, but to change them.

In ways less commercially driven, parents and teachers are crafting attention too. We're all researching, planning, constructing, testing, editing, trying out, editing again, shaping, reshaping, and, in other ways, typically without any conscious thought, crafting our values and expectations into a narrative as compelling and as acceptable as the Cymbalta ad. Our attention in the rest of our lives is no more natural, innate, genetic, or universal than is the crafted, produced version of attention in the Cymbalta ad.

But then the questions remain: Why? Why are we prisoners of attention? How did we get this way? Why do we see certain things so naturally and miss others that seem so obvious once others point them out to us? Where do our patterns of attention come from, and do we have any say in how they are shaped?

To answer those questions, we need to go back, all the way back to the nursery, where our own brains were formed and where we learned what to value. To say that another way, in the nursery we began to learn what is important to pay attention to—and what isn't. It's also in the nursery that we learned that the world is far, far too vast to be mastered one bit at a time. We need to organize all the stuff of the world around us. We need priorities and categories that make navigating through life easier and more efficient. And that's exactly where we get into trouble.

Years ago, I visited friends with their four-month-old baby. It was a large family gathering, with all the attention of parents, grandparents, nephews, cousins, aunts, uncles, plus a gaggle of friends all trained on little Andrew. Baby Andrew, on the other hand, had no interest in us. He was lying in his crib in the nursery, totally and happily absorbed by whirring fan blades making shadows and swooshing sounds overhead. When his mother picked him up and began rocking him, he began staring in another direction, oblivious to all the preening adult attention.

"What's he looking at?" Grandfather asked peevishly as Andrew stared in rapt attention elsewhere.

A few of us squatted down beside the rocker to see in the direction that Baby Andrew was looking. That's when we saw the light shine through the slits in a Venetian blind as the rocker moved back, then disappear as the rocker moved forward, a dramatic chiaroscuro of light and shadow that was far more captivating to Baby Andrew than his grandfather's attentions. So what did we do to divert him from that fascinating display and convince him to look at us instead? We did what any self-respecting adult would do. We shook a rattle at him. We distracted him from the absorbing light by an unexpected sound.

In a nutshell, all attention works that way, even for adults. Even multitasking is really multidistraction, with attention not supplemented but displaced from one point of focus to another. That's basic Brain Biology 101. But that's not the whole story. Sometimes there is continuity as we move from one
distraction to another, and sometimes there’s not very much. Many distractions happen and are simply forgotten. Others we take with us. We apply information from one experience when we need it in another. What makes the difference between the forgettable and the important is what I call learning.

From birth on, Baby Andrew is being taught, by those smiling, rattling grandparents and everyone else, what is and what is not worth paying attention to. Light through Venetian blinds is pretty, but not worth paying attention to in most situations. We count it as a distraction. The rattle isn’t worthy of attention either, except as a mechanism for getting Andrew’s attention and trying to make him focus on what is important in his world: all the relatives and friends gathered to focus love, affection, and what anthropologists would call “kinship bonds” on him. In shaking the rattle, we didn’t make the light go away. We just put it in a proper hierarchy of unimportant to very important things, of things that don’t matter and other things that are worthy of attention—that is, the things we adults consider to be more important. We diverted Baby Andrew’s attention from the light in the same way Draftfcb stows the side effects.

That day in the nursery with Baby Andy happened decades ago, and grown-up Andy now has a healthy law practice and kids of his own. How did he go from fascinated preoccupation with the motions of fan blades and sunlight through Venetian blinds to passing the bar exam and raising a family? There was no rule book. And yet, if we want to understand how our attention works—and how we can be brought along by the makers of Cymbalta or stumped in times of tremendous change such as our own—we need to uncover the patterns that shaped Andy. And just as these are revealed in the Cymbalta commercial to be diverse and multifaceted, covering everything from sense inputs to values, so are the patterns that shape each of us woven together beginning in our earliest moments.

Infants are not born paying attention. When babies come into the world, they think everything is worthy of attention. They see the whole world unsorted. They use those around them—their attitudes, gestures, emotions, language—as the scaffolding on which to build their own sense of what they should be paying attention to. Particularly from their main caregivers (typically, their mothers), they learn what they should be paying attention to, what counts, what is rewarded, and how to categorize all that does count into language, the single best organizer of what does or doesn’t count in a society. Each language sorts and categorizes the world in a unique way, marking differences between approved and disapproved, good and bad, and other distinctions that an infant being raised into that society needs to learn.

Adults looking at infants are in awe of how “quickly” kids learn language, but, when you realize that every contact they make reinforces language in the most positive and powerful ways possible, with affection and reward being the fulfillment of the baby’s basic needs, it becomes clear that language learning doesn’t actually happen quickly at all. The rule of thumb is that it takes 10,000 hours of practice to become a virtuoso at just about anything worth doing. There are approximately 8,765 hours in a year, and babies are awake and getting feedback from the world a lot of that time. The process of learning the complexities of vocabulary, syntax, and grammar can extend into adolescence and beyond. Even the full and clear articulation of all of the complex sounds of a language (including the difficult consonant blends in English) is a long process, taking up to seven or eight years. Adult learning builds on the efficiencies of past learning—which is why it is so difficult to unravel the process in order to see how much we’ve learned.

Infant psychologists, cognitive scientists, neurologists, and cultural anthropologists have studied how infant learning happens, all in an effort to understand the boundaries between culture and biology. They have studied our developmental patterns of attention as carefully as Draftfcb has. This is important because, as we have seen, we can’t really see ourselves very clearly. Many times, we assume we are acting “naturally” when we’re in fact enacting a cultural script that has been repeated for us many times and that we are beginning to imitate even as early as four months into life.

Andy came into a very particular world with a very specific genetic inheritance. The interaction between those two things, nature and nurture, is where attention begins. We’re looking at a few minutes in the life of Baby Andrew. But look in the mirror! Baby Andy R Us. Our attention and selectivity begins here.

What's Andrew’s backstory? Before we can even focus on seventy-five seconds in his crib life, we need to situate him, because these details, though selected randomly, will come together in all sorts of different ways to create the norms, values, and patterns that he sees as the world. Those details are analogous to the particulars in the home movie at the beginning of the Cymbalta ad, the one that makes clear we’re looking at a middle-class, nuclear family, with enough leisure to go on a vacation in a camper. In our own little scene, Andrew
is lying in a crib in his very own nursery in suburban Philadelphia. Let’s say his mother is a professional woman but, as far as we can tell, she’s now devoting herself to child care. We could say, for example, that she is on leave from her city law firm to take care of him for the first six months of his life. Mother and Daddy like to believe they are liberated co-parents; they both talked for months about “being pregnant.” But, like most men in his world, Daddy doesn’t take time off from his firm for parental leave. How can he? He’s part owner of a small advertising firm. Maybe his biggest accounts are direct-to-consumer television ads, and like everyone in television, he’s a bundle of anxieties about what the move to all-digital television format, with shows on demand anytime you want them, will do to his bottom line. He can’t be taking time off to play with Andy. Someone has to be the family breadwinner.

Andy has a big sister, Ashley, who is seven. Ashley’s best friend is named Sharon. The two of them visit Baby Andy in the nursery from time to time. Andy’s parents would call themselves Protestants, maybe Episcopalian, if asked, although there was at least one great-grandparent back there reputed to be Jewish and another who was German Catholic, and they aren’t a particularly observant family in any religious tradition.

Why are these categories important? One reason is that once everything is located in a proper category, the category itself (for better or worse) answers a host of unaskable questions. A category is a shorthand. “He’s a nerd” is a categorical statement that does and doesn’t tell you much about the whole person but says a lot about a society’s attitude toward people who are focused on intellectual matters. In Andy’s case, even if no one specified the various sociological and demographic labels, there are telltale signs of what category Andy fits into, just from the seemingly neutral fact that Andy sleeps alone in a crib in his own room (that he even has his own room!), and he isn’t even weaned yet.

Andy’s too little to know it yet, but in many societies, if his parents had isolated him alone in a crib in a separate room, they’d be considered cruel and abusive. If Andy had been born in that kind of society, he’d be getting more sympathy when he whimpered over being left alone again. Not in Philadelphia, though. Be tough, little Andy!

How well Andy fares alone in his crib represents a system of values that Andy learns by example, by the responses of those around him to his behavior, or by the concern or happiness of those around him, rarely by actual instruction. At four months, he’s already aware that people pay more attention to him when he cries about some things than about others. He is already aware that crying when he’s hurt brings succor fastest. Even at four months, he’s starting to realize crying has certain powers to command attention—but also that this tactic has to be used selectively or people aren’t as nice to him. They hold him, pat him, soothe him, all of which signals crying should stop.

Four-month-old Andy is also becoming aware that not everyone cries. He’s learning that crying is a kind of alarm when he is around other infants, and he’s becoming attuned to the crying of those around him. He’s beginning to make a “how crying is valued” map of the world. Big Sister cries less than Andy, Mama cries less than Big Sister. Daddy never cries.

If we share Baby Andrew’s backstory, we might not think twice about anything in our little scene (unless we happen to be one of those psychologists, neuroscientists, or anthropologists). In situations where we share the same cultural script, we proceed as if that script were natural. In most circumstances, it is invisible. That’s what “natural” means. In certain situations, though, we are jolted from our sense of the natural and then are suddenly forced to think about how and why we have certain habits. This is culture shock. When we’re plunked down into a very different society, especially if we do not know the language and don’t have a guide from our own culture, we suddenly start seeing what is “strange” about other customs and behaviors; we also see others treating our way of doing things as strange. “Natural” is always relative to our world.

Andrew learns the rules from family members who provide scaffolding for the values he is developing. Andy’s family may not be aware they are teaching Andy what to pay attention to and what to ignore. He’d be happy watching the fan blades twirl all day, so long as other basic needs for food, warmth, protection, and affection were being met. But the rest of the family, even his older sister, has already figured out that there isn’t much reward in this world for staring at the shadows. If Andy is going to live with these bigger people, he has to learn their strange ways. That’s what you do in a new culture, and if you are Andy, you have begun to enter the culture of your parents long before you’ve even begun to speak, simply by shifting your attention from fans and Venetian blinds to faces and wordlike sounds.

So what can seventy-five seconds of Baby Andy’s crib life tell us about the specifics of his developing attention? Let’s see. Start with Mama bending over his crib. “Is that a cute little nose, Baby Andrew?” she asks. Andrew is too
would give their infants an appreciation for classical music that somehow would make them smarter. It is true that Andrew would be born recognizing Mozart as well as the sounds of American English and that he would be startled into attention if suddenly his nursery filled with the sounds of African music and people speaking Somali. It is not true he would be any smarter for being born used to hearing Mozart.

If Andrew’s parents were listening to him as carefully as he was listening to the languages in his world, they might also have recognized that their baby cries with an accent. This is actually quite a new discovery. A study conducted in 2009 revealed that newborns cry in the language patterns they hear in utero. French newborns cry with an upward inflection, German babies cry with a falling inflection, mimicking the speech patterns of their parents. Andy cries in American.

Even at four months, a number of Andy’s behavior patterns are already distinctively American. For example, he is already smiling more than his Mexican or Kenyan or Japanese equivalents would. His American parents interact with him with a lot of talking, looking, and smiling—more than parents would in most other countries, in fact. Smiling and crying are also Andy’s two best gambits for eliciting the much-desired touch from his American parents. American parents rank almost at the bottom on the international scale of parent-infant physical affection, meaning that we just don’t touch and hold our babies as much as people do in most other cultures. Some people believe that is why American babies are more verbally boisterous—crying, babbling, claiming attention by making noise, using their voices to claim some of the touch they crave. Because he’s an American baby boy, Andy gets even less touching than Big Sister did when she was his age. That disparate treatment of male and female infants is more extreme in America than in most other countries. Andy doesn’t realize that he is being touched (or not touched) American-style.

The cognitive psychologist Richard Nisbett and his international team of researchers have now conducted dozens of experiments with mothers and children that show how radically different child rearing is in different cultures. Even how we go about communicating our social building blocks varies, it turns out. For example, Americans love to name things—like “nose” or “Dada”—for their infants. We do this far more than a Japanese, Korean, Hong Kong, or Taiwanese mother would. We’re “noun-obsessed.” We like organizing the world into categories. We like nouns and we like giving the things of the world names
and labels. We might think this is natural. How else would anyone group the world efficiently? That turns out not to be a rhetorical question but one with myriad answers, varying from culture to culture.

In one experiment, in which mothers were supposed to present their children with toys—a stuffed dog, a pig, a car, and a truck—the American mothers used twice as many object labels as Japanese mothers, even with their very youngest children. The American mother would say something like: “That’s a car. See the car? You like it? It’s got nice wheels.” The Japanese mother would say, “Here! It goes vroom vroom. I give it to you. Now give this to me. Yes! Thank you.” The Japanese mothers performed for their kids twice as many social routines that introduced the concept of polite giving and receiving, and they spent twice as much time emphasizing relationships, community, process, and exchange without describing the objects themselves. They used far more verbs and fewer nouns. As Nisbett notes wryly, “Strange as it may seem to Westerners, Asians don’t seem to regard object naming as part of the job description for a parent.”

This is how babies learn their world. They are not simply learning difference. They are beginning to chart out the concepts and the distinctions made by those whose world they mirror; they are learning the value of those distinctions and the values of those who make them. People depend on those distinctions and teach them to their children. But distinctions are normative, sensory, behavioral, social, cognitive, and affective all at once. Learning happens in categories, with values clumped together in our words, concepts, and actions. And this is where attention and its concomitant attention blindness come from.

We’ve analyzed only the tip of the iceberg in a scene that, so far, has probably lasted only ten seconds or so. What else might go on in this little scene? Let’s say little Andrew cries and, using Motherese, his mama asks, “Is my little Andrew hungry?” She starts to pick him up but then puts him back down, wrinkling her nose. “Stinky! Let’s get this diaper changed.” American again! Attitudes toward defecation rank way up there in the taboos and practices that anthropologists chart in every culture.

Let’s add another person to our scene. “Daddy’s here!” the mother calls out. Mama’s announcing Daddy’s arrival is another way of signaling to her baby that this is an occasion to pay attention to, a personage commanding attention. “Look! Daddy’s put away his cell phone!” Mama might add, words of praise that give weight and importance to any attention Andrew receives from Daddy. On the other hand, because attention is based on difference, remarking Daddy’s attention also suggests it’s not something that is routine. If Andrew wants to get his needs met quickly, as a general rule, he better holler first for Mama.

Again, these gestures happening in an instant do not come with lesson plans or Post-it notes or annotations. It’s how culture is learned, how attention is learned. But it is learned so early, reinforced so often, that we do not stop to think of it as anything other than reflexive, automatic, “natural” behavior. Mama reports glowingly to Daddy about how Baby Andrew stopped crying when she put on the Baby Mozart tape and says that he might even have said “Dada” today. Here we have another lesson in attention blindness in action, the sifting of the world into meaningful language. Amid all the other babbling of a four-month-old, those two special syllables—“da-da”—were plucked out by Mama, emphasized, rewarded, encouraged, and thereby given meaning along with affection. Different cultures reward early language acquisition in different ways. Perhaps not surprisingly, given our culture’s high valuation of language, in the West we consider precocious language skills as a distinguishing mark of an intelligent child. We spend a lot of time discerning words in baby babble, praising what we think are words, and bragging about an infant’s early word mastery to others.

If Andy hasn’t been fed yet because of the interruptions of the stinky diaper and the appearance of Daddy, it’s time for him to start fussing. If into our scene come big sister Ashley and her BFF Sharon and they want to “play with the baby,” it may require an actual shriek from Andrew to train the room’s attention back on his needs. He may not even notice when Ashley touches him but, if he’s fussing, Mama may well react by cautioning Ashley to be careful around the baby. If it is best friend Sharon who did the touching, Mama’s warning will be more insistent. (Yes, psychologists have studied all of these things.) “Not too hard,” Mama might warn her, a great way of communicating kinship relationships and rules, even without the help of a local Margaret Mead to describe what those are. Every society defines kinship differently, something I certainly saw in Japan when my students were baffled that “aunt” and “cousin” had so many kinship possibilities in English. We use “aunt” for the sister or the sister-in-law of a parent; “cousin” is so vague in our kinship system it basically means sharing a common ancestor. Other cultures describe familial relationships with different degrees of specificity.
the difference between faces of their own race and those of other races and ethnicities.13

Cute, nose, Mozart, Daddy, pretty, hungry, stinky, strong, careful, and stranger are some of the labels being built into Andy's cognitive system for mapping the world. He's learning how to pay attention to these, and he's learning the values so thoroughly that they will be close to automatic by the time he starts school, and then formal education will complete the process. He won't know why certain things go with other things, but he will act as if there's no other way for this to be—because that's how he's built. He won't even see any differently unless he has to.

We've only scratched the surface of all there is to know in a mere seventy-five seconds in Andrew's world, but it is a start at understanding how simple events, attitudes, sensory experiences, and linguistic cues are encouraging Andrew's habits of paying attention to what counts. Andrew doesn't understand this in anything like a rational or systematic way, but he is certainly getting the message that he's getting a message. He doesn't know the word for it yet, but he is noticing, even at four months, that there are patterns in his world and that those patterns have something important to do with him. For example, he is already wondering what everyone is trying to tell him, what it could possibly mean, and why some things are repeated over and over in so many ways, as if people are afraid he's not going to understand them.

And one other thing: Why, Baby Andrew wonders, is just about everything in his room—the walls, the carpet, the blankets, the stuffed toys, the clothes—so darn blue?

Attention begins in the nursery, but as we age, we also learn to shape and reshape the values we learn there. Learning is the cartography of cultural value, indistinguishable from the landscape of our attention—and our blindness. We map the world around us in our own behaviors. And we can be tricked or herded in ways we might not wish to be when we encounter features of the world that aren't anywhere on our map. When we encounter a mismatch between our values and some new experience, we have a choice to either hold on to our values against all the evidence, to insist they are right or natural no matter what; or we can
rethink them and even reject them, a process that can be smooth or traumatic, partial or complete. In any case, this process is a key component of the science of attention.

Once you have a category, it's hard to see past it without some serious reconsideration. That's the unlearning necessary to break an old habit before we can adopt a new one. It's a constant process and a crucial one.

That is exactly why it's so useful to understand what is going on with Andy. This story is not just about child rearing. It is about our own blind spots, and how we came to have them. By understanding that process, we increase our chances of intercepting the process, of intervening, and of changing its outcome. If the makers of the Cymbalta ad can understand our expectations well enough to manipulate them, so can we. But the only way we have a chance of paying attention differently is by understanding what we pay attention to when we're not thinking about it and where our reflexes and habits of attention came from. We cannot disrupt them, we cannot change them, until we understand these basic facts.

Andy's story is our story. We no longer know our own preverbal history. Because of the categories by which we bundle our world, we can see efficiently. But those same categories make us miss everything else. Andy's job is to mimic and to master his culture's categories, long before he has the words to describe them and long before he's developed sophisticated sociological terms to explain them away. Mostly, in infancy, he detects the feeling of the categories, as conveyed to him by the people who care for him most and on whom he depends for everything.

Andy's process is the one we all go through as human beings. This process teaches our brain to pay attention, which means it is how our brain learns not to pay attention to the things that aren't considered important to those around us. But those other things do exist, all the time, even if we are not noticing them. That is simply how the brain science of attention works, with the world around us focusing our attention on what counts. What we are counting makes the things that don't count invisible to us.

As adults, we are not as helpless as little Andy anymore. We have the power to make choices. When confronted with the new—with what seems odd or outrageous, annoying or nonsensical—we can deny it has any value. We can label it a worthless distraction. Or we can try, on our own or with the help of others, to redraw our maps to account for the new. We can actually use the new to reshape how we focus our attention.

We have the capacity to learn, which is to say we have the capacity to change. We were born with that capacity. Just ask Andy. This is why we had to return to the scene of the nursery, to discover how we came to know the world. By understanding how we learned our patterns of attention, we can also begin to change them.
Learning Ourselves

The first thing we need to know if we're going to make sense of the patterns of attention that are normally invisible to us is that the changes we talked about in the last chapter transform not merely our behavior but the underlying neural networks that make attention possible. Every manifestation of attention in the real world begins in the brain, which means that we need to look at a few basic principles of brain biology and at the way neural networks develop.

Neurons are the most basic cells in the nervous system, which includes the brain and spinal cord. Neurons are excitable, meaning that they process the body's electrical and chemical signals. There are various kinds of neurons, each with a specialized function, all interconnected in astonishingly intricate ways. The adult brain has been estimated to contain over a hundred billion neurons, each of which fires several times a second and has several thousand connections to other neurons. There are over a million billion neural connections in your brain. That's a lot of zeros.¹

Like so much else we believe we know, the basics of brain biology are often not what we think they are. In fact, for much of the twentieth century, it was believed that the number of neurons in the brain increased as we aged. It was thought that connections must expand in number in much the same way that we grow taller or gain more knowledge over time. That's a logical assumption, but a false one.² The way the brain actually works, then, is counterintuitive: An infant has more neurons, not fewer, than anyone old enough to be reading this book. Our little Baby Andrew has an excess of neurons. If his development unfolds as it should, he will lose 40 percent of his extra neurons before he grows up. If he does not, he will not be able to function independently in society and will be considered mentally handicapped or disabled.

On a structural level, the process by which neurons are shed is remarkably similar to, and in fact is prompted by, the processes of selecting what to pay attention to that we discussed in the previous chapter; an infant's brain matures by selection. As the infant selects from all the world's stimuli those that matter—that deserve attention—he is also "editing" neurons. As he begins to select, concentrate, and focus on some things and not others, his brain is shearing unused neural pathways. When the brain is not making connections, the unused linkages wither away. The excess is eliminated so only the relevant data and relevant neural pathways remain.

Canadian Donald O. Hebb is often called the father of neuropsychology because he was the first person to observe that learning occurs when neurons streamline into pathways and then streamline into other pathways, into efficient clusters that act in concert with one another. This is now called the Hebbian principle: Neurons that fire together, wire together. This means that the more we repeat certain patterns of behavior (that's the firing together), the more those behaviors become rapid, then reflexive, then automatic (that's the wiring). They become patterns, habits, groupings, categories, or concepts, all efficiencies that "wire together" sets of individual reflexes or responses. Reflexive behaviors combine into patterns so we don't have to think about the components of each series of reactions each time we call upon them. We don't have to think, every time it happens, "Now I see the red light, now I am lifting my right foot off the gas pedal and moving it to the brake, now I am pushing down on the brake in order that I can stop the car before this yellow crosswalk." I see the red light, I stop.

If it weren't for the Hebbian "wiring together" of actions we perform in tandem, we would feel like everything we do is taxing, everything requires extra energy, everything is inefficient—in a word, that everything requires multitasking. Seeing the light, releasing the gas pedal, moving to the brake, all the while keeping my eyes on the road, keeping control of the car, while the kids are chattering in the backseat and the radio is on; all of this is multitasking. Fortunately, the Hebbian principle of our wired-together, firing-together neurons makes most of life's multiple tasks easier to process and respond to at once.

We don't know exactly how many repetitions it takes to create the pathways that produce automatic responses in infants—clearly there is tremendous
variation, depending on whether the behavior is learning to smile or beginning the long conceptual and biological process toward toilet training. But we know that babies who do not receive a lot of care in infancy have a difficult time catching up, and some never do. This is why even infant care and preschooling are so crucial to a productive adulthood. All the pathways that will shape attention are being laid and reinforced, over and over, long before the child goes to school—where patterns will be named, mapped, and systematized—and long before that grown-up child enters the workforce, where the efficiencies that are developed and built upon since infancy will come to productive use.

Neural pathways connect the different parts of the brain and nervous system, translating ideas into actions in patterns learned over and over, reinforced by repetition, until they seem to be automatic. Repetitions literally shape specific patterns in very particular and extremely complex ways, coordinating impulses and activities across parts of the brain and nervous system that might be quite distant from one another. For example, the desire to walk and the ability to walk may seem automatic or natural to an able-bodied adult, but they are a complex operation involving many different parts of the brain that, with repetition, become more and more connected via neural pathways. To an infant, connecting the parts is a mysterious process. To a toddler, the process is clearer although not necessarily smooth. In those early stages, there are still many extraneous movements bundled into "toddling." We are constantly correcting this process (as we correct everything little Andy does) by our reward system, applauding some behaviors, moderating others.

Once human babies have learned to walk without thinking about it, they've reached a new level, both in learning and in the efficiency of the neural pathways. That means that the basic task of walking seems automatic: There are few impediments in the way between thinking you want to walk and walking. When transmittal is this reflexive, you can then build in other activities. You can think and walk. You can carry things. You can perform certain movements. Of course, all these are forms of multitasking, but because the basic task—walking—has happened so often and the complex network of neurons is so efficiently created and reinforced, we don't perceive it as multitasking. That which seems automatic doesn't feel to us like a "task." Because the most fundamental of the tasks—walking—seems natural and automatic and requires no premeditation, we can do other things easily as we walk. When you get really good at it, you might even be able to walk and chew gum.

Perhaps the single most important and certainly the most striking example of how an infant's neurons are firing together and wiring together—selecting relevant features from the irrelevant ones to be ignored—is language learning. At four months, an infant can still hear all the different sounds in all the world's languages. But barely. At four months, he's already beginning to shape pathways that allow him to hear in English. That means he is excluding—shearing away—potential language sounds that do not occur in English. On a neural level, that means he is losing an ability he was born with: to be able to recognize all linguistic sounds. Most infants in the United States lose this ability in order to focus on the sounds required for learning English and not French or Swahili or Icelandic or Arabic or Sanskrit or Chinese, all of which possess certain sounds that the other languages do not.

In the little scene with Andy, among all the babbling sounds he might make, Mama thinks she hears him say "Dada." She praises him, remarks on it, offers him affection as a reward, reinforcing the significance of those two syllables. "Dada" means something. When two syllables mean something, they are reinforced. "Mada" is ignored. "Dada" is a word; in English, "Mada" is noise, so it receives no reinforcement. He stops trying to say "Mada."

Andy's babbling includes many sounds that aren't used in English at all. Those become meaningless; surprisingly quickly, they become unbearable. If, later, Andy decides to take up another language where those sounds are crucial, he will have to studiously retrain his ear to hear the sounds he's taught himself to ignore.

So a Japanese infant can distinguish r from l. A Japanese toddler cannot. There is no distinction between r and / in Japanese. Westerners hear these as two sounds because they both are sounds in our language. They aren't in Japanese; there is no careful distinguishing of them to the Japanese Andy, no one is constantly speaking to him using the two sounds, correcting his use of them, and so the distinction simply goes away for him. A Japanese infant can't hear a difference between r and / once he starts being able to speak Japanese.

The principle we can learn from Andy and apply to our own lives is that this process doesn't stop with infancy. What we learn is also something we unlearn. Learn Japanese, unlearn the difference between r and / . It's not nearly as easy to relearn that difference, but it is possible so long as we remember that it is. If we believe capacities are "natural," we're lost. We need to remember how Andy's process of learning categories and concepts makes him believe that he is
seeing the whole world, even though he isn’t. He isn’t even seeing or hearing all of the world that was once available to him, before he got rid of that overabundance of neurons.

Even if Andy were raised from infancy to speak more than one language, there would still be innumerable sounds that would be lost to him. He would still be paring down countless potential neural connections to relatively few. By definition, making new neural connections means severing others—the yin and yang of attention is mapped in the yin and yang of neural development. That’s another key principle of learning. It’s so basic that it has been given an extremely dramatic and powerful name that sounds like science fiction: programmed cell death. Programmed cell death means that unused cells must die. They are use-less and soon don’t exist. Learning requires this selection and discarding. Learning makes speedy, efficient, seemingly automatic neural pathways out of a tangle of haphazard connections.

The world would be chaos if unused neurons didn’t atrophy and die. Without strong and efficient neural pathways, we’d be overwhelmed by the constant overstimulation of everything. Perceptually, it would be like being in the woods, lost and without a path, versus being in the woods on a well-marked path. Emotionally, it would feel terrifying to be constantly startled by events that always felt new and random.

An unsorted world would be almost impossible to navigate with any efficiency or success at all. One recent theory of severe autism is that something like this absence of categories happens in the early neurological development, around the same time that language learning is coalescing. Instead of being able to understand and assimilate and use categories, the autistic child can’t make the groupings. Bundling never happens. The world may well make sense to the autistic individual, but that “sense” is incomprehensible to those around him. Communication falters, and so does the autistic child, whose development, in many cases, takes a very different course.

Those of us who don’t suffer from an unusual neural condition rarely pay attention to the efficiency of our neural pathways until something gets in their way, as might happen if one were to experience a crippling disease like Parkinson’s or an injury that affects the limbs or spinal cord. In the aftermath of some catastrophic disruption of the neural pathways, the relay between the desire to walk and the act of walking can once again become a conscious process, often an arduous, sometimes impossible one.

These instances, when we need to consciously “rehab” and relearn what once seemed automatic, reveal to us the complexity of the task made efficient by neural shearing. Because learning how to walk again as an adult is very different from learning it as an infant, there is a significant component of unlearning, on a physical and neurological level, for one first has to break one’s old habits and expectations in order to learn how to effectively walk again. The end result may seem the same, but because the process is so different, you actually need to retrain your mind to a new concept of “walking.” Neural shaping and shearing that occurred during childhood made walking easy. After the injury, one has to disrupt the old patterns in order to find a new way to learn to walk, thus forming new neural pathways that eventually will make the relearned skill of walking more automatic. Because the injury unbinds well-trodden neural pathways, each part of learning to walk again requires creating new pathways, new patterns that, with extensive rehabilitation, may become automatic once more.

On a biological level, attention blindness is located deep within the brain and nervous system. If things are habitual, we do not pay attention to them—until they become a problem. Attention is about difference. We pay attention to things that are not part of our automatic repertoire of responses, reflexes, concepts, preconceptions, behaviors, knowledge, and categories and other patterns both mental and physical (if we can make such a crude distinction) for which we have, over time, developed more and more efficient neural pathways. We are constantly developing efficient ways of processing information so that certain sequences become automatic, freeing up valuable strategic thinking for novel tasks that have not yet been incorporated into our brain’s repertoire of automatic actions.

It’s only when something major and disruptive happens—say a kitten steps into the road right before I get to a stoplight—that I might break my pattern. Instead of bringing the car to a calm halt, I might jam on the brakes. I might even swerve sharply to miss the kitty. That change in my behavior, stimulated by the kitten, shakes me up in ways that bringing my car to a halt at a red light does not. I’ve been more or less paying attention as I drive, but braking for the cat makes me aware of paying attention.

Being aware of where and when I’m paying attention marks the difference
from the usual forms of attention in everyday life. Suddenly being aware of having to pay attention is stressful, in good ways (exhilaration, inspiration) and in bad ways (anxiety, anger). On a biological level and on a pedagogical level, we become conscious of things that we normally don’t think about. As sociolinguist George Lakoff says, we can be “reflective about our reflexes.” Self-reflexiveness or self-awareness is not necessary in all situations, but it is a key aspect of all successful informal and formal learning.

In times of major, global changes such as our own, a lot of life’s incidents leave an indelible mark in the same way as slamming on the brakes to avoid the kitty, and for the same reason: They disrupt patterns that were laid down long ago. They unbundle neurons that have been firing together for a while. They start a new process of bundling, but until that process is successful—until enough firing and rewiring occur to become habitual—we will feel the stresses of the new. We will be aware that we need to pay attention in order to learn.

With new experiences, neurons that were not wired together by previous experience now have to fire urgently and independently. In the example of the straying kitty, there is also an emotional jolt to the system that I won’t forget for a long time. Those powerful moments of learning—ones that come accompanied by some trauma or thrill—are the ones that make a difference. This is one reason why, as we shall see, a number of educators are advocating game principles as a learning system. If learning is exciting and as instantaneously self-reinforcing as winning a new game challenge, which comes with its own emotional bells and whistles to signal our learning victory, we are much more likely to remember and to incorporate the experience of our own success into other aspects of our life. We not only learn the content but we learn the form of winning, making us more adaptable and receptive to change in the future.

The upshot of all this is that disruption in all its forms has the same effect: It makes us realize that what we thought was natural is actually a learned behavior that has come to feel that way thanks to the biological consequences of repetition. And natural defines not merely behavior, but culture and environment as well. In the Cymbalta ad, many of the most skillful manipulations were playing to our cultural efficiencies, to the thoughts, feelings, and desires we take for granted. Thanks to how often these are reinforced, they of course have neurological underpinnings just as ingrained as those that allow us to walk without thinking about it. Any new experience disrupts them in small or large ways, from a first taste of Ethiopian food to learning to drive stick shift after a decade on automatic to learning how to navigate the Internet. You thought you had those neural pathways nicely sheared and shaped only to find them disrupted.

Our institutions—family, friends, churches, social organizations, schools, workplaces—reinforce biological patterns all the time, thereby shaping those biological processes on the most fundamental levels. Sometimes, in periods of great change, there is a mismatch between the patterns our institutions reinforce and the patterns we need to operate efficiently in the new situation we are facing. If we had been in a terrible car accident or were suffering from a degenerative disease, we’d be using physical rehabilitation and the expert advice of others to make our motor neurons (which connect the spinal cord to muscles) work as smoothly as possible, given impediments that no longer allow us to work as efficiently as we once did.

The same is true in times of tremendous change. That is when we need to unlearn the previous patterns because they are not serving us. That is when we need to unlearn old habits so we can begin to relearn how to learn again.

At the nexus of culture and biology we find the catastrophic neurological condition called Williams syndrome, which has much to tell us about both the necessity of neural shearing and the relativity of cultural norms that we often take for granted. It is now thought that this rare genetic disorder (technically, the absence of twenty-six genes from the seventh chromosome) results in a systemic aberration of the architecture of the cortex in which too few neural networks are cut away. A child with Williams syndrome is bombarded with too much information and has no efficient way to sort it all out.

Children with Williams syndrome typically test very low on IQ tests, in the 40–50 range, and have very little working memory, lacking the ability to remember a sequence of simple operations required to perform such simple tasks as shoe tying or counting. Yet despite these abilities, the disorder’s unique genetic makeup also bestows personality traits and aptitudes that we might find quite valuable. Preschoolers with Williams syndrome exhibit exceptional ability at facial recognition, a difficult cognitive task not mastered in most children with “normal” intelligence until the age of five or six. Williams syndrome children often also have a love of music, typically have perfect pitch, and tend to
be oblivious to negative cultural cues, such as those for racial bias that adults passively (and often unknowingly) transmit to children. On tests for racism, Williams syndrome children often test virtually prejudice-free.

The single most immediately obvious characteristic of children with Williams syndrome is a tendency to have an abundant and precise vocabulary and exceptional storytelling abilities.\textsuperscript{12} Asked to name ten animals in a timed test, an average child might name such animals as cat or dog. The child with Williams syndrome might say ibex or newt or alpaca but might not be able to understand a simple processing concept such as naming ten animals. The child will therefore keep going, naming more and more animals until the tester stops him.

Things get even more interesting when we look at perceptions of Williams syndrome across cultures. In the United States, the diagnostic literature on Williams syndrome invariably defines a variety of personality traits thought to be characteristic of the disease. The words for these are almost entirely positive. Children with Williams syndrome are considered remarkably affable, inquisitive, charming, smiling, laughing, cheerful, affectionate, loving, and gregarious. In the West, that string of attributes is valued. The pleasing personality of the child with Williams syndrome is often considered a saving grace or blessing, some compensation for all the disabilities, varying in degree, of those born with this neurodevelopmental disorder. Children with Williams syndrome are sometimes described as “elfin,” both because of their characteristic appearance and their spritely personalities. American researchers are studying oxytocin levels of Williams children with the idea that perhaps there is something about those twenty-six deleted genes on chromosome 7 that contributes to this powerful neurotransmitter, which helps us regulate pleasure, maternal feelings, empathy, and other positive responses.

In Japan, however, gregariousness, intrusiveness into other people’s business, effusiveness, and affection in public or to casual acquaintances are fundamental offenses against the social fabric. Rather than being positive, these emotional and social traits rank as disabilities, as significant as neurologica disorders in the catalogue of problems inherited by children with Williams syndrome. In Japan, they are considered continuous with the other mental and physical disabilities, and Williams syndrome children are not held up as a model for positive personality traits. They are pitied because of those same characteristics of personality. They are not studied for potential positive characteristics that might be used someday to help genetically engineer better human beings. They are far more

likely than Western children with Williams syndrome to be institutionalized because of (what the Japanese perceive as) their antisocial nature.\textsuperscript{13}

There is one last feature of brain biology we need to understand before we move on to schools, that formal place where our categories, concepts, patterns, and all our other habits of learning become reinforced in the most rigid way possible: through grades, rankings, evaluations, and tests. Everything we’ve seen about attention will be enacted—for good or ill—in the schoolroom.

The final principle of learning—and unlearning and relearning—we need to understand is mirror neurons. They were discovered in the 1980s and 1990s, and some people consider their discovery to be as important for neuroscience as sequencing the genome has been for genetics.

It happened in the lab of Giacomo Rizzolatti and his colleagues at the University of Parma in Italy. His lab didn’t set out to find mirror neurons, as no one really knew they existed. At the time, the Parma scientists were studying how neurons synchronize hand-eye coordination. They placed electrodes in the ventral premotor cortex of macaque monkeys to see how their neurons were firing when they were picking up food and then eating it.\textsuperscript{14} By doing so, the neurophysiologists were able to record the activity of single neurons when the monkeys were feeding themselves. That, alone, was news.

Then, one day, something really interesting happened. The Parma scientists began to notice that some neurons were firing in exactly the same pattern whether the monkey was picking up a piece of food and eating it or was watching a human or another monkey pick up a piece of food to eat. It didn’t matter whether the monkey was performing the activity or watching it: The neural response was the same.

Many years later, we are finding that humans, too, have mirror neurons. Mirror neurons respond in the exact same way when a person performs a certain action and when a person observes someone else performing that action. That is so startling and so counterintuitive that it bears restating: These specialized neurons mirror the person (or monkey) observed as if the observer himself were performing the action.

Not all neurons act this way, only a particular subset. But this discovery was far more revolutionary than anything the scientists had set out to find about
the neural mechanism of hand-eye coordination. The Parma neuroscientists switched the hypothesis and the protocols of their experiments. Soon they were isolating and identifying a subset of neurons that they named mirror neurons. They argued that approximately 10 percent of the neurons in the monkey’s frontal cortex had these mirroring properties.

Since those early experiments, fMRIs have been used to study the human brain, and more and more mirror neurons are being found in new areas. There are mirror neurons that register the sounds we hear others make, as well as visual mirror neurons too. Recently, mirror neurons have also been located in the somatosensory areas of the brain associated with empathy.15 Throughout our life, our mirror neurons respond to and help us build upon what we see, hear, and experience from others around us. In turn, their mirror neurons respond in the same way to us.

Primatologist Frans de Waal likes to say that imitation doesn’t begin to comprehend the complex, mutually reinforcing interactivity of human teaching and learning.16 He notes that teaching requires that mirroring work both ways. The child watches the parent do something and tries it, and then the parent watches the child trying and reinforces what she’s doing right and corrects what the child is doing wrong: an intricate, empathic dance. Mirror neurons help to make the correction.

De Waal is highly skeptical of the claim, through the ages, that one or another distinctive feature “makes us humans” or “separates us from the animals.” We are animals after all. De Waal, in fact, believes that animals can do just about everything we think defines us as humans. However, he still thinks that there is something special, exceptional even, about the calibrated, interactive nature of teaching. The animals he studies feel, think, solve problems, and have all kinds of astonishing capabilities that humans don’t even approach—animals fly on their own power, navigate on and beneath the oceans without vessels, and migrate thousands of miles without instruments, and so on and so forth.

But teaching is a very complicated, interactive process. And it is possible, he suggests, that humans are among the only animals that actually teach not just by modeling behavior, but by watching and correcting in a complex, interactive, and empathetic way. De Waal claims that there is only one other very clear example in the nonhuman animal kingdom of actual teaching in this sense: a pod of killer whales off Argentina. He says this particular pod of killer whales actually trains its young in the dangerous practice of pursuing seals onto shore to eat them, managing this feat with barely enough time to ride the surf back out to safety again without being beached there to die. The older whales evaluate which of the young ones are good enough to do this, and they encourage this behavior relative to the young whales’ skills. They don’t just model but actually calibrate how they teach to those gifted students capable of learning this death-defying feat. These whales school their young the way humans do.

This particular ability to teach individually, to the best skills and abilities of the students, in a way that’s interactive and geared to the particular relationship of student and teacher, seems if not exclusive to humans then certainly one of our very special talents. De Waal doesn’t know of other animals able to calibrate empathy with instruction in this way. It is how we humans learn our world.17 In the classroom and at work, it is the optimal way to teach any new skill and to learn it. It is the way most suited to all aspects of our brain biology, the way most suited to what we know about the brain’s ways of paying attention.

Mirror neurons allow us to see what others see. They also allow us to see what we’re missing simply by mirroring people who see different things than we do. As we will find in the subsequent chapters on attention in the classroom and at work, that feature alone can be world-changing for any of us.

To live is to be in a constant state of adjustment. We can change by accident—because we have to, because life throws us a curveball. But we can also train ourselves to be aware of our own neural processing—repetition, selection, mirroring—and arrange our lives so we have the tools and the partners we need to help us see what we might miss on our own. Especially in historical moments such as our own rapidly changing digital age, working with others who experience the world differently than we do and developing techniques for maintaining that kind of teamwork can help to take the natural processes of repetition, selection, and mirroring, and turn them to our advantage.

One guide to keep in mind—almost a mnemonic or memory device—is that when we feel distracted, something’s up. Distraction is really another word for saying that something is new, strange, or different. We should pay attention to that feeling. Distraction can help us pinpoint areas where we need to pay
more attention, where there is a mismatch between our knee-jerk reactions and what is called for in the situation at hand. If we can think of distraction as an early warning signal, we can become aware of processes that are normally invisible to us. Becoming aware allows us to either attempt to change the situation or to change our behavior. In the end, distraction is one of the best tools for innovation we have at our disposal—for changing out of one pattern of attention and beginning the process of learning new patterns.

Without distraction, without being forced into an awareness of disruption and difference, we might not ever realize that we are paying attention in a certain way. We might think we’re simply experiencing all the world there is. We learn our patterns of attention so efficiently that we don’t even know they are patterns. We believe they are the world, not a limited pattern representing the part of the world that has been made meaningful to us at a given time. Only when we are disrupted by something different from our expectations do we become aware of the blind spots that we cannot see on our own.

Many of our anxieties about how the new digital technologies of today are “damaging” our children are based on the old idea of neural development as fixed, or “hardwired,” and on notions of distraction and disruption as hindrances instead of opportunities for learning. Our fears about multitasking and media stacking are grounded in the idea that the brain progresses in a linear fashion, so we are accumulating more and more knowledge as we go along. Most of us, as parents or teachers or educational policy makers, have not yet absorbed the lessons of contemporary neuroscience: that the most important feature of the brain is Hebbian, in the sense that the laying down of patterns causes efficiencies that serve us only while they really are useful and efficient. When something comes along to interrupt our efficiency, we can make new patterns. We don’t grow or accumulate new patterns. In many cases, new ones replace the old. Slowly or rapidly, we make a new pattern when a situation requires it, and eventually it becomes automatic because the old pattern is superseded.

Pundits may be asking if the Internet is bad for our children’s mental development, but the better question is whether the form of learning and knowledge making we are instilling in our children is useful to their future. The Internet is here to stay. Are we teaching them in a way that will prepare them for a world of learning and for human relationships in which they interweave their interests into the vast, decentralized, yet entirely interconnected content online?

As we will see, the answer more often than not is no. We currently have a national education policy based on a style of learning—the standardized, machine-readable multiple-choice test—that reinforces a type of thinking and form of attention well suited to the industrial worker—a role that increasingly fewer of our kids will ever fill. It’s hard to imagine any pattern of learning less like what is required to search and browse credibly and creatively on the free-flowing Internet than this highly limited, constricted, standardized brand of knowledge.

If some pundits are convinced that kids today know nothing, it may well be because they know nothing about what kids today know. A young person born after 1985 came into a world organized by different principles of information gathering and knowledge searching than the one into which you were born if your birthday preceded that of the Internet. Their world is different from the one into which we were born, therefore they start shearing and shaping different neural pathways from the outset. We may not even be able to see their unique gifts and efficiencies because of our own.

When we say that we resent change, what we really mean is that we resent the changes that are difficult, that require hundreds or even thousands of repetitions before they feel automatic. Adults often feel nostalgic for the good ol’ days when we knew what we knew, when learning came easily; we often forget how frustrated we felt in calculus class or Advanced French, or when we played a new sport for the first time, or had to walk into a social situation where we didn’t know a soul, or interviewed for a job that, in our hearts, we knew was wrong for us. We also tend to forget that, if we did poorly in French, we stopped taking it, typically narrowing our world to those things where we had the greatest chance of success.

We humans tend to worry about the passing of what and who we once were, even though our memories, with distance, grow cloudy. When calculators were invented, people were concerned about the great mental losses that would occur because we no longer used slide rules. With programmable phones, people wonder if anyone will memorize phone numbers anymore. Both predictions have probably come true, but once we no longer think about the loss, the consequences stop seeming dire. But, yes, that’s how it does work, on a practical level and also on a neural level. Unlearning and relearning, shearing and shaping.

All of us like to believe we are part of the 50 percent in any situation who see it all clearly, act rationally, and make choices by surveying all the options
and rationally deciding on the best course of action. But for most of us, it takes
something startling to convince us that we aren’t seeing the whole picture. That
is how attention works. Until we are distracted into seeing what we are missing,
we literally cannot see it. We are, as my colleague the behavioral economist Dan
Ariely has shown us, “predictably irrational.” You take courses in psychology and
business on your way to designing direct-to-consumer ads in order to under-
stand the ways most of us, most of the time, think. We believe we are rational,
but in quite predictable patterns, we are not.\textsuperscript{18}

We do not have to be stuck in our patterns. Learning happens in every-
thing we do. Very little knowledge comes by “instinct.” By definition, instinct
is that which is innate, invariable, unlearned, and fixed. Instinct applies to those
things that cannot be changed even if we want to change them. So far as any-
one can test, measure, or prove, instinct doesn’t account for much in humans.
Biologists unanimously define as “instinctive” only a few very basic reflexive
responses to stimuli. One of these, known as the Babinski reflex, is an involun-
tary fanning of the newborn’s toes when her foot is stroked, a primitive reflex
that disappears by around twelve or eighteen months.\textsuperscript{19}

Except for this very specific reflex, babies come into the world having
learned nothing by instinct and eager to pay attention to everything. We focus
their attention and, in that process, also focus their values and deepest ways of
knowing the world. The world we want them to know and explore should be as
expansive and creative as possible.

As we move from the world of the infant to the world of formal education,
the big questions we will be asking are: What values does formal education regu-
late? What forms of attention does formal education systematize? How valuable
are both in the contemporary world? And, most important, are the educational
areas on which we’re placing our attention a good match with the world for
which we should be preparing our children?