WHAT WE VALUE

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THE NEUROSCIENCE OF Choice and Change

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For my mom, Katherine, and my grandma, Beverly

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INTRODUCTION

IT WAS A TYPICAL night at my house. One of my kids was jumping on the arm of the couch, playing a new song he had learned on the guitar. The other was trying to show my grandma, Bev, a new Lego creation, proudly thrusting the bricks within inches of her eyeballs. As dishes clanged and my phone pinged, I felt a now-familiar sense of constriction—like being stuck in a cave where the walls are closing in.

Many of us know this feeling—of being trapped in an impossible negotiation of trade-offs, of needing to choose between different things that matter in different ways. Whether it's supporting colleagues at work or trying to protect a weekend of quality time with family, it never seems like there's enough of me to choose everything I want to choose.

On that night, I looked at Bev—one of my favorite people in the world—and chose to prioritize some quality time with her. I took her hand and guided her around piles of cast-off Legos, past the remains of a wooden block castle in disarray, and out the door.

At ninety-nine, Bev's hands are soft and strong, and I try to memorize them, how thin her skin feels, like smooth tissue paper, gripping mine. Outside, I could breathe again. I felt the momentary relief that comes with having made what you think is the right choice. But only briefly—only until Bev turned to me and said that although she liked

coming to my house and seeing my kids, we weren't *really* spending time together.

I dropped her hand. "Of course we are," I insisted.

"Not really," she said. "We get to see each other, but when I come to your house, you're not really paying attention to me." I knew she was really saying, though not aloud, "I see that you think we're spending quality time together, but we can do better, go deeper, than a ten-minute walk around the block."

I didn't want Bev to be right, but I knew that she was. In the back of my mind, there's often a whisper reminding me to spend more quality time with her, but it's a whisper among so many shouts. When she proposed changing our routine so that I came to her house instead of she to mine, the shouts started up again: kids, work, the traffic and parking situation near her apartment. Under the open night sky, I found myself back in that cave, elbows pushed into my sides, shoulders pressed up to my ears. How could I navigate through this feeling?

Maybe you've also been in a situation like this—one where you know that there's an important thing you need to do, but you can't seem to do it. Maybe your doctor is concerned about your health, and you know you need to exercise more, but in what little free time you have it's hard not to sink into a favorite TV show. Maybe you've been wanting to make more time to mentor a promising person on your team at work, but urgent deadlines keep you from getting there. Maybe you have a goal to meet new people, but you find yourself talking with the same familiar friends or, worse, staring at your phone every time you go to a party or event.

The structure of the situation is familiar to so many of us: I want to do the thing, and the thing is important to me, but it's also *hard*. For . . . *reasons*.

Though I didn't think about it this way at the time, this is the same basic problem I've studied for most of my career: how we choose—including how we choose to change. Every morning, I walk to the University of Pennsylvania, where I direct Penn's Communication

Neuroscience Lab, and my team and I design experiments to explore (among other things) the relationship between what people value, the choices they make, and how this is shaped by the outside world. Specifically, we use neuroimaging to explore the brain systems that handle this process, and in doing so we helped discover how these systems relate to the ways people spend their time, change their behavior, and connect with others. So shouldn't I be the expert? Bev is one of the most important people in my life. Shouldn't I know how to make a choice to prioritize time with her? Shouldn't I be in control of what's valuable to me?

It seems I wasn't. It was hard even to clear out enough space in my defenses to pause before telling her she was wrong, let alone to ask myself: *What's going on here? Why am I resisting visiting one of my favorite people?*

Why is this *the choice I'm making?*

And worse, *Why do I* keep *making this choice, over and over?*

If a friend had posed this dilemma to me, I might have told them that we often focus so much on the results of a choice that we miss the opportunity to understand *why* we made it to begin with, making lasting change harder. One way to adjust that kind of thinking is to understand a system in the brain that's fundamental to many of the choices we make. Neuroscientists like me call it the *value system*.

People are sometimes surprised to hear a neuroscientist talk about a "value system" and "what we value." When they think of "values," they might think of moral values—a code of conduct, a sense of what is intrinsically good and right, or a few important principles we choose to live by. Alternatively, they might think of economists or market analysts discussing prices or the feeling of getting a good deal at the store. But when neuroscientists talk about value, we mean, most basically, the amount of reward your brain expects you to derive from a particular action in a particular moment.

With every choice we make, the value system's job is to weigh disparate elements against each other in what my colleagues and I call the

value calculation. These elements indeed include things like moral values and the economic value of an option, but they also include the consequences of your past choices, your mood, the opinions of the people around you, and so much more. A reward can be money, but it can also be friendship. It can be seeing something good happen in the world for others, achieving a small goal, or having enough energy and strength to finally run a marathon. There are many things that our brains value, many ways our brains can find reward—but as we find ourselves making the same choices again and again, it doesn't always feel that way. Getting takeout trumps saving for retirement; hitting deadlines trumps professional development; the Internet vortex trumps spending time with the people we love. In this way, the choices the brain hands down don't always align with what we might explicitly think of as the thing we value most.

Sometimes this is because external expectations are unreasonable, but sometimes it's within our control to make a different choice. And the value system is at the heart of these decisions to change, too. I began my career in the late aughts and early 2010s looking at what happens in people's brains when they choose to change their behavior. In a series of experiments, my graduate school adviser, Matt Lieberman, fellow graduate student Elliot Berkman, and I scanned people's brains as they responded to messages about wearing sunscreen and quitting smoking. After I became a professor, we continued with similar experiments encouraging people to exercise more and drive safely. Our goal was to identify what was going on inside people's brains as they considered how they might change, and then to see if they actually did. Back then, no one knew if it would be possible to link what we saw in a neuroimaging lab to actual behavior change. But when we started to see a pattern in the data, we realized that we had identified an important intervention point, one we could target to help people change.

We found that if parts of a person's value system, like a region known as the medial prefrontal cortex, ramped up their activity when they

saw a message about sunscreen or smoking or exercise, they were more likely to change their behavior to conform to the message—regardless of whether they said they consciously thought the message was effective. This offered our first glimpse of how the value system was linked to relatively high-stakes, real-life choices outside the lab. A plethora of other studies, by my team and others, have shown similar findings when people are deciding what to eat, what to buy, how much to save for retirement, and more.

At first we were only looking to see if activity in the brain correlated with the choices people made outside the lab. Once we saw that it did, we asked: *How can we use this to help facilitate change?* I believed that the answer was to somehow ramp up activity in the system, but it would take more than a decade of research to understand how.

During that time, in experiments ranging from giving people feedback about their peers' experiences, to helping them connect with their core values as a way of becoming more open to change, to comparing how the value system responds to immediate rewards versus those that lie in the more distant future, my team and others saw how simple interventions could dial value system activity up or down, which could ultimately help someone change their behavior. We discovered how changing where people put their attention—on different past experiences, current needs, or dreams for the future—*changes* the value calculation. This research also made it clear that activity in the value system captures something that goes beyond people's initial instincts about what they'll do next and can sometimes help explain the discrepancy we observed between what people say they will do and what they actually do.

As research on the value system progressed, we learned that the value system isn't only measuring what we think we *should* do in the abstract, or what we'd *want* to do if we were our best selves. There is so much more going on under the surface than the basic push and pull between desire and reason. The value system takes into account what we've done before and what the outcomes were. It asks: What do

I need, *right now*? The solution isn't simply to try harder, to will ourselves to make "good" decisions so that our self-control can override our baser impulses. When we understand how and why our brains make decisions, it highlights different inputs to the value calculation that we might focus on to shape the choices we make and how we feel about them. This reveals new potential intervention points, and each of those can represent an opportunity for change.

In this way, I like to think of understanding the value system as a means of having a flashlight in the cave—one that helps us gain clarity about what shapes choices for ourselves and others. My team and others have found that being clear about what we want and why is a key ingredient for happiness and well-being, but that people vary a lot in how much they tend to know why they are doing what they are doing. This understanding might make us more compassionate toward ourselves and each other, showing us that there are *reasons* we make the choices we do, even if our best selves might make a different choice or we wish we'd done something different in retrospect. But even beyond this compassion (which I'd argue can itself be transformative), this understanding can help us make *different* choices, maybe aligning our daily decisions better with our big-picture goals and values. Shining a flashlight around a dark cave might reveal a pulley that opens a door or a lever that reveals a skylight. Sometimes there are whole new pathways that we didn't know were there—they just weren't illuminated. If we know how the inner workings operate, it becomes easier to understand ourselves and others and to better navigate our way through, together.

As for me, I kept thinking back to what Bev had said. I had known for a long time that I wanted to spend more time with her, and she was right that the quality of time we spend together is different when we are at her house, just the two of us. There, we go for walks, run errands, or go through her clothes like I'm shopping in a fancy thrift store, all the while talking and connecting, with relatively few interruptions. But I also wanted to be seen as a hardworking lab director,

professor, and administrator, and amid the flurry of emails and deadlines, it felt hard to say to someone expecting a report or feedback by the end of the day that I wouldn't be able to do it because I needed to hang out with my grandma.

Even if my best self wanted to hang with Bev, my value system was also heavily weighing other immediate demands along with my identity and the opinions of those around me—maybe even more than I'd want it to if I took a step back and more actively reflected on which goals were most important to me in that moment. This is because the value system doesn't operate in isolation, measuring objective rewards and making the same choices no matter what. Instead, it interacts with other brain systems, including ones that deal in who we think we are (the *self-relevance* system) and what we think others think and feel (the *social relevance* system). These were hard at work when I prioritized other things over Bev. I understood myself as a hardworking leader in the lab I had founded, and I understood those around me as people who also prioritized work, maybe parenting, or even being up on the latest trash TV—but not hanging out with their grandmas. These brain systems were foregrounding that information in my value calculation as I considered what my options were for visiting Bev and how important it should be to me.

But Bev *is* important to me, and after her wake-up call, I wanted to change for her. Once I had clarity about that goal, I knew I needed to take a different approach. My research told me that the most salient inputs into my value system were giving me answers day-to-day that weren't aligned with how I wanted to behave. I also knew that one way to change what you think is to change what you think about. I had to find an opportunity to see the situation differently—to help my value system reach the conclusion that visiting Bev is the decision that most resonates with who I am and what I want.

Sometimes it begins with stepping back, noticing what inputs to the value calculation we are prioritizing, and asking, *where are the other possibilities?* Then, sometimes, we see something we hadn't seen

before, or a new voice changes the way we understand what was there in the first place. I started looking for a new intervention point, an unnoticed lever to pull.

For me it came from an unexpected source: the podcast *How to Save a Planet*, in an episode by Kendra Pierre-Louis encouraging people to ride their bikes more and capturing the joy that riding could bring to their lives. It's not that I had never ridden my bike in Philly before, but when I thought of riding in the city, I imagined speeding along the way bike messengers do and ending up sweaty and stressed weaving through traffic. Now, as I listened to people on the podcast teetering along on bicycles, laughing gleefully as they gained speed, I started to wonder if this was the lever I had been looking for. If I went at my own pace and used the bike lanes, not only could biking circumvent the traffic and logistical hassles of getting to Bev's house, it could make the journey itself fun.

On a bright fall day, the sun warm on my skin, I stood halfway up on the pedals as I glided down the sidewalk from my house to the corner. I accelerated to the recently repaved asphalt of a bike lane on Spruce Street, past the turrets of the frat houses before the smoother section of bike lane gave way to potholes, and bounced past the hospital complex, on toward the Schuylkill River. On the car-free path, light gleamed off the water, joggers passed people walking their dogs, and I passed the joggers. On my bike I could go fast, faster than running. It felt so free, as though the city—and everything it might have to offer—was available to me in a completely different way. And it was *fun*.

When I got to my grandmother's, we went for a walk, picked up what she needed at the drugstore, continued up her favorite winding residential street in the neighborhood, and looped around to say hello to the statue of General Pulaski behind the Philadelphia Art Museum (she thinks he's very handsome).

Doing it once made it easier to imagine doing it again; this visit gave way to more. Biking to Bev's helped me to feel good about a choice that I had realized was the right one for me—it tipped the

scales of my value calculation by moving the "getting there" part of visiting Bev from the aggravating side of the equation to the joyful side, which let me focus on the rest of what I love about those visits. I help her do tasks around her house, we go for walks, and I hear stories about her childhood, about raising my mom, about what it's like getting older. And that feeling of impossible effort? It doesn't feel as hard when I focus on what actually matters most to me, along with the joy of coasting on my bike, the chance to have fun with her, how I never regret having gone.

I still get that feeling of constriction at work when deadlines pile up, or with friends when I realize it has been years since we've meaningfully caught up, but these moments of self-clarity and corresponding change can open space, a crack for light to peek through, a possibility that wasn't there before. It starts with getting curious about why we do what we do, and then gathering possibilities to change. It can mean trying something new, even if you're worried you won't do it right, or listening to the perspective of someone very unlike you. Maybe this will allow other possibilities to take root, grow, and push the crack open a little wider, exploring, reaching out for a new way forward. Maybe you'll be able to see more as the tiny crack widens—and maybe not just for yourself but for those around you. It could mean encouraging your kids to try something that seems scary to them, or helping a colleague say no to adding something else to their overly packed schedule. These kinds of changes can seem small at first, but sometimes these choices mean a lot. After all, you make yourself with what you choose.

So how do we expand our possibilities for choosing? This book explores some key brain systems that shape both what we choose and why we choose. Once we understand why we do what we do, we can explore how we might more deliberately align our daily decisions with our bigger-picture goals and values. In the first part of this book, we'll explore the basic workings of the value system and the value calculation and how we can begin to influence that process. We'll look at

different ways of taking a step back to reflect on what is important to us, and we'll see how the way the brain naturally weights inputs to the value calculation may be aligned or misaligned with our bigger goals. In my team's research, we've found that this kind of increased self-clarity translates into greater well-being and a stronger sense of purpose. Understanding the value system helps us see why we make certain choices and can make us more forgiving of ourselves when we regret our decisions or more understanding when others make choices we don't agree with. This lays the groundwork for change.

In the second part of this book, we'll explore how we can change our own behaviors. We'll learn how the brain understands "Future You" much like a whole different person, helping us to understand why it can be so hard to convince ourselves to change by focusing on that future self—as when we try to motivate ourselves to exercise by thinking about how it'll help us live longer, for instance, or go to that networking event with long-term benefits to our career in mind. We'll look at how to turn this insight (and others) into tools for having more agency and bringing our daily decisions into alignment with our goals. With these tools, we can illuminate ways to find more joy and reward in the moment, as biking to Bev's did for me, and in doing so, work *with* the value system. We'll also see how defensiveness can get in the way of transformation. We'll inspect the self-relevance system, which provides inputs to the value calculation, and with this knowledge learn some techniques for becoming more open to—even seeking out—new perspectives, feedback, and change.

The third part of the book is where we'll broaden our lens to see how larger webs of influence interact with our social relevance and value systems to help us change or encourage us to stay the same—and how we can cultivate those influences a little more intentionally. There we'll see what happens in our brains when we communicate and connect effectively and when we don't. We'll delve into neuroimaging, highlighting how one person's brain can come into synchrony with another's, helping us to connect and communicate. In fact, in a

classroom setting, the more students' brains aligned with their teacher's, the more they learned. Likewise, teammates whose brain activity comes into sync perform better on certain kinds of problem-solving tasks. But we don't *always* want to be in sync; there are also benefits to divergence. People enjoy wide-ranging conversations more, and strangers working together on a complex problem strike better deals from exploring new ground. Understanding the value system's role in how we do and don't come together might help us forge the kinds of connections that can lead to our strongest routes of influence. It might help us come closer to the kind of role models we want to be and help us collaborate across differences to create the culture that we want to be a part of.

I hope that if you understand how your brain makes decisions, you might see more possibilities in how to create value for yourself and others. If you're feeling the constriction of cave walls, maybe it will help you to shine a light in a different direction, illuminating the levers that reveal new pathways, the pulley that opens a skylight. This might mean making a change in your own life, seeing a new way through the eyes of someone you admire, or working with others in your community to start a conversation about changes that no one person can make happen alone.

While on the surface this book is about how individuals make choices based on the brain's value system, what I really learned during this research—the bigger, bolder thing I walked away with—is that we have the capacity to consider a much broader range of choices than we think; that we never make a choice in isolation; and that we make ourselves, and the world we live in, with each choice we make.

So how can we embrace that capacity?

It will begin for us as it began for Ayana Elizabeth Johnson, the co-producer of *How to Save a Planet*—the podcast that helped me see a new path forward when I was stuck. Though she has made a career of helping people interact differently with the environment, Johnson's love of the natural world began when she was just eight years old. She

was in a glass-bottom boat, peering down at the clusters of different brightly colored fish moving through the coral reef, able to see the ocean from a whole new angle. Sometimes a new perspective can change a whole trajectory, a life.

For us, it won't be the ocean but another extraordinary and mysterious place: the mind. What's really in there? What's the value system up to? And how can we find a flashlight and begin to shine it around, looking for new answers to choices big and small?

A NOTE ON THE RESEARCH

To study the brain, my lab primarily uses functional magnetic resonance imaging (fMRI), which measures changes in blood flow in the brain as a proxy for neural activity. Since all the cells in your body need oxygen to work, and blood brings them fresh oxygen when they need energy, an fMRI scan allows us to get an idea of where neurons are firing most heavily (where the most blood is flowing). Through fMRI scanning, researchers can get a sense of how and where brain activity *changes* when people are presented with different stimuli, including visuals shown on a computer screen; audio played through headphones; and various tasks they can engage in by pressing buttons, using a joystick, or following along with their imagination.

Scientists use this technology to observe what is happening throughout the brain without necessarily having to interrupt people to ask what is driving their thoughts. This is significant, because such questions could change the very processes we are trying to observe: How emotional is this decision? Is your process automatic or more effortful? Are you relying on social thinking, emotions, basic sensory inputs, memory? How much of this is driven by your identity? Measuring brain activity gives scientists information that complements people's reports of their perceptions, preferences, and intentions, which helps us understand and predict their future choices.

In this book, we will explore a wide range of neuroimaging exper-

iments that use fMRI and that share these benefits but also some core limitations. In some areas of cognitive neuroscience, we know a lot about the function of different brain regions or networks of brain regions, so when we see those regions activate, we have a good idea about the types of thoughts or feelings people might be having. For example, seeing activity in the brain's visual cortex, scientists can pretty impressively reconstruct the type of image the person was looking at. But when we move beyond lower-level sensory experiences, things become more complicated. When it comes to higher-order thoughts about our own identities or how we make sense of other people and situations, brain scans can't reveal exactly what any individual is thinking. In the best cases, neuroscientists like me are making educated guesses. For example, we might infer from the activation of certain brain regions that people are experiencing a sense of reward or are thinking about their own or other people's thoughts, but we wouldn't know for certain, because most brain regions do multiple things. This means that we couldn't specifically see what thoughts they imagined that other person to be having or specifically whom they had in mind, since each brain region serves so many different functions.

Another major limitation of most of the neuroimaging research that I'll share in this book is that the research participants whose brains were scanned represent only a very small sliver of humanity. Functional MRI requires costly equipment that is typically operated at major research universities, and each brain scan is expensive. It is also convenient to study college students as participants. In part for these reasons, many of the early studies in this field were limited to white, Western, educated young adults; information about other important dimensions of participants' identities, like their religion and sexual orientation, often isn't measured or reported. In addition, the results we'll explore in this book come from averaging across many people's brains; since each of our brains works a bit differently, these findings represent some of what is common across the groups of people scanned, rather than what is true for everyone. Although more

recent work is actively trying to address this major gap in our knowledge, there's a ton we don't yet know about whether and how specific conclusions might change for different people, holding different identities, across different cultures and contexts.

Finally, this field is very new relative to other social and biological sciences. We are learning more and more about how human brains work, and how they vary between people and across time. This makes it especially exciting to do this work now, but also means there is still a lot to learn. This book is, in a way, a snapshot of what we understand now. I expect that, as with science itself, this understanding will grow and evolve over time. It is a powerful time to stand on this frontier and look toward the horizon.

PART 1

CHOICE

1

The Value Calculation

JENNY RADCLIFFE IS KNOWN online as "The People Hacker." There are many ways she describes her job: a "burglar for hire," a "professional con artist," a "social engineer." But officially, she's a "penetration tester"—a security consultant whom companies hire to break into their buildings and computer systems to help identify weaknesses in their security infrastructure.

Although Jenny sometimes uses physical force, lock picks, or computer code, her main tools come from psychology. She can read a person or a situation and predict how someone (or a group of people) will respond to her, depending on what she does. Then she can create a situation that moves her toward particular goals and outcomes.

This is just what she did when she was hired to break into a bank in Germany. Her mission was to enter the bank during business hours, get past security, and locate a particular office, where she was to plug a USB drive the company had given her into a computer. A program preloaded on the drive would then install itself on the computer, letting the company know that Jenny had successfully penetrated their security.

The morning of the big job, Jenny readied a costume and props.

She wrapped her hand and wrist in a bandage, figuring that people might be more likely to hold doors open for her if she appeared to be injured. She brought a big file box full of papers to occupy her hands, further increasing the odds people might hold doors for her. Thus prepared, she went to the bank, walked into a grand lobby furnished with leather sofas, and approached huge doors blocking access to the "employees only" portion of the bank.

Those doors presented Jenny's first of many obstacles. They were operated by fingerprint scanners, and of course, Jenny's fingerprint wasn't in the bank's system—she wasn't an employee, she was pretending to be one. But she walked over to the fingerprint scanner and put her finger on the pad anyway. It beeped—no luck. She hadn't expected the sensors to let her in, but as a penetration tester performing a security audit, it was still part of her job to check.

At this point, Jenny had choices. She could ask the security guard on duty in the lobby to let her in, but what incentive would he have to do that? It was his job to keep strangers out. So instead she did the obvious thing: she swore, really, really loudly.

Just as Jenny had planned, the security guard came over to see what was happening.

"You don't have to work on the lock," Jenny later explained. "Work on the person behind the security. It doesn't matter what they put in place; if someone's got access, then I can access them, and then we're down to me versus the person."

When the guard approached, Jenny said impatiently, "This isn't working. It was working yesterday." The security guard suggested that she try the fingerprint sensor again. She made a big show of being annoyed, cursing once more and awkwardly balancing her big box of papers on her bandaged hand. She tried again; the machine beeped again. Maybe she wasn't pressing hard enough, the guard ventured. She grudgingly placed her finger on the sensor again—at which point the guard took her hand and tried to help her press her finger onto the machine.

Jenny yelped in apparent pain and swore loudly once again. She made a point of dropping the file box, which scattered papers everywhere, and made a big show of trying to pick them up, all while swearing away. Now she had drawn attention to herself—people in the lobby were looking.

"For God's sake, go in," the guard said, and beeped her through the doors. "Thank you, danke schön," Jenny replied. And she was on her way—down the hallway to the designated office, where she inserted the USB key she had been given.

What happened here? Making a big commotion like Jenny did might not work for every person in every situation. For one thing, some people might be more influenced by being buttered up or feeling like they're doing someone a favor. For another, the same actions can be interpreted as more or less threatening, depending on the characteristics of the person doing them and the environment they are in. But in this case, Jenny felt confident that causing a scene would help her break into the bank because she knew that in Germany people generally feel highly embarrassed by a scene, and based on her gender and the way she looks, she wasn't likely to be perceived as a physical threat or a computer hacker. Under these conditions, making the commotion the most prominent thing in the guard's mind would tip the scales of his decision-making. She figured that the guard would perceive her as low-risk and would rather buzz her in than deal with the discomfort and disturbance of a spectacle. And she was right.

Maybe you feel tempted to harshly judge the guard for letting Jenny in. The bank's rules no doubt emphasized that he should not let strangers through the door. If Jenny had been a malicious hacker, the USB drive she plugged in could have uploaded a computer virus that stole customers' personal information and life savings or taken down important parts of the bank's infrastructure. But the truth is that many of us would do the same thing in that situation. We want to see ourselves as helpful, kind people, and much of the time other people aren't trying to deceive us. If Jenny *had* been an injured employee

simply trying to get into her office to do her job, the guard's actions would have been helpful to the bank, not harmful.

For better or worse, Jenny's understanding of these decision-making mechanics—the sometimes-unconscious, near-instant calculus we perform when choosing between options—and how they can be influenced enabled her to break into the bank. Recent advances in neuroscience allow us to understand more about the underlying systems in the brain that allowed her to do this, and that might allow others to resist, including one that scientists call the value system.

As we begin to explore the value system, which brings together many different types of information to guide our decisions, it may be helpful to imagine the thought process of the security guard when he was confronted with Jenny. His brain's value system would compute the value of different possible choices (allow the swearing woman to continue making a scene or buzz her in), select the one with the highest value (buzz Jenny in), then track how rewarding the choice is (now the scene is quiet, and I feel good that I helped an injured person). Much of the time, this value calculation happens quickly and seamlessly. Importantly—as Jenny understood so well—its outcome depends on what our brains pay attention to in the moment. In that split second, the value calculation can be shaped by any number of factors: our own goals, how we feel, our identities, what we think others will think and feel, other people's actions, cultural norms and expectations, our social status, and much more.

Jenny used her implicit understanding of the value calculation to gain access to the bank, as she had been hired to do. Now alert to this vulnerability, the bank, in turn, might take steps to ensure a different outcome to guards' value calculations in similar situations in the future. Making the guards aware of how Jenny broke in could empower them to exert more agency over their decision-making in such a moment and resist future attempts to hijack it in that way. Or, the bank might provide more opportunities for security guards to get

to know the other bank employees so that it would be clear when a new employee joined, as well as who was a stranger.

Of course, to think of all these options requires thinking along a number of different dimensions: checking in with the bank's big-picture goals, the security guard's goals, and where there might be room for greater possibility in the overlap. So what options, or combinations of options, would make it more likely that the security guard chooses differently next time? How might we become more aware of when our value calculations are being shaped by people who don't have our best interests at heart? To figure this out, it's helpful to know what's going on in our brains when we are confronted with choices.

KOOL-AID OR PEPPERMINT TEA?

One remarkable power of the value system is that it allows our brains to take complicated, messy, real-world decisions and boil them down into comparable quantities. Thus simplified, our brains are able to choose between options—often almost instantaneously and with a fair amount of internal consistency.

I find it useful to think of the value calculation as a hidden game of "Would You Rather?" You're probably familiar with this common icebreaker, in which one player offers two (ideally silly) choices, and other players say which they would prefer: Would you rather have a cat's tongue or roller skates for hands? Would you rather be able to speak every language or have the most beautiful singing voice on earth? Would you rather live alone on a desert island with all the movies and books ever made or with one other person you choose, but no media?

When you think about it, it is borderline magical that you *can* answer "would you rather?" questions, comparing alternatives that differ in so many ways. From low-stakes situations like playing the

game "Would You Rather?" at a party, to the decisions that determine our actual behavior each day, our value systems help guide us to our choices. But *how* does the brain do this?

For a long time, no one knew the answer. Did the brain have different systems that each monitored different dimensions of a choice? (How much sugar or salt is in each food we are choosing between? How hot or cold is each food? How green is each food?) Or were there different brain systems that would handle choices in different domains? (A brain system that decides what kinds of foods we want to eat, a different brain system that keeps track of how much fun each of our potential dinner companions is, and a third that handles the financial decision about whether we can afford to eat out?)

The foundations of how we currently think about the neural underpinnings of this kind of decision-making were laid in the 1950s by researchers who mapped a set of brain regions that tracked simpler types of rewards and that guided animals' behavior to maximize those rewards—even if choosing the reward was objectively bad for the animal's well-being in the longer term.

James Olds and Peter Milner, scientists at McGill University in Canada, discovered that when given the chance, rats repeatedly pressed a lever that triggered electrodes that stimulated particular parts of their tiny rat brains that made them feel good. In other words, the rats found it "rewarding" to stimulate these parts of their brains, and scientists at the time began to think of the regions being stimulated as the "reward system." It turned out that stimulating this reward system had powerful consequences for the rats' behavior. For example, when rats were given the chance to press a lever that stimulated these reward regions, they would even forgo food that they needed to stay alive.

And it wasn't just rats. Scientists soon found parallel reward systems in rhesus monkeys and eventually came to learn that all mammals had similar infrastructure in their brains. Across species, when scientists stimulated neurons (the cells that transmit messages through the

nervous system) deep in the brain in a region called the striatum and in certain regions in the front of the brain (frontal cortex), the animals seemed to experience reward, as evinced by their tendency to seek out the stimulus over and over. Like humans, some animals also displayed facial expressions or made sounds showing their pleasure. But although it was clear early on that stimulating specific reward regions caused animals to want things, it took several decades for scientists to understand how this translated into more complex decision-making in humans. Why would a system that tracks how much food you want or how much you want to press a lever have anything to do with whom you want to be president or which movie you want to see? Could a single brain system really handle comparing choices that take place at various points in time (now versus later), concrete rewards like which snack to eat, and abstract questions about society and morality?

A series of important insights about how brain systems make more complicated calculations about the relative values of a wider range of goods and ideas came in the mid-2000s—one of them through offering Kool-Aid to monkeys. Camillo Padoa-Schioppa and John Assad were researchers at Harvard Medical School studying decision-making and economic choices when they wondered whether the reward system discovered in rats and other animals could also help monkeys make somewhat more complicated decisions, and if so, how? On the one hand, they reasoned, it was possible that regions of the reward system might respond to objective properties of different potential rewards (like the amount of sugar in a juice). This might be the case if a particular nutrient, like sugar or fiber, had been important to the survival of the species in the evolutionary past, and a physical feature of the food, like color or firmness, was a good indicator of how much of this nutrient was present in it. If so, there should be a tight correspondence between certain biological or chemical properties of foods and the response of the reward system. On the other hand, what if the reward system could take a wider range of things into account, to make more subjective calculations? Could it explain why a monkey might have

different food preferences at different times—or even predict what a monkey was in the mood for?

In their experiments, Camillo and John would present a monkey—let's call him Gizmo—with a series of choices while recording the activity from neurons in his brain. Would Gizmo like one drop of lemon Kool-Aid or two drops of peppermint tea? Five drops of milk or one drop of grape juice? Gizmo would look left or right to indicate his decision.

After many of these choices, the researchers could calculate how much value Gizmo assigned to each drink relative to the other drinks—what neuroscientists now call its *subjective value*. We say the value is subjective because it turned out not to be fixed to some objective quality like the density or overall amount of sugar present in each liquid, the exact temperature, the quantity of liquid, and so on. The scientists found that Gizmo and other monkeys generally preferred to have more to drink, if possible, but, like humans, they liked some drinks (specifically, lemon Kool-Aid and grape juice) more than others. Depending on the offer, the monkeys would sometimes choose a smaller amount of their preferred drink over more of one they liked less. By offering the monkeys the drinks in different ratios, Camillo and John could arrive at a mathematical description of the monkeys' preferences in each session. For example, if Gizmo was really in the mood for grape juice in one session and chose one drop of it over up to three drops of water, then Camillo and John could say that one drop of grape juice was worth three points, while one drop of water was worth one.

While hanging out with the monkeys, Camillo and John also found that subjective value was influenced by the *context* within which the decisions were made: the monkeys' drink preferences (that is, the relative value of one drink to another) varied from day to day—even for the same monkey. Imagine that you yourself are at someone's house and they offer you a cup of coffee or a cup of lemon-ginger herbal tea. Your decision depends partly on stable preferences you have (you

typically like coffee more than lemon-ginger tea), but also on the situation (it's late and you worry that caffeine might make it hard to sleep). Similarly, on Tuesday Gizmo might prefer grape juice to water 3:1, but on Friday he might feel less strongly because he's already had plenty of fruit and may prefer the grape juice to the water only 2:1. This is what "subjective value" means—different aspects of a situation change how much something is worth to someone, at a given time, in a given situation.

When Camillo and John looked at the data from the monkeys' brains, they discovered that neurons in the front and center—specifically, a region called the orbitofrontal cortex—fired in response to each monkey's overall *subjective* preferences for the juices. The activity in these neurons correlated with the overall ratios Camillo and John had calculated based on the monkey's decisions—when the monkey preferred one option three times as much, these neurons fired correspondingly more. Interestingly, the firing didn't seem to depend on objective aspects of the choice, such as the specific ingredients of the drink (if, as you might think, there were neurons tracking the amount of sugar), which side of the screen showed the offer (if neurons here kept track of what motion the monkey needed to perform to get juice), or how many drops of juice were offered in total (if more is always better). Instead, the neurons tracked the overall, *subjective* value.*

And this subjective value was tied to the choices the monkeys made. Just by seeing what was happening within Gizmo's orbitofrontal cortex when he was shown the different options, Camillo and John could

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* Neuroscientists sometimes use the words "reward" and "value" interchangeably, though "value" commonly refers to expected outcomes, and "reward" the actual outcome. Other researchers think of the process of calculating value as a more deliberate, cognitive process, whereas the experience of reward is more basic and pleasure-based. In this book, we will often use these words interchangeably, though the basic idea that animals have a reward system has been around for much longer than the recent insights about how the brain makes more complex calculations related to what we value.

predict which choice Gizmo might make with remarkable accuracy. In other words, the monkeys' brains were computing subjective values for each option on a common scale that allowed them to make decisions and compare apple juice and orange juice.

But what about humans? Around the same time that studies on monkeys revealed that their brains responded to subjective (rather than objective) value, scientists began to find similar responses in the human brain. In the span of a decade or so in the early 2000s, scientists ran hundreds of experiments mapping what happened in people's brains when they made choices based on these subjective preferences.

In one early study, the neuroscientist Hilke Plassmann and her colleagues at Caltech found that when they measured how much human volunteers were willing to pay to eat different snacks, they showed similar activity in brain regions analogous to those the monkeys used to choose between lemonade and grape juice. The team showed pictures of salty and sweet junk foods, like chips and candy bars, to hungry humans while scanning their brains using functional magnetic resonance imaging (fMRI). This type of brain scan lets scientists see when different parts of the brain are active and then connect this activation to different psychological processes and behaviors. The volunteers in Hilke's study were told they had a specific budget and were asked how much they would be willing to pay for different food items, shown as images on a screen in the fMRI scanner.* As in the case of Camillo and John's monkeys, brain activity increased the most within a similar region in humans—the ventromedial† prefrontal cortex—

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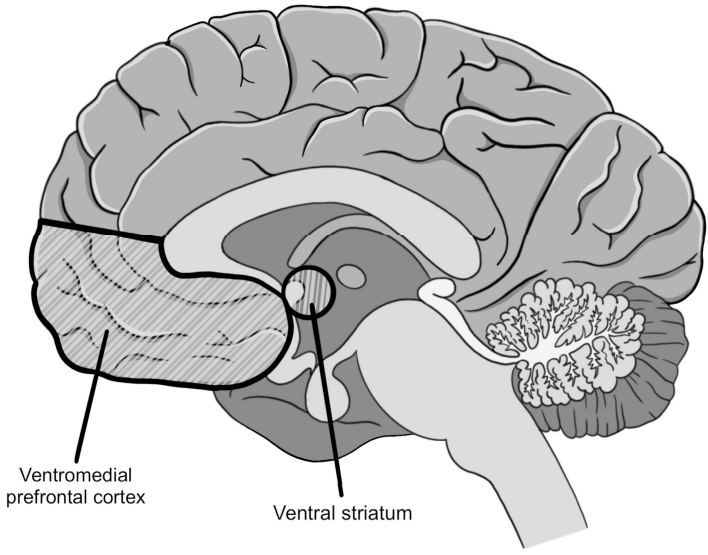
* Importantly, once the volunteers got out of the scanner, one of the snacks was randomly selected, and if the price they had been willing to pay was equal to or lower than the actual price of the food, they would receive the food, along with change from their budget. If the actual price of the food was higher, they would simply receive the total budget in cash as payment at the end. This incentivized participants to report a price they were truly willing to pay for each product, revealing their honest preferences and therefore encouraging them to behave just as they would outside the lab.

† The ventromedial prefrontal cortex is the lower portion of the broader medial prefrontal cortex.



The ventral striatum and ventromedial prefrontal cortex, pictured here, are key regions in a broader system that tracks subjective value when people make decisions across many domains.

for the items they rated as most valuable. In other words, there was more activity in response to snacks they were willing to pay $3 for than snacks they were willing to pay $1 for or didn't want to buy at all. People's brains kept track of the subjective value (to them, personally) of different foods, and chose accordingly.

This was a breakthrough—but in daily life, we often have to choose between options that are harder to compare than two kinds of snack foods. Could the same brain regions that decide if you'd rather drink coffee or tea also compare things that are rewarding in very different ways—for example, would you rather drink grape juice or go see a movie?—or did such choices go beyond their role in decision-making?

To probe this question, a team of scientists at Caltech and Trinity College Dublin designed an experiment that was, in essence, a variant of the "Would You Rather" dilemma: The research team gave volunteers in an fMRI scanner a $12 budget that they could use to bid

on different types of goods, from sweet and salty snacks, to DVDs, Caltech memorabilia, and monetary gambles. They found that an overlapping area of the ventromedial prefrontal cortex tracked how much people were willing to pay not only for different foods but also for products like college memorabilia and DVDs. Around the same time, other groups of scientists were also finding that activity in the human medial prefrontal cortex and other regions, like the ventral striatum, tracked people's willingness to pay different prices for a range of consumer goods. These findings suggested that a common system was keeping track of the value of a wide range of different kinds of choices.

As this body of research grew, this group of brain regions, including the ventral striatum and ventromedial prefrontal cortex, came to be known as the value system. By 2010, activity in the value system had been shown to track not only people's decisions about how much money they would pay for different goods, but other kinds of financial choices as well. For example, would you prefer to take a 100 percent chance of winning $10 or a 50 percent chance of winning $20? Would you rather have $10 now or $20 in six months? All these types of choices seemed to work through a similar mechanism in which the value system identified and assessed the subjective value of different choices, compared them, and then acted.

By 2011, researchers could even predict, based on activity observed in volunteers' value systems while they were looking at different goods, what they would later choose—even when they weren't asked to make any choices during the initial scan. In other words, the value system seems to track the subjective value of different things regardless of whether the person is consciously trying to make a decision about them. When we're in line at the grocery store, our value systems are weighing the value of the candy bars by the register and absorbing information from the news headlines and magazine covers. When we're scrolling through social media, passively consuming ads, our value systems are still registering the inputs, even if we aren't actively paying attention to them.

A decade later, it is now more widely accepted that our brains can make calculations using a "common value" scale that allows us to compare things that aren't inherently comparable. You could probably easily decide if you'd rather snuggle a puppy or have $5 right now. This is because your value system converts each option onto a common scale and makes the comparison. Likewise, when Jenny yelled for the security guard, he quickly made the decision to try to help her use the fingerprint scanner, rather than demand ID, and eventually to let her through the doors, rather than calling for backup, asking her to leave, or asking her on a date.

PREDICTING AND LEARNING

It's tempting to think there are *good* choices and *bad* choices, but the truth is that these are moving targets, and the value system is dynamic, constantly weighing competing interests and the context. This means that the choices we make depend on what options we imagine we are choosing between and what dimensions of the choice we focus on. If your kid has never met a male nurse, it might constrain the career options he imagines choosing to suit his empathic personality. Moreover, the subjective value we assign to a given choice option can change, depending on a variety of factors related to our past experiences, our current situation, and our future goals. If your kid believes you'd like him to get a job that helps a lot of people, that dimension might weigh heavily as he considers career options. Likewise, if his crush gushes about Austin, Texas, that might cause your son to give weight to the geographical flexibility of different job options. This is one neural foundation of what social psychologists call "the power of the situation": our decisions depend on our current context, which gives certain inputs to the calculation more weight.

Let's say you're deciding whether you'd rather eat a salad or chocolate cake. If your brain only followed "objective" rules, you might

only care about how much the food filled your stomach or how many calories it offered (which could translate directly to keeping you alive in earlier moments of human evolution). But that's not how it works. As you have no doubt experienced, when you decide what to eat, you might focus on any number of things: how does the food taste, how will you feel after eating it, what is your date eating, did you just get a bad doctor's report, do you have a great metabolism, is it someone's birthday, how much does each cost, did you just run a marathon, are you in a bad mood? Your brain does this quickly and may not even take into consideration all these dimensions, limiting what it weighs in any given choice. Based on what factors it does weigh, your brain can compute subjective values for salad and cake on a common scale, then choose the higher-value alternative.

Once you've made the choice, your value system transmits it to the parts of your brain that help you act on the decision, like reaching out and grabbing your chosen food and eating it. Importantly, your brain's value system then keeps track of how good the decision's outcome was, relative to what you thought would happen—in other words, how accurately it guessed how rewarding the choice would be. It tracks not only your prediction (That cake looks delicious! I remember how much fun I had at birthday parties as a kid!), but the *prediction error*, or the discrepancy between your prediction and the actual outcome. If the choice ends up being more rewarding than you expected (That cake was delicious! Totally worth it!), your brain generates what neuroscientists call a "positive prediction error," seen as an increase in activation within the value system after the choice; conversely, if the choice ends up being worse than you thought (That cake made me feel gross!), your brain generates a "negative prediction error," seen as a decrease in activation within the value system after the choice. These prediction errors help you learn for the future, updating how your brain makes the value calculation over time.

In sum, there are three basic stages to what neuroscientists call

value-based decision-making. First, our brains determine what options they are choosing between, assign a subjective value to each one, and identify the option with the highest value *in that moment*. This means that from the start, our choices are shaped by what we consider the possible options in the first place. Next, our brains move forward with what is perceived as the highest-value choice (which may or may not be the *best* choice in the context of our larger goals or longer-term well-being). This means that there isn't one single right answer, and what our brains perceive to be the "highest-value" option right now might change if considered from other perspectives (for example, when thinking about career goals versus wanting to be a good friend). Finally, when we've made the choice, our brains track how rewarding it turns out to be, so they can update how they make the calculation next time; this means that we often overweight the outcomes of our choices rather than improving our process. This highlights at least three places where we can intervene: we can imagine more (or different) possibilities; consider the existing possibilities from different angles; or pay attention to different aspects of the outcome.

We can think again of our security guard. If, as the guard, you buzz in a bumbling person making a scene and it yields a better social reward than you had expected (the person gives you a big, grateful smile and tells you how much she appreciates you), your brain will generate a positive prediction error, that data will be stored, and in the future, you will be more likely to let in the next bumbling stranger. But if something bad happens and the outcome is worse than you anticipated (the bumbling person turns out to be a security tester and your colleagues are annoyed with you because now you all have to sit through extra training sessions), your value system stores that too. Next time, you might think twice before letting in a stranger.

But, of course, no one scanned the brain of the security guard. Most of the studies we've explored so far have taken place in highly controlled lab settings. So what actually happens outside the lab, in

the real world? Can we link activity in the value system to what people do in their day-to-day lives outside the brain scanner?

A GREAT DAY FOR SCIENCE

I was a budding neuroscientist in the early 2000s, when our understanding of the value system first started to take shape, and I was interested in whether brain imaging could give us insight into health decision-making. I wanted to help people make choices that would help them live healthier, happier lives, but I also knew that these choices could be very difficult to make. It's hard to change, and even when we *are* motivated to change, we don't always take time to figure out why we do what we do in the first place or know why some ways of thinking are helpful in achieving our goals, and some aren't.

I was thinking about how to make better health coaching and messaging campaigns. I was also thinking about how we might talk with our family members and friends, roommates and colleagues, to help motivate them to make healthy changes, and even how we might talk to ourselves to make decisions that are more in line with our goals. I wondered if brain imaging could give us a new window into this decision-making. Maybe looking at brain responses to health campaigns and health coaching messages could help us understand what made people change and what would make it easier to work with, rather than against, our desires. If that were true, maybe it could help us design and select better messaging.

I decided to apply to graduate school to work with Matt Lieberman at UCLA. Matt's lab was full of scientists studying how people understood themselves and others and how they made important decisions. Along with a group of other young faculty, Matt had recently ignited a new field of study that combined social psychology with cognitive neuroscience; whereas neuroscientists before had focused on topics ranging from vision and memory to reward and motor actions,

many fewer had delved into topics that were more at the core of being human, like where our sense of self comes from, how we understand what others think and feel, and how imagination works.

At the time, it felt like a long shot to connect what happened in a neuroimaging lab to real-world behavior changes outside the lab. But it also felt fundamental: what good was all this research if it couldn't help us in real life? Luckily, during the years I was in graduate school, we *did* start to see a connection: a pattern indicating that activity in the brain's value system could reveal who is more likely to change their behaviors in response to messaging and what kinds of messages were most likely to elicit this kind of activity.

The first work we did in this space focused on sunscreen use. In Los Angeles, where it is sunny almost every day, I had a daily reminder that—despite how great the sun feels warming your skin—sunburns and other invisible damage from UV rays can cause skin cancer. Matt and I designed an fMRI experiment, scanning the brains of volunteers while exposing them to messages about the importance of wearing sunscreen every day.

The finding was simple: the more activation we saw in a person's value system—specifically, the ventromedial prefrontal cortex—in response to the messages, the more likely they were to increase their sunscreen use in the next week. It suggested that the value system helps guide not only simple choices that people make in the lab but also real-world, consequential behavior change outside the lab.

When I saw the data, I started jumping up and down on the lab couch. My friend and then-officemate Sylvia claims that I screamed, "This is a great day for science!"* While I don't know if nonscientists would be this excited about a data plot, it felt like a big moment. And although this initial study relied on what people told us about their sunscreen use, later studies in the lab I now run at the University of Pennsylvania and others have shown similar results in people being

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* I deny it.

coached on other health habits, where behavior change has been measured more objectively.

When sedentary adults were exposed to messages encouraging them to get more exercise, the activity in their value system corresponded with how much exercise they got later, measured objectively using wrist-worn activity trackers. Similarly, smokers whose value systems responded more strongly to messages encouraging them to quit smoking were significantly more likely to reduce their smoking over the following month, which we confirmed using a device that measures how much carbon monoxide smokers have in their lungs. In fact, our ability to predict how much people would reduce their smoking was twice as good when we included information from both brain responses and self-report surveys as when we included only information from the surveys. This suggests that there was useful information that the value system captured that was not fully captured by surveys alone. Figuring out why this is the case, and how far in the future we can predict, is a current frontier.

Another current frontier involves understanding when and how people make the kind of deliberate decisions that we'll mostly focus on in this book, compared with other kinds of decisions. For example, it is increasingly clear that a lot of what humans do is guided by habitual routines—which is not the kind of choice we'll be discussing. But some of these habits start with deliberate choices, which *is* our focus. To illustrate this distinction, let's consider my walk to work.

When I first moved to Philadelphia, I wanted to walk to work, rather than drive or take the subway, so I'd get outside more—that was an active choice. I used my phone's map to find the shortest route, and following my phone's map was also an active choice. Over time, as I repeated this walking route over and over, it became a habit—something I could do (and did) on autopilot, whereas other options like driving, taking the trolley, or even walking a different route require more conscious thought. In other words, when repeated over and over, what start as goal-directed, value-based

decisions become routine and get handed over to another brain system that supports the kind of automatic pilot I was on. This book explores what happens in the first type of decisions—when we are more deliberately choosing and setting in motion paths that may (or may not) eventually become habits.

CHARTING A NEW PATH

My partner, Brett, and I don't usually walk to work together, but one morning the stars aligned to make one of these mini-dates possible. Then, as we set out, Brett turned down Osage instead of walking up to Pine. *This isn't the right way to campus*, I thought, annoyed. But as we walked, he pointed out beautiful buildings, interesting turrets, arches, and other charming details he likes about the fraternity houses that line that street. He had discovered them by investigating different routes to work every morning. Instead of going on autopilot like I typically did, he had decided to take advantage of his morning walk to work as a time to see new things, a series of small adventures that enriched his day. The various paths from our house to the University of Pennsylvania are all pretty much the same length, so it wouldn't even cost me time to try something new. It might even lead me to discover more of the world around me, have more interesting things to share with people I care about, and just generally be the kind of person who looks for little adventures each day. What other opportunities was I missing?

This makes it worthwhile to do an audit every once in a while and to work toward developing an awareness of *why* we do what we do. What are the everyday choices we're making? How are we making them? Are there new choices that we can make or ways to choose differently? Are there possibilities we haven't even considered? And are the choices we are making really serving the lives we want to lead, the people we want to be?

Although this is a bit oversimplified, what we do when we ask these questions is bring into play brain systems that can help probe and shape the value system's workings.

In fact, the value system works in coordination with many other brain systems, including sensory inputs (what am I seeing, hearing, smelling, touching, tasting?), memory systems (what has been rewarding to me in the past?), and attention systems (where is my current focus?). Brain systems involved in reasoning and regulating our emotions can also change how much weight we give to different inputs. For example, as we'll explore more in Chapter 4, I might give more weight to how tasty or how healthy different foods are, depending on my goals. By observing what happens *throughout* the brain when someone is presented with a choice, neuroscientists like me have seen that the value system synthesizes and uses many kinds of information to arrive at a decision.

In the chapters that follow, we will put special focus on two brain systems that influence valuation and have emerged as especially important in decision-making. The first, called the *self-relevance system*, helps us understand ourselves. The self-relevance system is concerned with questions I call "Me or Not Me"—questions like: What do I care about? What has happened to me in the past? What might I do in the future? Although the details vary from person to person and context to context, in general we categorize things in terms of their personal significance to us (whether they are "relevant to me" or not), which in turn shapes how much effort we put into making the choice and also shapes the personal rewards we expect from different choices. The brain then creates the feeling that something is "me" or "not me" in relation to what I like and value. Jenny likely used this brain system to summon her confidence that she's the kind of person who can pull off a stunt. In turn, the guard's self-relevance system may have reminded him of an identity as a helpful person. A helpful person would assist the struggling employee who was having trouble with the fingerprint scanner. Whether a given option feels like "me"

or "not me" can influence the outcome of the value calculation, as we'll explore more in Chapter 2.

Another key input to the value calculation comes from the *social relevance system*, which helps us understand what other people think and feel: What do *you* care about? What knowledge do *you* already have? What might *you* do next? This knowledge helps us think through more specific questions, like: Why didn't you answer my text message? Do you like jokes? How will you respond if I hug you? The human brain has evolved to help us make sense of other people and to evaluate what someone else might think and feel. Jenny was using this brain system when she formulated her plan to break into the bank, guessing about how the security guard would react. In turn, the guard's brain was likely leaning on input from his social relevance system when he saw the effects of her commotion and made the decision to buzz her through. Our social relevance system allows us to simulate (sometimes accurately, sometimes not) what happens in other people's minds, and the value system uses this information to guide our own choices. We will explore the social relevance system more in Chapter 3.

As a neuroscientist and as a person, I find this knowledge empowering. Knowing how flexible, dynamic, and influential the value system is—how many different factors it is able to weigh in a given choice—helps me to appreciate my own and others' ability and potential to change, adapt, and grow. Once you understand how the brain assigns value to different options, you can view the decisions you can make with a broader lens. I like to think of it as a way of exploring the question, Where is the possibility? It's a way to direct a flashlight around in the dark, finding crawl spaces, escape routes, and paths forward that you might not have otherwise realized were there. As we've seen already, the value our brains assign to any given option is never fixed. Your behavior isn't determined solely by your genes or your education or your personality, and it is highly dependent on context and culture. Understanding this, someone like Jenny can guess some of the factors

that go into a person's value calculation and construct a situation that spotlights those that serve her goals. But it doesn't only help faux bank robbers. By understanding these principles, leaders at the bank might see the situation from the guard's perspective and offer solutions that appeal to the security guard's identity as a helpful person, while also protecting the bank. In the same way, we can influence what our own and others' value calculations focus on and in so doing potentially change the outcome—bringing our daily choices in better alignment with our bigger goals by expanding the range of possible options before us, and noticing where we might be vulnerable to influences that go against our goals and values. But to understand what these possibilities are, we first need to understand who we think *we* are, at our core—and what that has to do with the way we make choices.