THE ALTRUISTIC BRAIN

How We Are Naturally Good

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WITH

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2015

OXFORD
UNIVERSITY PRESS

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ALTRUISTIC BRAIN THEORY INTRODUCED

So far, we have examined biological approaches to how reciprocal altruism evolved over several millennia. The narrative is a timeline of hard scientific evidence that describes how humans' basic instincts—parenthood, sex—led even the earliest people to become unalterably communal. It was human instinct wired into our brains that enabled us to form crucial bonds, to care for each other because it seemed natural and because communities offered a form of well-being superior to that felt by remaining on one's own. In terms of explaining how *Homo sapiens* got to be recognizably human, therefore, no single approach is more powerful than evolution. Humans feature complexes of personality traits that have stood the test of time and allowed them to develop a basic, shared, indeed universal personality substrate. The point of dwelling on "evolutionary biology" for an entire chapter was thus to demonstrate that altruism is not something that humans recently learned as life became more "civilized." To extend the theme further, it is also not something that we discovered along with the development of religious morality. Altruism is as much a part of us as the desire for a mate or concern to protect our children. We do not have to think about it when the occasion presents, just as we don't have to think about whether sex is interesting. It just is.

But just as evolutionary biology is essentially a trajectory of how-we-got-here-from-there, so is of the idea of Altruistic Brain Theory (ABT), albeit on a much compressed timescale. How, over the course of some few hundredths of a second, do our brains make us swing into action to help another person? This book explains altruistic behavior for the first time by reviewing hundreds of scientific papers that coalesce into support for a five-step theory of how altruistic action occurs. It does not "just happen;" rather, we are unconscious of discrete *steps* that our brains take to bring us to that point. Part of our evolutionary adaptation is that our brains do not stop to reflect when we are about to be altruistic; if they did, we might not act, as sometimes altruism involves personal risk. Think, for example, of Wesley Autrey, or the school personnel in Newtown, Connecticut who jumped on top of five- and six-year-olds in their charge to shield them from a rampaging gunman. Nonetheless, there is a series of definable, neuronal/hormonal activities that our brains undertake before we can actually behave altruistically. Until now, neuroscientists have described elements of a mosaic that, had they been assembled in just the right order, might have constituted a similar theory. Yet though the constituent knowledge was available in the literature, no one ever made the leap. ABT thus represents the first time that our knowledge has been synthesized into a comprehensive neuroscientific approach to altruism.

An historian or philosopher of science might ask why, when knowledge of the brain has been accruing for decades, no one ever saw how the pieces could fit together into a *brain mechanism* for altruism. Why didn't anyone even try? As stated in the Introduction, there were plenty of institutional reasons why scientists might have shied away from this topic. Among those were neuroscientists' needs to attack easier and clearly solvable problems. Plus, scientists are eager to show quantifiable results. It may also have been because scientists always cited evolution when they sought to explain altruism. Hence the question got pigeonholed in evolutionary biology.

But evolution, which is crucial for demonstrating that the biological sources of human altruism have run deep through time, does not explain how altruism actually works, right now, on a neuronal/hormonal level. In *The Neurophysiology of Mind*, the Nobel Prize winner Sir John Eccles speculated that God somehow designed the brain to produce altruistic behavior. But that is simply not a scientific theory. Accordingly, while I wish that I could say that I am intervening in a vigorous scientific debate about how brain mechanisms produce empathy and altruism, in fact there is very little debate because the problem has not been the focus of research. Lately, the psychologist Richard Davidson, who is discussed later in this book, has shown that if we practice morality the brain will actually develop pathways that reinforce that behavior. This is an important insight and draws attention to the connection between morality and brain mechanisms. But even Davidson does not broach the idea that the mechanisms for moral behavior exist in our brains from the day that we are born. What I want to do now, therefore, is to demonstrate how all the latest science leads us to specific, definable neuronal/hormonal mechanisms that necessarily entail altruism, such that mechanisms for altruism are literally built into the brain.

ABT explains exactly how altruistic behavior happens when it happens. The theory comprises a surprising convergence of decades of neurophysiological evidence gathered in laboratories all over the world. My expertise in this area comes from producing and studying data from several areas of neuroscience—neuroanatomy, neurophysiology, behavioral neuroscience, and molecular neuroendocrinology—and bringing them together in ABT, which explains the best, most prosocial features of the vast majority of human social behaviors. But how does it work?

This chapter, therefore, asks (and answers) this question: *What brain mechanisms operate to impel us toward mutual concern, and indeed toward a virtually instinctive disposition toward acting on those concerns?*

In the simplest terms, how do we accomplish the altruistic acts that nature programmed us to perform? It is crucial that we understand this "how" if only as an exercise in self-exploration. Humans are curious about themselves, and the brain is our most complex organ, one that affects every other organ in our bodies. To understand the brain—to appreciate it—is therefore not just for neuroscientists. At the other extreme, neither is it just for philosophers who seek to extend our understanding of the brain into theories of how we experience the world. If the average person would have a basic understanding of metabolism, sleep, and other physiological functions (which, by the way, the brain controls), why shouldn't he seek to understand at least one phase of how the brain orders the moral equivalent of these basic functions, what we might call their temperament? Obviously, he should.

As a corollary, if we are ever to systematically address our own self-improvement, then knowing where in the brain to start would obviously be necessary. Social engineers come in every stripe imaginable, but they are all mostly hortatory, appealing to everyone's desire to live in a better world without yet getting down to the one organ that actually controls behavior. Of course, culture is indeed a *backdrop* to any aspirational activity, but starting with the brain provides the sort of instant credibility that, say, an abstract appeal to "fighting poverty" does not. We can all agree on the brain, and an understanding of its functions can help us agree on addressing our shared, human concerns in a way that is as culture-neutral as it is possible to be.

Moreover, by realizing how the brain naturally favors altruistic behavior, we can bolster our confidence in humanity's own best instincts, as well as society's confidence in the various social tools that rely on trust. (I discuss these in Chapter 7.) When you look around right now, be it at our squabbling Congress or the various rogue nations developing atomic weapons, it is easy to be pessimistic about ever improving the human condition. But there is still a great deal in all of us that can inspire hope. ABT seeks to establish a degree of scientific reliability in our expectations about human behavior. If we can count on ourselves to display an instinctive altruism—if altruism is our default position—then we can potentially believe that cultural differences are not insurmountable, and that the brain holds out the promise of our working together. As I observed in Chapter 1, such "working together" is how we were *wired* to behave as we evolved. Indeed, ABT is powerfully predictive of how our brains will compel us, over the long haul and in the great majority of instances, to behave well toward one another, both individually and in groups. Altruism will carry the day. As a species, it is our destiny. We cannot allow ourselves to become stymied by the outcrop of bad, even egregious behavior. In the aggregate, we are *going* to display socially useful traits. The point is to develop mechanisms, personal and social, to harness this built-in proclivity. As this book demonstrates, ABT can provide the basis for new initiatives that clear away the impediments to prosocial behavior and allow people to perform *on a regular basis* in accordance with their potential.

This is not a blithely futuristic claim. This book contends that if bad behavior represents a very small proportion of people's actions, then ABT explains the rest—that is, all the tremendous amounts of good behavior. It does so, furthermore, without making extraordinary assumptions about the brain's reasoning abilities. Step by inexorable step, the theory shows how the brain produces altruistic behavior in quite a surprising way: not by relying on greater information processing than usual, but by actually cutting back on the precision of the information flow. Actually, ABT theory says that we do "more" with less overall data.

This chapter will therefore do three things. First and most importantly, it will lay out the details of ABT. Second, it will provide a glimpse of the large amounts of neuroscientific evidence that proves each step and that will be explained in detail Chapter 3. Third, to follow the details of ABT in terms of a real-life event, we will consider a striking example: Stephen Siller. Siller, an experienced New York City fireman, was going to play golf with his brothers on his day off, September 11, 2001. He was in Brooklyn. When he learned about a plane hitting one of the Twin Towers, he drove to the Brooklyn Battery Tunnel, ran through it carrying more than 50 pounds of fire-fighting gear, and made his way as quickly as possible into Manhattan. Once there, another fireman brought him to the towers, where he died during a rescue attempt. So how do we explain Siller's altruism, as well as that of 343 other firefighters and first responders who lost their lives on 9/11 trying to help others? What are the brain mechanisms of such incredible altruism, and of millions of everyday acts of kindness?

ABT tells us that within a few hundredths of a second after we realize a need for action our brains will make the decision for altruistic behavior. It's hard to imagine that it all happens so fast, but the entire task of neuroscience is to analyze and describe what is essentially imperceptible in real time. In this sense, neuroscience is unlike, say, cardiology or most medical disciplines, which can literally watch the body in real time as it functions. In neuroscience, we have to understand the brain's deep structures and functions, and describe what is virtually impossible to capture in a stop-time photograph. *The brain is that fast.* It is in this mode, describing what we can illustrate in a diagram but cannot see as it unfolds, that I present the steps of ABT, together with just a "snapshot" of the scientific proof cited in the next chapter. Moreover, because the steps identified in ABT issue in an action—rather than, say, an ongoing physical condition—the theory has an abstract quality that does not lend itself to the examining table. But if you think about it, it's in this very sense that it shares in the basic aspect of how we live most of our lives. That is, we *don't* examine the vast majority our actions in advance. So it is in this everyday sense that I present the theory, which comes in five definable steps.

STEP 1: REPRESENTATION OF WHAT THE PERSON (IN THIS CASE, SILLER) IS ABOUT TO DO

This step of ABT does not merely rely on just one study or one lab's work to support it. Rather, it is proven by an entire field of neurophysiology called corollary discharge, summarized in Chapter 3 and introduced here.

Electrophysiological research going back to 1947 proves that virtually all neuronal signals sent from the brain or spinal cord to the muscles to produce a body movement have a copy. These copies are sent over to the relevant sensory systems so that the brain knows what is about to happen. In our September 11, 2011 example, however, Siller's impending act (running to the towers) will unconsciously be represented in his brain before he can carry it out. Here's how that happens. The same nerve cells at the top of the neural system that will command the muscles to contract (and hence undertake the act) also send a second, identical message back to the sensory systems of the brain that essentially says "these muscles are about to contract in this exact manner." While it's perhaps easiest to understand the capacity to send this second, identical electrical signal (called "corollary discharge") from parts of the cerebral cortex controlling movement (the "motor cortex"), many other parts of the brain directing motor activity are capable of doing the same thing: this includes a large motor control zone in the forebrain beneath the cortex, the cerebellum, and the hindbrain. All of these motor control zones are known to cooperate in the production (and registering) of coordinated movement.

In the meantime, however, "corollary discharge" serves perfectly as the first step of ABT, and has become an ordinary part of our understanding of neurophysiology. Corollary discharges from the motor controls to sensory systems are required for our perception that the world is "holding still"—is physically in the same place despite our bodily movement—because such discharges allow our brains to predict changes in the world that are consequent to each of our behaviors. That is, as a result of this second motor signal, the brain knows what the body is about to do.

It is important to note that this first step is not particular to ABT, but is rather an ordinary part of everyday neurophysiology. Unless one's act toward another person is represented to one's central nervous system, the potential effect of that act on the other person cannot be evaluated in Step 4. In ABT, the representation of our incipient behavior leads naturally to Step 2, perceiving the social object of that behavior.

STEP 2: PERCEPTION OF THE INDIVIDUAL TOWARD WHOM THE BENEFACTOR (IN THIS CASE SILLER) WILL ACT

A major development in neurophysiological research has been the explanation of exactly how we perceive the visual world. Of course, when we look at the object of our intended social action we cannot avoid perceiving him or her. Here and in Chapter 3, I will summarize the evidence from the field of visual physiology that leads inevitably to ABT Step 2.

Hundreds of scientific papers describe how our brains perceive the visual world around us. Patterns of light pass through our eyes to cause corresponding patterns of nerve cell excitation on the retinas in the backs of our eyes. Those electrical signals race up the optic nerve and then either turn toward our midbrain, where a simplified version of the visual pattern triggers a rapid, reflex action, or go to the thalamus, where the really detailed visual processing begins. "Thalamus" is the Greek word for "antechamber" and is called that because the thalamus is the obligatory processing station for visual signals to enter the cortex. When Siller is about to act toward a wounded person in the tower, he brings to mind a vision of a (generic) person in the tower. Neurons in the visual part of Siller's brain fire in patterns that represent the image of such a person, who represents large numbers of actual people in the tower. (While a benefactor frequently sees the object of his intended action right in front of him, in other cases the visual cortex simply registers a vision of a distant or even hypothetical person, in this case, a generic person in the tower.) In our example, Siller's brain processes the visual information that creates an image of a generic tower victim. In other cases, when the actual beneficiary is right in front of the benefactor, the patterns of light, dark, and color that pass through the eyes of the actor (the person who is about to behave, i.e., the benefactor) cause electrical signals to be sent from the cells of the retina; the signals travel through the optic nerve. As I mentioned, the signals follow two major pathways. The simpler, more primitive pathway heads for the midbrain, where visual signals can be put together with signals from other senses to get a rapid picture of what is in front of the actor and enable rapid, almost automatic action. The longer, more detailed visual pathway special to the human brain travels to the very top of the brainstem, thus to signal to the very back of the cerebral cortex, the visual cortex. There, individual features of the image of the other person—lines, angles, shadows—converge in groups of cells to form a unified image. Neuron by neuron, these lines and angles are encoded, as shown by the Nobel Prize–winning work of Torsten Wiesel (former president of Rockefeller University) as he worked at Harvard with David Hubel.

Step 2 is crucial to ABT because we cannot act toward another human being unless we can literally picture that person—or visualize a generic person—in all of his or her humanity. This is part of the communal impulse programmed into us by evolution, and necessary for our survival. Apart from the bare physiological mechanisms that make up Step 2, it is *understandable* and even necessary in evolutionary terms.

STEP 3: MERGE IMAGES OF THE VICTIM WHOM SILLER WILL HELP WITH SILLER'S OWN SELF-IMAGE

Step 3 is the most novel for neuroscience, unique to ABT, and is crucial for ABT to work properly. It represents a new insight, and a different way of thinking about how the brain produces altruistic behavior. While each nerve cell mechanism mentioned here and illustrated in Chapter 3 is grounded in hundreds of scientific papers, ABT brings them together in a single theory.

In everyone's brain a set of firing nerve cells constitutes a unified image of the person toward whom one will act, as well as a neural image of oneself. (We always have an image of ourselves in our brain). The question for Step 3 of ABT is: how exactly could the image of another person be linked, constantly overlapped with our own image? The answer is: an increase in the excitability of cortical neurons, such that when the nerve cells representing the other are firing signals, the nerve cells representing self are also firing.

How might this cross-excitation of images happen in the cerebral cortex? There are three cellular mechanisms that can do this. One is that inhibition in the cortex is reduced (for details, see Chapter 3). A second mechanism is that tiny tunnels between nerve cells are created, thus allowing electrical excitation to spread quickly. A third mechanism implicates excitation by the powerful neurotransmitter acetylcholine. In addition to these three mechanisms for merging sensory images of other with self, the so-called mirror neurons unite the actions of another person with our own. My mirror neurons that signal I will raise my right hand fire signals when you raise your right hand; in this way, such mirror neurons can be thought of as supporting my empathy for you. So a multiplicity of nerve cell mechanisms underlies the merging of your image with mine, as we shall see in Step 4.

But as frequently happens in the brain, we are not dealing with processes that are distinct or mutually exclusive. Rather, all of these mechanisms for merging images can work in parallel, and can assume different relative importance in different individuals. ABT takes advantage of the brain's redundancies, its capacity to do things in different ways, sometimes in many ways at once. Of course, this type of multifaceted capability makes sense from an evolutionary standpoint, because if one capacity goes down another will still be available. But for my purposes, it also means that ABT does not at this stage have to rely on one or another process, as humans have built-in overcapacities to perform even the simplest mental tasks.

In our 9/11 example, Siller visualizes a wounded person in the Twin Towers. Whereas it is extremely difficult for the brain to keep these visual images separate and distinct, it is *extremely easy* for them to get mixed up with each other; that mix-up or "blurring" of images is precisely what is needed for an efficient theory of altruistic behavior. To put it another way, in the brain of the person who will initiate the act toward another person, the difference between the target person's image and his own will unconsciously be brought to zero. Where there is a discrete image of the target in the cerebral cortex and elsewhere, and another discrete image of the target person, the brain now produces a merged image where images of the two persons coalesce. Step 3 is important because unless the two images are merged in the cerebral cortex, the image of the "other" cannot be treated like the "self." Chapter 3 will show four separate brain mechanisms by which this can happen.

STEP 4: THE ALTRUISTIC BRAIN

A long tradition of research on the functions of the prefrontal cortex shows how the outputs from Steps 1 and 3 arrive at neurons whose activities produce the Altruistic Brain. That is, the representation of the act (from Step 1) and the united, combined image (from Step 3) must arrive at an "ethical switch" in the brain just before we carry out an act toward another person. As a result, instead of literally seeing the consequences of the act for another person, we automatically envision the consequences as pertaining to our own self! For example, Siller acted in a way that he would have wanted someone to act toward him if he were in the Twin Towers. While this ethical evaluation may occur at a conscious level, it also can be instantaneous and unconscious.

Where in the brain does this juncture of the act's representation with the combined image of self and other take place? Based on current neuroscience, the best conclusion is that it takes place primarily in a part of the brain that is bigger and stronger in the human brain than in other brains: the prefrontal cortex (see Figure 2.1). The work of Joshua Greene, covered in Chapter 5, highlights the activation of neurons in the prefrontal cortex during the making of moral decisions. There, a value—"good" or "bad," "do" or "don't do"—is attached to the combination of the act and the combined self/other

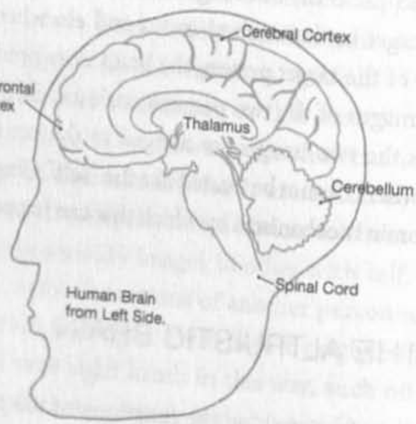

Figure 2.1 The prefrontal cortex of the human brain plays an important role in Altruistic Brain function.

target. These prefrontal cortical neurons allow the positive, altruistic, act to proceed. Thus Step 4 is important because it enables us to evaluate the relative goodness of the act intended toward another person.

STEP 5: PERFORMANCE OF AN ALTRUISTIC ACT

The neurophysiology of motor control has occupied neuroscientists since the time of Nobel Prize–winning physiologist Sir Charles Sherrington, and is enlisted here to explain how a person carries out a beneficial act. The prosocial decision has occurred in Step 4. In Step 5 we leave the neuroscience that is specific to ABT and enter the common neuroscience of ordinary movement control. The output from the prefrontal cortex permits the motor cortex and subcortical movement-control neurons to perform the act that was so rapidly and automatically evaluated. In our 9/11 example, Siller swings into action, forgoes the day off with his brothers, and heads for the Tunnel to try and save other lives. He proceeds because he envisions himself in the target person's place. Any one of the generic "persons" that he imagines in the tower is sufficient to motivate his altruistic act. Step 5 is necessary to turn an ethical decision by neurons in the frontal cortex into an actual behavior. The positive, generous act occurs because it matches the way he himself would wish to be treated.

In summary, through the series of five ABT steps the brain carries out the neurohormonal mechanisms that produce behavior obeying an ethical universal, commonly called the Golden Rule. It should be emphasized here that such behavior is not part of a "bargain," where one person does something nice for another (because she thinks that the other will do something nice for her), and then that other reciprocates (out of obligation). The brain mechanisms just described do not involve such calculation. They do not involve religious training or social conditioning. Rather they are precipitated because humans are wired to be altruistic. And, of course, that includes *reciprocal* altruism. Here's an illustration. Not long before I sat down to write this chapter, I was standing on a subway platform when an old man emerged from a train pushing a cart full of groceries. When he got to the stairs leading to the exit, he stopped, wondering how he would possibly drag that cart up. But just then, a young man who was about to enter the train said "Wait, I'll do that for you," and he pulled the cart up to the top of the stairs. By the time he returned to the platform, he had missed his train, and I asked him in my best field-study voice "Why did you do that?" Acting genuinely surprised, he replied "Why wouldn't I? I just did what I had to." Indeed. Though he would never see that other man again, he felt the natural urge to help someone who could not help himself. He did this even though he would miss his train. The point is that he didn't stop to calculate whether to put someone else's needs ahead of his own.

So now let's explore still further reaches of ABT.

AVOIDANCE OF ANTISOCIAL BEHAVIOR

Because ABT deals with two classes of behavior (the first type being altruistic/good), let's now deal with the second type, that is, when we avoid doing something bad. Here a person's brain makes a decision to refrain from carrying out a nasty act against another person, let's say the murder of a competitor in a jealous rage. Again, ABT posits that during the next few hundredths of a second, the potential murderer's brain will follow the same five key steps.

The first three steps (representation, perception, and merging of images) are exactly the same as for the altruistic act. The next two steps differ.

Step 4: The Altruistic Brain

Representation of the act (from Step 1) and the united, combined image (from Step 3) arrive at the "ethical switch" in the person's brain. If a potential killer, for example, was planning to murder another person, the combined self/other signal is sent to the prefrontal cortex. There, Altruistic Brain neurons *are unable to register the difference* between the effects on the target and on himself and they inhibit motor cortex neurons that might have carried out the heinous act. While this may occur at a conscious level, it also can be instantaneous and unconscious. Altruistic Brain mechanisms in the prefrontal cortex also, of course, inhibit nasty acts much less serious than murder. Mechanisms for this are spelled out in Chapter 3.

Step 5: Behavior. Decline to Perform an Antisocial Act

In this case, Altruistic Brain neurons in the prefrontal cortex prevent motor acts that would harm another person. No harmful act takes place.

As you can see, avoidance of the nasty act achieves the same result as performance of the altruistic act: benevolence. The first three steps in the Altruistic Brain program are, in fact, identical in both scenarios. Step 4 differs because in the avoidance scenario the potential bad actor is revolted by the consequences of what he could do, whereas in the altruistic scenario he feels the glow of satisfaction. Step 5 is also different. The potential killer declines to perform the harmful act in the avoidance scenario, but in its altruistic counterpart he willingly performs the altruistic act.

This "avoidance" scenario, like its "performance" counterpart, is also totally spontaneous in the sense that humans are wired to produce good (and avoid bad) behavior. I am reminded of when one of my friends was furious at her neighbor whose dogs never stopped barking. She and the neighbor got into regular shouting matches. She wanted to push the woman and make her physically suffer. But did she? "No," she said, "something always restrained me." Of course, we can all identify with such restraint, which represents ABT in action. If community is built on being kind to others, it also relies on not doing things that hurt. It is this combination of action and restraint that is part of our evolutionary equipment, and that has contributed so profoundly to our species' survival.

A Parsimonious Theory

Scientists call a theory "elegant" when it efficiently explains a lot of phenomena without making a lot of special assumptions. Steps 1 through 5 do not require the brain to have any special "religious" capacities or any superhuman discriminatory powers. In fact, information is *lost* by the merging of images that occurs in Step 3.

So think about these scenarios of performing prosocial behaviors and avoiding antisocial behaviors for a moment, both positively altruistic and that based on avoidance. Nothing in either requires the brain to do anything extraordinary. ABT is plausible because all of the mechanisms on which it relies are (as the next chapter shows) well understood. Each step that it posits has its counterpart in fundamental experiments that have shown them to work. There is no supposition involved. The theory establishes that these steps can operate together, programmatically, and that when they do a person will behave in a manner that is altruistic. So what will really matter in the next phase of our journey, now that we have briefly reviewed the five steps of ABT, will be to visit some neuroscience labs where we can examine work that proves that Altruistic actions rely on trains of physiological events that include mundane sensory-motor data.

But to make the chapter's main point using different terms, ABT demonstrates that an ethical decision by one person about to act toward another involves only the *loss* of information, which is all too easy to achieve, as anyone who just forgot something will tell you. I reemphasize that the theory does not require special abilities. Indeed, learning complex information and storing it in memory are hard to explain. On the other hand, damping or suppressing any one of the many mechanisms involved in perception and memory are easy to achieve and can explain the blurring of identity required by this explanation of altruistic behavior. In the "potential murder" example imagined earlier, a loss of individuality as a result of blurred identity temporarily puts the potential murderer in the other person's place. Because that other person would be afraid, so will the potential actor. He avoids an unethical act because of shared fear.

All of the findings summarized in this chapter demonstrate how our brains can do the job of producing altruistic behaviors. Most important, several independent mechanisms allow image-of-other to blend with image-of-self, to foster the production of altruistic behaviors. These mechanisms are not exclusive of each other—they could work in various combinations—and those combinations could be different among different individuals.

Sometimes generous people contribute to causes, their behavior not seeming to reflect altruism toward an individual but rather toward an abstract entity. I conjecture that in all such cases the generous person has the "idea" of a person in mind. That is, she brings to mind a vision of that person. If the idea is generosity toward a library, then the generous person imagines a librarian. If it is brave acts in a crippled Japanese nuclear power plant, then the altruistic person imagines the image of a Fukushima villager. ABT, exactly as presented here, would apply.

APPLICATION OF ABT TO REAL-LIFE SITUATIONS

Having explained the five steps essential to ABT—steps that use ordinary brain mechanisms that neuroscientists work with every day—I now want to weave these steps into stories of good human behavior ranging from the smallest to the most serious examples. My point will be to illustrate how ABT actually plays out, how the individual steps can actually be mapped onto human acts. Thus though we cannot see the brain during the few hundredths of a second that it takes to make an altruistic decision, we can nonetheless identify how the brain is working as that decision is formulated and carried out.

Kindness

It was one of those days when the sun's glare off shadeless streets made everyone wince. I was just beginning to cross Third Avenue in Manhattan when I saw that a limousine had stalled. The overweight, middle-aged driver was breaking into an impressive sweat, straining to push his vehicle out of the traffic and into a parking space on East 65th Street. Just then, a slim, smartly dressed young man changed his direction and approached. It was obvious that he didn't know the driver, and was under no obligation to offer a hand and mess up his pristine suit in the process. Yet when I looked back, he had put down his expensive-looking briefcase and was pushing the stalled limo to a safe spot. Why?

I never got a chance to ask him, but his spontaneous action was of a piece with the heroics of Wesley Autrey, albeit on a much smaller scale. Think about ABT's five steps. (Step 1) The young man's brain represented the limousine-pushing action. Neurons that would have to direct the straining and stressful movements caused by contraction of the driver's leg and back muscles send corollary discharges to the young man's sensory systems. (Step 2) The young man's visual cortex got the electrical signals of neurons representing the visual image of the overweight driver, and (Step 3) merged the driver's visual image with his own, using one or more of the mechanisms I introduced in Step Three above. Sent to the prefrontal cortex, this combination signaled to Altruistic Brain neurons there (Step 4) obviously resulted in a sense of relief from help pushing the limousine and these prefrontal neurons told motor cortex neurons "Yes," "Do It." As a result (Step 5) the young man pushed the limo to a safe spot using his own motor control systems, both cortical and subcortical.

Though this action would not be considered heroic, it constitutes one of the myriad kindnesses that we perform literally without thinking. In any given instance, we do not even calculate whether someone will sometime help us, as kindnesses are unconsciously traded all day long in a kind of unregulated moral economy. We go through life giving each other a hand, running down the Up escalator to retrieve someone's dropped glove. It's this low-level back-and-forth of kindness that makes life tolerable, that we think about after the fact as opposed to in advance. Evidence of ABT is everywhere. It gives us reassurance and, indeed, a measure of courage in the face of adversity.

Everyday Heroes

When you start thinking about the everyday heroes around us, either in the neighborhood or on the news, there are so many: not just people who do good deeds, but those who flat out risk their lives (or even give them) without stopping to calculate the odds. For example, a few months after Wesley Autrey startled the world, another less celebrated hero saved even more young people. This was Professor Liviu Librescu, a Holocaust survivor who taught engineering at Virginia Tech. When a deranged student, Seung-Hui Cho, started rampaging through campus—finally killing 32 and wounding 17—Librescu blocked his classroom door with his own body, giving students the chance to escape. While most made it out the windows to safety, Librescu never emerged alive, taking several bullets through the door. His family was in shock, but his son told an Israeli newspaper that people said "my father was a hero." And there have been others.

In July, 2012, a horrific drama played out where a group of young people, at the expense of their own lives, saved loved ones from a deranged gunman. At a premier of *Batman: The Dark Knight Rises*, James McQuinn, 27, threw his body in front of his girlfriend and took two bullets meant for her. Jonathan Blunk, 26, a military veteran, also died when he saved his girlfriend. How did they so react so courageously?

Think about this as instantaneous, unconscious applications of ABT in action. These two young men (Step 1) had in their brains the "corollary discharge" representation of their movements, to throw themselves protectively in front of their girlfriends, and obviously (Step 2) had the visual images of these women merged with their own (Step 3). These motor and sensory neural signals sent (Step 4) to Altruistic Brain mechanisms in the prefrontal cortex rapidly and emotionally yielded a "Go," "Do it" decision because of the positive valence associated with saving the two women's lives. As a result (Step 5) they leapt, thus performing the ultimate prosocial act. They didn't stop to think whether the other person was "worth it," or whether the odds were in favor of their personal survival. They just acted. Because we have seen this type of action involving total strangers, we know that the motivating factor was not—in some soap-opera sense—undying love. We know that neurohormonal processes kicked in at lightning speed, changing some people's lives forever. Ultimately, the community benefits from this type of action, which is why—in evolutionary terms—we can have expected it. Those who expressed surprise and admiration should have shelved their surprise and admired the human brain.

Earthquake, Tsunami, Meltdown

The whole world felt like an unintended and infernal field study when in March, 2011, a continuous loop of coverage depicted the Japanese earthquake, the tsunami that followed, and finally the flooded Fukushima nuclear plant that contaminated an area the size of New Jersey. In the ensuing days, as the magnitude of the tragedy—and the danger—became apparent, people from all over Japan volunteered to clean up the environment and stabilize the plant. Their narratives form a mosaic of unfettered selflessness, a commitment to their fellow citizens that held the world in thrall. CNN, for example, reported a story with the title "Japanese seniors volunteer for Fukushima 'suicide corps,'" about hundreds of older people willing to don emergency gear so that they could work inside the crippled plant. One such man, however, Masaaki Takahashi, 65, said that he didn't understand all the fuss over their efforts. "I want them to stop calling us the 'suicide corps' or kamikazes. We're doing nothing special. I simply think I have to do something and I can't allow just young people to do this." One hears Wesley Autrey ("You should do the right thing") in this quiet acceptance of a moral code impelling him to act on behalf of others. Another member of the group, Kazuko Sasaki, 69, articulated a sense of responsibility that he also could not ignore: "My generation, the older generation, promoted the nuclear plants. If we don't take responsibility, who will?" (Figure 2-2).

And consider an *ABC News* story entitled "Japan's Fukushima 50: Heroes who volunteered to stay behind at Japan's Crippled Nuclear Plants." The "50" were actually 200 seasoned technicians, who worked in shifts of 50 so as to avoid the worst doses of radiation through prolonged exposure. But their conditions were still almost unendurable. According to the story "They are working as temperatures at the plants soar to nerve wracking levels, radiation is leaking, rain may be carrying it down upon them, and a toxic fire burns, likely spewing more radiation into the

Figure 2.2 Following the explosion at the Fukushima nuclear power plant, Japanese workers exposed themselves to danger in order to cool the plant down and prevent greater risks to the population in northern Japan.

atmosphere.... They've gone into battle, crawling at times through dark mazes, armed with flashlights and radiation detectors, wearing full body hazmat suits and breathing through cumbersome oxygen tanks." What's fascinating is that these were ordinary men who rose to the occasion. In a tweet picked up by several news services, one woman said of her neighbor: "At home, he doesn't seem like someone who could handle big jobs... but today I was really proud of him." The hazards faced by the Fukushima 50 were big news. The *New York Times* reported:

> Those [workers] remaining are being asked to make escalating —and perhaps existential—sacrifices—that so far are only being implicitly acknowledged.
>
> Japan's Health Ministry said Tuesday it was raising the legal limit on the amount of radiation to which each worker could be

> exposed, to 250 millisieverts from 100 millisieverts, five times the maximum exposure permitted for American nuclear plants.

Nonetheless, the workers kept rotating in and out of the plant, with apparently none giving up. It was observed that "Nuclear reactor operators say that their profession is typified by the same kind of esprit de corps found among fire fighters and elite military units." This commitment, both to one another and to society, was borne out in an email from the daughter of one of the 50: "He says he's accepted his fate... much like a death sentence." Less dramatically, but with no less certitude, an American consultant, Michael Friedlander, observed: "I can tell you with 100 percent certainty they are absolutely committed to doing whatever is humanly necessary to make these plants [stabilized] in safe condition, even at the risk of their own lives."

As the events unfolded, people in the street were too scared to psychoanalyze the 50. One such person, Maeda Akihiro, said: "They're putting their life on the line. If that place blows up, it's the end for all of us, so all I can do is send them encouragement." But as I will argue, the individual psychologies of these men—where they grew up, whether they had served in Japan's armed forces—was never the critical issue. Rather, the men exemplified a common human capacity to act in the interest of others, even in the face of danger. Of course, this is not to diminish their heroism in the slightest, but only to suggest how they made their decision to act and how they remained committed to it. The Fukushima disaster will be studied for years by planners hoping to prevent another such occurrence, but if there is one positive side to the story it is that human beings acted so well. It was one example among many.

Now think of the decision that an individual Fukushima worker had to make in terms of the five steps of ABT. (Step 1) He represents in his own brain the action of re-entering the nuclear plant to cool it and prevent an explosion. From his premotor cortex, signals emanate that yield the corollary discharge that informs his own sensory systems of what he is about to do. (Step 2) He envisions the generic farmer and village dweller in the Fukushima area. This envisioning uses standard visual signaling pathways. (Step 3) Losing the distinction between his self-image and that of the local Fukushima citizen, by the three mechanisms I introduced previously and will explain in Chapter 3, he literally "identifies with" that citizen in his cerebral cortex. (Step 4) Signals of the explosion-preventing act combined with his self/citizen merged image reach Altruistic Brain neurons in the prefrontal cortex, leading to a "Yes," "this is good." (Step 5) The Fukushima worker reenters the plant. No secondary explosions occur.

We could go on studying examples of outstandingly altruistic behavior such as that by Oskar Schindler, who saved Jewish citizens from the Holocaust; Doctors Without Borders (Medecins Sans Frontiers), an international medical humanitarian organization created in France; and kidney and bone marrow donors across the country. However, I have already made the point: exemplary behavior can be understood at the level of basic brain research.

Neuroscientific Evidence

Now that I have provided a brief outline of how ABT explains the decision to act in an ethical, even altruistic fashion, Chapter 3 will open up the neuroscience laboratory to allow you to appreciate some of the vast scientific evidence for how such behavior is activated. I will now share some of this thrill with you, so that you can see how the pieces (or rather, steps) of ABT fall into place. And then, beyond the ethical decision, we'll look at why we actually behave in an altruistic way: both neuronal and hormonal forces that have evolved among vertebrate animals will provide the "drive" to accomplish the deed. Consider this automotive analogy: if the Altruistic Brain turns the switch so that the engine is on, these neuronal and hormonal forces provide the fuel for the engine to move the car forward. Chapter 4 talks about these forces as well.

FURTHER READING

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