THREE

A MAP OF THE WORLD

WHEN I WAS a teenager and my father could see how hard I was trying to be cool, he took me aside and gave me a little talk about the difference between being cool, which he clearly was (though he didn't say that), and acting cool, which I clearly was. I was already doing risky things, and he remarked that to die a needless death of your own making was not cool, man, not cool.

One summer, some years later, I was going out on night assault maneuvers with the Army's 82nd Airborne Division at Fort Bragg in a live fire exercise. I was working with Army Rangers, who were some tough mothers. We spent a few days hopping in and out of helicopters, shooting off rockets, and blowing up tanks. Oh, it was great fun.

But I was most interested in hearing from the Rangers about their training. It was hard core. The training lasted eight weeks, starting at Fort Benning in Georgia and winding up sometimes as far away as Utah. It was the most intense, demanding, and exhausting ritual the U.S. Army had.

We'd just come on a night drop into sand dunes. They didn't let

me jump, so I was on the ground when the planes came over. I could hear the distant chattering of automatic weapons fire somewhere in the forest and then the faint droning hammer of the C-130 engines. The moon had not yet risen, but the Big Dipper was up in the western sky, and a big orange planet burst halfway up beyond the southern treeline as I walked out onto what seemed like desert but had been, 10 million years before, ocean floor. The darkness was so complete that I could see nothing before me as I struggled through the sand. Then one of the stars in the southern sky resolved itself into an artificial light, and I walked toward it, knowing that it was a turn-in point for parachutes and that people would be there.

As I walked toward it, I saw a planet suddenly rise half out of the eastern sky, and I watched it for a moment before I realized that I was looking at a flare. A moment later automatic weapons ripped away, and then the heavy *whoosh-thud* of a howitzer peeled back the pretense of solitude for a moment before night closed once more around me. There is nothing quite like the sound of a howitzer—an enormous, galvanized steel door being slammed, jamming the air up into the valleys of these hills. Like a surf, the waves of air come back when they've spent all their energy out there.

Then the planes came, and I saw their green and red navigation lights moving toward us along a line parallel with the drop zone. I ran to get under them as they came on and on. I reached the middle of the DZ just as they drew overhead. Everything seemed to grow silent as the stress of the moment narrowed my perceptions. The sky was light compared with the land, and against that shimmering, cold, feather-gray scrim I saw the dark leviathan shapes of the ships crossing to the south. Without warning, a blossoming profusion of jellyfish sprayed out across the sky. Silently and swiftly they grew from black points in the sky to the swelling, round, living atoms of darkness, filling in the spaces between the stars.

Now the planes were gone, and truly there was no sound at all except my heart hammering. As I stumbled on the ocean floor,

watching scores of the creatures come down all around me, I knew that one must surely drift down on top of me and engulf me in the trembling petals of its mushroom flesh. I could see, as they descended in the fluid of the air, that men were dangling from them. Within 100 feet of the ground, each man pulled the release that dropped his rucksack to dangle on a 15-foot lanyard, and all around me now I heard the snap-clatter-swishing of the packs as they hit and the men prepared to land.

Just beside me, the first man landed hard, and I heard his "Oof!" and saw the gray jellyfish above him balloon and invert, dumping its bubble of air, then drift and fold and lie down quietly on the sand. "Oh, God, I've got to piss!" the man groaned, and I heard the clanking of his gear as he tried to free himself of hasps and clips and webbing.

His face came up and I could see him just well enough in the dim light to recognize him. It was a guy they were calling Buddy. When we were gearing up for the drop, zipping speed loaders into M-16 clips, spacing them with red phosphorous tracer rounds, and unpacking mortar rounds to stuff into butt packs, I'd seen Buddy down on his knees, cradling a Claymore mine. A Claymore is a modern version of the stand of grapeshot, a fiberglass shell filled with plastic explosive mixed with seven hundred steel ball bearings. It's rectangular, about 6 by 10 inches, 1½ inches thick, dull silver colored, curved from side to side, with pointed metal legs that fold down from underneath so that it can be stuck into the ground like a miniature drive-in movie screen. When it's fired, that load of grapeshot sprays out, supersonic and molten, and anyone within a 325-foot swatch is reduced, as the Rangers liked to say, to Hamburger Helper.

I'd been playing with the switch on a mortar round, flipping it from proximity to impact, when I looked over and saw Buddy with his face against the Claymore, a cigarette in his mouth, smelling it. I went over to see what madness motivated him to do that, and he looked up, smiled at me dreamily, and said, "Mmm, I love the smell of a Claymore." I got down and cradled it to my face and smelled it, too. It smelled like cherries.

Now on the DZ, as all the men landed around us—first the rucksack's crunch, then the man, hitting and rolling as best he could, encumbered as he was with live rounds, rockets, high explosives, Claymores, grenades, flares, and then the great weight of the parachute itself, the sea creature that carried him here, dying in the dead air on the ancient shore, I heard one man say as he drifted down toward me, "Look out, son. I'm gonna 'splode on impack."

Then I was humping through the forest in the middle of the night with a 40-pound pack, talking with Colonel Robert Lossius, who'd gone through it. He was a Ranger. This night, for him, was just a picnic. He told me that after a week or two in Ranger training, he'd begun to hallucinate, an experience often reported by survivors. The Colonel's ration had been two MREs (meals ready to eat) every three days, which is to say he was slowly starving. He lost 30 pounds in fifty-eight days. There was sleep deprivation and an escalating series of trials—forced marches, free-climbing sheer cliffs without ropes, and being thrown into the snake- and alligator-infested swamps in Florida to find his way out on his own. Fear of death, fear of height, fear of dark, fear of drowning, all combined to make him descend deeper and deeper into himself and find what was there, to change it, to build it. Some say to put it to sleep. Others say to wake it up. I left Fort Bragg thinking that of all the people I'd known, certainly a Ranger would be the most likely to survive the hazards of nature. But the training is only as good as the environment.

ON SEPTEMBER 6, 1997, Captain James Gabba, an Army Ranger, was taking a guided commercial rafting trip down the upper Gauley River in West Virginia when the raft hit a rock. Gabba, thirty-six, was thrown from the raft, and his guide, trying to save him, fell in too. The guide tried to rescue Gabba, but Cap-

tain Gabba "just laughed and pushed him away." Gabba floated calmly downstream, and if he was anything like the Rangers I'd known, he must have felt that he was in no real danger because of all the training he'd had under much worse conditions. He must have felt good, too, masterful, confident. He'd eaten, he'd slept—hell, he could do this until the wheels came off. Then he arrived at a place where a big rock blocked the middle of the current. Gabba was sucked under, pinned, and drowned. The official report said, "The guest clearly did not take the situation seriously." But that's not true. He took it very seriously.

It's easy to see hubris in Gabba's behavior, but it's more subtle than that. Everyone carries around a necessary measure of his environment and of the self. From conception onward, the organism defines what is self and what is not. The immune system examines materials from the environment to assess whether they are a threat or harmless. Cells within that system hold up proteins in an almost ritualistic way so that T-cells can read them and see if they are self or foreign. If a T-cell recognizes the protein as self, it commits suicide. If the protein is unfamiliar, the T-cell gives the B-cell permission to create an antibody, which helps mobilize an attack to destroy the invading protein.

In that and other ways, the immune system continuously rearranges the organism's relationship to its environment. That's called adaptation. A lifetime of experience builds the system, but a subtle change in the environment can mean that the system no longer has the correct response. It's suddenly out of adjustment. For example, when Europeans brought unfamiliar diseases west with them in the 1500s, the previously healthy and thriving Native Americans were rapidly wiped out. But some creatures are amazingly adaptable. At the beginning of summer, I used to have hundreds of crows circling my house at dawn, barking noisily. Then one morning they were all gone. They'd been threatened by the West Nile virus. They went away for months. Now they're back. Crows are survivors.

The emotions are another mechanism for defining self (actually creating the self) during the process of protecting what is within from what is without, both by avoiding or fighting what is bad and by seeking out what is good. As Joseph LeDoux put it, "People don't come preassembled, but are glued together by life." Like the immune system, the emotional system evolves continuously, taking experiences and situations and attaching emotional value to them in subtle gradations of risk and reward.

Children begin learning even before birth, and near the end of pregnancy their brains may be forming as many as 250,000 new nerve cells a minute. (Scientists estimate that the mature brain has 100 billion neurons and trillions of connections.) Once infants begin moving about in the world, they engage in a process of trial and error by which they find out how much risk they can take to reap a given amount of reward. Every experience adds to the body of knowledge and shapes future behavior. Children constantly test and sample their environment and themselves, taking risks that give big rewards without too much exposure. It's a delicate, often beautiful, balancing act. I watched my newborn son, Jonas, learn to cry on purpose. In animal terms, you can view crying as a risk, because it attracts attention, and there's no way for the infant to know if that attention is going to be good or bad. At first, he'd only cry when something bothered him—discomfort, pain, hunger—and you could tell by the sound of the cry that it was genuine (and loud). Each time he cried, however, his mother held him and most times she fed him, too, or changed his diaper. Soon Jonas learned that if he wanted some sort of attention, he could cry, and it was a different cry with none of the urgent, shrieking qualities it had before. It was more a whimper, and he used it effectively to get what he needed or wanted.

Moderate stress enhances learning. When two neurons fire together, they become wired together. When a strong and weak neuron—call them Al and Betty—stimulate a third neuron—call it Charlie—at the same time, the weak one, Betty, gains the ability

to stimulate Charlie to fire. That's why the ringing of a bell could cause Pavlov's dog to salivate even when there was no food present. Scientists, with their ever playful juggling of three or four languages at once, call that long-term potentiation (LTP). So risk is an integral part of life and learning. A baby who doesn't walk, for example, will never risk falling. But in exchange for taking that risk, he gains the much greater survival advantage of being bipedal and having his hands free. That's another reason play becomes important to most people. That's why we go out there and do the things we do in the wilderness. Amelia could have refused to snowboard after her first painful fall. But in exchange for the risk, she gets to have the emotional rush of zinging down a mountain and catching some phat air with the old man. She also gets to wear cool snowboarding clothes to attract boys, so perhaps there is survival value in it, too, at least for the species.

The knowledge gained from that risk-reward loop does not involve reasoning. It comes to the child coded in feelings, which represent emotional experiences in a particular environment. If the environment changes, if it has unfamiliar or subtly different hazards, those adaptations may turn out to be inappropriate.

Logic simply takes too long, often impossibly long, and in a child logic is not well developed enough at any rate. Instead, he rapidly and unconsciously pages through his atlas of emotional bookmarks (probably an instance of LTP). Numerous neural networks, associations that connect the situation he's in with similar situations or experiences from the past, flicker with electrochemical energy, illuminating memories and feelings of circumstances and actions that led to good and bad outcomes, projecting forward to future paths of action and feeling. Jonas is forming a dynamic map of himself, his world, and his experiences in it, and is sending projections through time in the form of images of the future. In a sense, he can see down his own path by the light of that circuitry. The emotional map of the world, with him in it, is doing its work all the time, essential as a heartbeat to his survival.

His work had only just begun. Years later, he might be sitting quietly at home, and that system will be doing another kind of work, perhaps helping him to decide whether to read *War and Peace* or eat ice cream. If he ever falls into a fast-moving river, that system will be doing a much more urgent sort of work. And if he's had the right experiences, it will instantly direct correct action.

IF YOU could see the brain working, if it gave off light as it worked, then at a decision point, different areas would begin glowing all over like the lights of cities going on at dusk as seen from space. The patterns contained in those networks, formed from unique experiences of life, inform decisions at a rate of speed that can never be achieved by logic. And all of this takes place in the shadowland just beyond conscious thought.

Most people who fall into swift water would welcome rescue. But Captain Gabba, the Army Ranger, may have set himself up for disaster through extreme experiences in extreme environments. As a Ranger, Gabba had had experiences that seemed more hostile than a guided river tour. He'd not only taken care of himself, but if the stories told me by other Rangers are any indication, he came away feeling more alive than he'd ever felt. Worse, in Ranger culture, having to be rescued is ignominious. It is associated with a bad outcome: shame, failure. In Ranger training, if you have to be rescued, you are out of the program. The emotional bookmarks that Gabba developed had labeled rescue as bad and self-sufficiency and even pain as good, no matter how threatening the environment. His training and experience taught him that it was better to die for his country than to fail. Death before dishonor. Rangers lead the way, they don't follow. The training worked.

The Canadian snowmobilers suffered a similar consequence stemming from emotional bookmarks. The first snowmobiler who went up the hill had the abstract concept of an avalanche idling around in the front part of the brain, looking for something physi-

cal (i.e., emotional) to attach itself to. Unfortunately, it found nothing in the atlas of experience. His emotional map of the world contained no feelings about avalanches because his body had had no experience of them.

On the other hand, he had clear perceptions to help find an emotional bookmark: the mountain and environs, the noisy snowmobile. For example, he may have smelled the pine forest and it was the same smell he'd noticed the last time he tried hammerheading, and when he did, he got this boss feeling. He had the bodily memory of pleasure from previous runs. One was an abstraction, the other a physical certainty, clearly illuminated within his emotional map and signaling deeply instinctive behaviors ("If you don't hunt, you don't eat," for example).

Certainly, there were other factors. The masterful feeling of being the rescuer and the speed of riding ahead to that beautiful spot in the woods, not to mention, perhaps, fatigue, dehydration, an earlier bout with anxiety about their lost friends, the relief of finding them (the "Whew Factor," in which you let down your guard once you feel safe). All of those influences, too, must have conspired to derail the efforts of reason to constrain action.

There was another more fundamental difficulty that the snowmobilers faced. Our sense of a mountain, the earth, is a sense of something solid, and our experience confirms that. Nothing in our learning tells us that a mountain is going to come apart before our eyes. It makes no sense. It hasn't happened, therefore it cannot happen. The mountain certainly didn't look fragile. The snowmobilers literally couldn't believe it. We think we believe what we know, but we only truly believe what we feel.

ONLY IN recent years has neuroscience begun to understand the detailed physiology of emotional states such as fear. The neocortex is responsible for your IQ, your conscious decisions, your analytical abilities. But the amygdala stands as a sort of watchdog for the

organism. Amelia, who is the younger of my two daughters, has a chocolate Lab, Lucy. Lucy sometimes reminds me of the amygdala: When anyone comes to the door, she barks before I even hear it.

Perceptions from the world around us (sight, for example) reach the thalamus first. In the case of vision, axons from the retina go to the visual thalamus (there are two, one in each side of the brain, receiving information from each side of the body). From there, the signals travel by way of axons from the visual thalamus to the middle layer of the neocortex and from there are sent out to the other five layers for processing. What emerges is a perception of sight. But before all that can be completed, a rough form of the same sensory information reaches the amygdala by a faster pathway. The amygdala screens that information for signs of danger. Like Lucy, the amygdala isn't very bright, but if it detects a hazard, or anything remotely resembling one, before you're even conscious of the stimulus, it initiates a series of emergency reactions. The approach is: Better safe than sorry. (Unlike Lucy, the amygdala also is capable of ignoring a lot of information as irrelevant.) It is a primitive but effective survival system that causes the rabbit that visits our backyard every morning to freeze and then run when she sees Amelia let Lucy out. Like Lucy, the amygdala is wrong a lot of the time: There is no danger. But in the long course of evolution, it has been a successful strategy.

So information from the senses takes a neural route that splits, one part reaching the amygdala first, the other arriving at the neocortex milliseconds later. Rational (or conscious) thought always lags behind the emotional reaction. Anyone can demonstrate this at home: Everyone has been startled by someone. It's a powerful response, marked by the familiar rocket rush of adrenaline (actually catecholamines), increased heart rate, flushing, and panting. Then, as soon as you realize the person is someone you know, the response deescalates. But it takes a while to metabolize all those chemicals. It's a powerful emergency reaction and completely illogical, because you know the person and are not in any danger.

But you can't think of that logically before reacting because the visual signals reach the amygdala first. It's a big shadowy form: It could be a spouse, it could be a bear—you don't know. Only later (in milliseconds) does the visual cortex piece together an accurate picture that lets you in on who it is. Only later can you reason: No bears in this house.

While the pathways from the amygdala to the neocortex are stronger and faster than the ones going the other way, some ability may remain for the neocortex to do the following: First, to recognize that there is an emotional response underway. Second, to read reality and perceive circumstances correctly. Third, to override or modulate the automatic reaction if it is an inappropriate one; and fourth, to select a correct course of action.

Since emotions evolved to elicit behaviors in a split second, clearly, that is a tall order, and some people are much better at it than others. In addition, there is wide variation in individual reactions. Some people startle easily. Others tend not to react at all. Some people function better under stress, such as professional golfers, fighter pilots, elite mountain climbers, motorcycle racers, and brain surgeons. And some emotional responses are more easily controlled than others.

Elite performers, as they're sometimes called, seek out the extreme situations that make them perform well and feel more alive. At the other end of the scale are people who don't want any excitement at all. It takes all kinds. But it's easy to demonstrate that many people (estimates run as high as 90 percent), when put under stress, are unable to think clearly or solve simple problems. They get rattled. They panic. They freeze. Muddled thinking is common in outdoor recreation when people get lost or injured or are otherwise threatened with harm.

But even elite performers are not immune to the effects of stress. Greg Norman completely blew the 1996 Masters golf tournament after developing a crushing six-stroke lead over Nick Faldo. He missed a three-and-a-half-foot putt, knocked a ball into the water—

twice—hooked balls, missed another putt . . . it was brutal. At the end, Norman and Faldo could only hold each other and weep.

When you learn something complex, such as flying, snowboarding, or playing tennis or golf, at first you must think through each move. That is called explicit learning, and it's stored in explicit memory, the kind you can talk about, the kind that allows you to remember a recipe for lasagna. But as you gain more experience, you begin to do the task less consciously. You develop flow, touch, timing—a feel for it. It becomes second nature, a thing of beauty. That's known as implicit learning. The two neurological systems of explicit and implicit learning are quite separate. Implicit memories are unconscious. Implicit learning is like a natural smile: It comes by way of a different neural pathway from the one that carries explicit memory. LeDoux reports that his mother, who has Alzheimer's disease, cannot remember ordinary events but can still play the accordion, because although her hippocampus is likely damaged by the disease, the memory of how to play accordion comes from an as yet undamaged part of the brain. Implicit memories are not stored in or necessarily even available to the analytical, reasoning part of the brain.

In a normal person and under just the right conditions of stress—perhaps you're tired, perhaps you're getting a cold, perhaps you're going through a divorce—that implicit system can break down. Then you're left with the explicit system, thinking through each motion like a rank beginner. Malcolm Gladwell, writing in the *New Yorker*, put it succinctly: "Choking is about thinking too much. Panic is about thinking too little."

I flew aerobatics for a number of years and competed with the International Aerobatics Club. One day my instructor and good friend Randy Gagne crashed with a student on board. They went into the ground going perhaps 250 miles an hour. Until then, I thought I had some special dispensation to fly upside down with impunity. After that accident I realized I was not an elite performer. Most people aren't. They're just out there to have a good

time. And when things go wrong, they have no idea what's happening to them. It may seem as if we live and die by dumb luck, but it is much more subtle and complex than that.

Everything was stacked against those snowmobilers, including the way their brains were organized and shaped by continuous adaptation to their environment. Those were not stupid people, nor were they ignorant, nor even necessarily reckless.

At the decision point, with all those neuronal networks lighting up, fixing their focus, and arming the mechanism of physical action, the one clear and certain thing was that riding up the hill would produce a good feeling and one that, to the organism, seemed necessary, for it arose from emotion aimed at ensuring survival. Since they were already all pumped up, the concept of idleness as a haven of safety couldn't compete with the feeling of motion as survival. To the organism, the decision was clear. The emotional bookmark, that "beacon of incentive," burned brightly, and the decision was made in an instant, outside the realm of conscious thought.

As Captain Gabba laughed and pushed his rescuer away, he too must have had a good feeling about what he was doing, just before he was pinned and drowned.

FOUR

A GORILLA IN OUR MIDST

THE ILLINOIS RIVER in southwestern Oregon has thirty-five miles of class III to IV rapids with a class V, moss-covered gorge in the middle. That section is known as the Green Wall. Gary Hough, a minister on holiday, knew that with his level of skill, he could run the Illinois at flows between 900 and 3,000 cubic feet a second. He also knew that half an inch of rain would be sufficient to bring the flow above 4,000 cubic feet a second, at which volume the Illinois would be too rough for all but the most prodigious paddlers, who preferred to run it at 2,500.

Conditions looked right, if just barely, that Saturday morning when his group began the trip. The flow was 2,000 cubic feet a second. Although a storm was predicted for late Sunday, Hough estimated that they'd have enough time for the three parties attempting the run to get through. He was willing to accept a certain level of risk for the reward of the trip. He had a clear idea of the dynamic forces involved in the environment he was about to enter. He had a reasonable conception of his ability to deal with it, and he knew what changes in the system would overpower his skills.