6

HOTHEADS

On March 13, 1996, Thomas Hamilton walked into an elementary school in Dunblane, Scotland, carrying two revolvers and two semiautomatic pistols. After wounding staff members who tried to tackle him, he ran to the gymnasium, where a kindergarten class was playing. There he shot twenty-eight children, sixteen fatally, and killed their teacher before turning the gun on himself. "Evil visited us yesterday, and we don't know why," said the school's headmaster the next day. "We don't understand it and I don't think we ever will."

We probably never will understand what made Hamilton commit his vile final acts. But the report of pointless revenge by an embittered loner is disturbingly familiar. Hamilton was a suspected pedophile who had been forced to resign as a Scout leader and then formed his own youth groups so he could continue working with boys. One group held its meetings in the Dunblane school's gymnasium until school officials, responding to parents' complaints about his odd behavior, forced him out. Hamilton was the target of ridicule and gossip, and was known in the area, undoubtedly for good reasons, as "Mr. Creepy." Days before his rampage he had sent letters to the media and to Queen Elizabeth defending his reputation and pleading for reinstatement in the scouting movement.

The Dunblane tragedy was particularly shocking because no one thought it could happen there. Dunblane is an idyllic, close-knit village where serious crime was unknown. It is far from America, land of the wackos, where there are as many guns as people and where murderous rampages by disgruntled postal workers are so common (a dozen incidents in a dozen years) that a slang term for losing one's temper is "going postal." But running amok is not unique to America, to Western nations, or even to modern societies. *Amok* is a Malay word for the homicidal sprees occasionally undertaken by lonely Indochinese men who have suffered a loss of love, a loss of money, or a loss of face. The syndrome has been described in a culture even more remote from the West: the stone-age foragers of Papua New Guinea.

The amok man is patently out of his mind, an automaton oblivious to his surroundings and unreachable by appeals or threats. But his rampage is preceded by lengthy brooding over failure, and is carefully planned as a means of deliverance from an unbearable situation. The amok state is chillingly cognitive. It is triggered not by a stimulus, not by a tumor, not by a random spurt of brain chemicals, but by an idea. The idea is so standard that the following summary of the amok mind-set, composed in 1968 by a psychiatrist who had interviewed seven hospitalized amoks in Papua New Guinea, is an apt description of the thoughts of mass murderers continents and decades away:

I am not an important or "big man." I possess only my personal sense of dignity. My life has been reduced to nothing by an intolerable insult. Therefore, I have nothing to lose except my life, which is nothing, so I trade my life for yours, as your life is favoured. The exchange is in my favour, so I shall not only kill you, but I shall kill many of you, and at the same time rehabilitate myself in the eyes of the group of which I am a member, even though I might be killed in the process.

The amok syndrome is an extreme instance of the puzzle of the human emotions. Exotic at first glance, upon scrutiny they turn out to be universal; quintessentially irrational, they are tightly interwoven with abstract thought and have a cold logic of their own.

UNIVERSAL PASSION

A familiar tactic for flaunting one's worldliness is to inform listeners that some culture lacks an emotion we have or has an emotion we lack. Allegedly the Utku-Inuit Eskimos have no word for anger and do not feel the emotion. Tahitians supposedly do not recognize guilt, sadness, longing, or loneliness; they describe what we would call grief as fatigue, sickness, or bodily distress. Spartan mothers were said to smile upon hearing that their sons died in combat. In Latin cultures, machismo reigns, whereas the Japanese are driven by a fear of shaming the family. In interviews on language I have been asked, Who but the Jews would have a word, *naches*, for luminous pride in a child's accomplishments? And does it not say something profound about the Teutonic psyche that the German language has the word *Schadenfreude*, pleasure in another's misfortunes?

Cultures surely differ in how often their members express, talk about, and act on various emotions. But that says nothing about what their people feel. The evidence suggests that the emotions of all normal members of our species are played on the same keyboard.

The most accessible signs of emotions are candid facial expressions. In preparing *The Expression of the Emotions in Man and Animals*, Darwin circulated a questionnaire to people who interacted with aboriginal populations on five continents, including populations that had had little contact with Europeans. Urging them to answer in detail and from observation rather than memory, Darwin asked how the natives expressed astonishment, shame, indignation, concentration, grief, good spirits, contempt, obstinacy, disgust, fear, resignation, sulkiness, guilt, slyness, jealousy, and "yes" and "no." For example:

(5.) When in low spirits, are the corners of the mouth depressed, and the inner corner of the eyebrows raised by that muscle which the French call the "Grief muscle"? The eyebrow in this state becomes slightly oblique, with a little swelling at the inner end; and the forehead is transversely wrinkled in the middle part, but not across the whole breadth, as when the eyebrows are raised in surprise.

Darwin summed up the responses: "The same state of mind is expressed throughout the world with remarkable uniformity; and this fact is in itself interesting as evidence of the close similarity in bodily structure and mental disposition of all the races of mankind."

Though Darwin may have biased his informants with leading questions, contemporary research has borne out his conclusion. When the psychologist Paul Ekman began to study emotions in the 1960s, facial expressions were thought to be arbitrary signs that the infant learns when its random grimaces are rewarded and punished. If expressions appeared universal, it was thought, that was because Western models had become universal; no culture was beyond the reach of John Wayne and Charlie Chaplin. Ekman assembled photographs of people expressing six emotions. He showed them to people from many cultures, including the isolated Fore foragers of Papua

New Guinea, and asked them to label the emotion or make up a story about what the person had gone through. Everyone recognized happiness, sadness, anger, fear, disgust, and surprise. For example, a Fore subject said that the American showing fear in the photograph must have just seen a boar. Reversing the procedure, Ekman photographed his Fore informants as they acted out scenarios such as "Your friend has come and you are happy," "Your child has died," "You are angry and about to fight," and "You see a dead pig that has been lying there for a long time." The expressions in the photographs are unmistakable.

When Ekman began to present his findings at a meeting of anthropologists in the late 1960s, he met with outrage. One prominent anthropologist rose from the audience shouting that Ekman should not be allowed to continue to speak because his claims were fascist. On another occasion an African American activist called him a racist for saying that black facial expressions were no different from white ones. Ekman was bewildered because he had thought that if the work had any political moral it was unity and brotherhood. In any case, the conclusions have been replicated and are now widely accepted in some form (though there are controversies over which expressions belong on the universal list, how much context is needed to interpret them, and how reflexively they are tied to each emotion). And another observation by Darwin has been corroborated: children who are blind and deaf from birth display virtually the full gamut of emotions on their faces.

Why, then, do so many people think that emotions differ from culture to culture? Their evidence is much more indirect than Darwin's informants and Ekman's experiments. It comes from two sources that cannot be trusted at all as readouts of people's minds: their language and their opinions.

The common remark that a language does or doesn't have a word for an emotion means little. In *The Language Instinct* I argued that the influence of language on thought has been exaggerated, and that is all the more true for the influence of language on feeling. Whether a language appears to have a word for an emotion depends on the skill of the translator and on quirks of the language's grammar and history. A language accumulates a large vocabulary, including words for emotions, when it has had influential wordsmiths, contact with other languages, rules for forming new words out of old ones, and widespread literacy, which allows new coinages to become epidemic. When a language has not had these stimulants, people describe how they feel with circumlocutions, metaphors, metonyms, and synecdoches. When a Tahitian woman says, "My husband died and I feel sick," her emotional state is hardly mysterious; we can bet she is not complaining about acid indigestion. Even a language with a copious vocabulary has words for only a fraction of emotional experience. The author G. K. Chesterton wrote,

> Man knows that there are in the soul tints more bewildering, more numberless, and more nameless than the colours of an autumn forest; . . . Yet he seriously believes that these things can every one of them, in all their tones and semitones, in all their blends and unions, be accurately represented by an arbitrary system of grunts and squeals. He believes that an ordinary civilized stockbroker can really produce out of his own inside noises which denote all the mysteries of memory and all the agonies of desire.

When English-speakers hear the word *Schadenfreude* for the first time,

their reaction is not, "Let me see . . . Pleasure in another's misfortunes . . . What could that possibly be? I cannot grasp the concept; my language and culture have not provided me with such a category." Their reaction is, "You mean there's a *word* for it? Cool!" That is surely what went through the minds of the writers who introduced *Schadenfreude* into written English a century ago. New emotion words catch on quickly, without tortuous definitions; they come from other languages (*ennui, angst, naches, amok*), from subcultures such as those of musicians and drug addicts (*blues, funk, juiced, wasted, rush, high, freaked out*), and from general slang (*pissed, bummed, grossed out, blown away*). I have never heard a foreign emotion word whose meaning was not instantly recognizable.

People's emotions are so alike that it takes a philosopher to craft a genuinely alien one. In an essay called "Mad Pain and Martian Pain," David Lewis defines mad pain as follows:

There might be a strange man who sometimes feels pain, just as we do, but whose pain differs greatly from ours in its causes and effects. Our pain is typically caused by cuts, burns, pressure, and the like; his is caused by moderate exercise on an empty stomach. Our pain is generally distracting; his turns his mind to mathematics, facilitating concentration on that but distracting him from anything else. Intense pain has no tendency whatever to cause him to groan or writhe, but does cause him to cross his legs and snap his fingers. He is not in the least motivated to prevent pain or to get rid of it.

Have anthropologists discovered a people that feels mad pain or something equally weird? It might seem that way if you look only at stimulus and response. The anthropologist Richard Shweder points out, "It is a trivial exercise for any anthropologist to generate long lists of antecedent events (ingesting cow urine, eating chicken five days after your father dies, kissing the genitals of an infant boy, being complimented about your pregnancy, caning a child, touching someone's foot or shoulder, being addressed by your first name by your wife, ad infinitum) about which the emotional judgments of a Western observer would not correspond to the native's evaluative response." True enough, but if you look a bit deeper and ask how people *categorize* these stimuli, the emotions elicited by the categories make you feel at home. To us, cow urine is a contaminant and cow mammary secretions are a nutrient; in another culture, the categories may be reversed, but we all feel disgust for contaminants. To us, being addressed by your first name by a spouse is not disrespectful, but being addressed by your first name by a stranger might be, and being addressed by your religion by your spouse might be, too. In all the cases, disrespect triggers anger.

But what about the claims of native informants that they just don't have one of our emotions? Do our emotions seem like mad pain to them? Probably not. The Utku-Inuits' claim that they do not feel anger is belied by their behavior: they recognize anger in foreigners, beat their dogs to discipline them, squeeze their children painfully hard, and occasionally get "heated up." Margaret Mead disseminated the incredible claim that Samoans have no passions—no anger between parents and children or between a cuckold and a seducer, no revenge, no lasting love or bereavement, no maternal caring, no tension about sex, no adolescent turmoil. Derek Freeman and other anthropologists found that Samoan society in fact had widespread adolescent resentment and delinquency, a

cult of virginity, frequent rape, reprisals by the rape victim's family, frigidity, harsh punishment of children, sexual jealousy, and strong religious feeling.

We should not be surprised at these discrepancies. The anthropologist Renato Rosaldo has noted, "A traditional anthropological description is like a book of etiquette. What you get isn't so much the deep cultural wisdom as the cultural clichés, the wisdom of Polonius, conventions in the trivial rather than the informing sense. It may tell you the official rules, but it won't tell you how life is lived." Emotions, in particular, are often regulated by the official rules, because they are assertions of a person's interests. To me it's a confession of my innermost feelings, but to you it's bitching and moaning, and you may very well tell me to put a lid on it. And to those in power, other people's emotions are even more annoying—they lead to nuisances such as women wanting men as husbands and sons rather than as cannon fodder, men fighting each other when they could be fighting the enemy, and children falling in love with a soulmate instead of accepting a betrothed who cements an important deal. Many societies deal with these nuisances by trying to regulate emotions and spreading the disinformation that they don't exist.

Ekman has shown that cultures differ the most in how the emotions are expressed in public. He secretly filmed the expressions of American and Japanese students as they watched gruesome footage of a primitive puberty rite. (Emotion researchers have extensive collections of gross-out material.) If a white-coated experimenter was in the room interviewing them, the Japanese students smiled politely during scenes that made the Americans recoil in horror. But when the subjects were alone, the Japanese and American faces were equally horrified.

FEELING MACHINES

The Romantic movement in philosophy, literature, and art began about two hundred years ago, and since then the emotions and the intellect have been assigned to different realms. The emotions come from nature and live in the body. They are hot, irrational impulses and intuitions, which follow the imperatives of biology. The intellect comes from civilization and lives in the mind. It is a cool deliberator that follows the interests of self and society by keeping the emotions in check. Romantics believe that the emotions are the source of wisdom, innocence, authenticity, and creativity, and should not be repressed by individuals
or society. Often Romantics acknowledge a dark side, the price we must pay for artistic greatness. When the antihero in Anthony Burgess' *A Clockwork Orange* has his violent impulses conditioned out of him, he loses his taste for Beethoven. Romanticism dominates contemporary American popular culture, as in the Dionysian ethos of rock music, the pop psychology imperative to get in touch with your feelings, and the Hollywood formulas about wise simpletons and about uptight yuppies taking a walk on the wild side.

Most scientists tacitly accept the premises of Romanticism even when they disagree with its morals. The irrational emotions and the repressing intellect keep reappearing in scientific guises: the id and the superego, biological drives and cultural norms, the right hemisphere and the left hemisphere, the limbic system and the cerebral cortex, the evolutionary baggage of our animal ancestors and the general intelligence that propelled us to civilization.

In this chapter I present a distinctly unromantic theory of the emotions.

It combines the computational theory of mind, which says that the lifeblood of the psyche is information rather than energy, with the modern theory of evolution, which calls for reverse-engineering the complex design of biological systems. I will show that the emotions are adaptations, well-engineered software modules that work in harmony with the intellect and are indispensable to the functioning of the whole mind. The problem with the emotions is not that they are untamed forces or vestiges of our animal past; it is that they were designed to propagate copies of the genes that built them rather than to promote happiness, wisdom, or moral values. We often call an act "emotional" when it is harmful to the social group, damaging to the actor's happiness in the long run, uncontrollable and impervious to persuasion, or a product of self-delusion. Sad to say, these outcomes are not malfunctions but precisely what we would expect from well-engineered emotions.

The emotions are another part of the mind that has been prematurely written off as nonadaptive baggage. The neuroscientist Paul MacLean took the Romantic doctrine of the emotions and translated it into a famous but incorrect theory known as the Triune Brain. He described the human cerebrum as an evolutionary palimpsest of three layers. At the bottom are the basal ganglia or Reptilian Brain, the seat of the primitive and selfish emotions driving the "Four Fs": feeding, fighting, fleeing, and sexual behavior. Grafted onto it is the limbic system or Primitive Mammalian Brain, which is dedicated to the kinder, gentler, social emotions, like those behind parenting. Wrapped around that is the Modern Mammalian Brain, the neocortex that grew wild in human evolution and that houses the intellect. The belief that the emotions are animal legacies is also familiar from pop ethology documentaries in which snarling baboons segue into rioting soccer hooligans as the voice-over frets about whether we will rise above our instincts and stave off nuclear doom.

One problem for the triune theory is that the forces of evolution do not just heap layers on an unchanged foundation. Natural selection has to work with what is already around, but it can *modify* what it finds. Most parts of the human body came from ancient mammals and before them ancient reptiles, but the parts were heavily modified to fit features of the human lifestyle, such as upright posture. Though our bodies carry vestiges of the past, they have few parts that were unmodifiable and adapted only to the needs of older species. Even the appendix is currently put to use, by the immune system. The circuitry for the emotions was not left untouched, either.

Admittedly, some traits are so much a part of the architectural plan of an organism that selection is powerless to tinker with them. Might the software for the emotions be burned so deeply into the brain that organisms are condemned to feel as their remote ancestors did? The evidence says no; the emotions are easy to reprogram. Emotional repertoires vary wildly among animals depending on their species, sex, and age. Within the mammals, we find the lion and the lamb. Even within dogs (a single species), a few millennia of selective breeding have given us pit bulls and Saint Bernards. The genus closest to ours embraces common chimpanzees, in which gangs of males massacre rival gangs and females can murder one another's babies, and the pygmy chimpanzees (bonobos), whose philosophy is "Make love not war." Of course, some reactions are widely shared across species—say, panic when one is confined—but the reactions may have been retained because they are adaptive for everyone. Natural

selection may not have had complete freedom to reprogram the emotions, but it had a lot.

And the human cerebral cortex does not ride piggyback on an ancient limbic system, or serve as the terminus of a processing stream beginning there. The systems work in tandem, integrated by many two-way connections. The amygdala, an almond-shaped organ buried in each temporal lobe, houses the main circuits that color our experience with emotions. It receives not just simple signals (such as of loud noises) from the lower stations of the brain, but abstract, complex information from the brain's highest centers. The amygdala in turn sends signals to virtually every other part of the brain, including the decision-making circuitry of the frontal lobes.

The anatomy mirrors the psychology. Emotion is not just running away from a bear. It can be set off by the most sophisticated information processing the mind is capable of, such as reading a Dear John letter or coming home to find an ambulance in the driveway. And the emotions help to connive intricate plots for escape, revenge, ambition, and courtship. As Samuel Johnson wrote, "Depend upon it, sir, when a man knows he is to be hanged in a fortnight, it concentrates his mind wonderfully."

The first step in reverse-engineering the emotions is try to imagine what a mind would be like without them. Supposedly Mr. Spock, the Vulcan mastermind, didn't have emotions (except for occasional intrusions from his human side and a seven-year itch that drove him back to Vulcan to spawn). But Spock's emotionlessness really just amounted to his being in control, not losing his head, coolly voicing unpleasant truths, and so on. He must have been driven by *some* motives or goals. Something must have kept Spock from spending his days calculating pi to a quadrillion digits or memorizing the Manhattan telephone directory. Something must have impelled him to explore strange new worlds, to seek out new civilizations, and to boldly go where no man had gone before. Presumably it was intellectual curiosity, a drive to set and solve problems, and solidarity with allies—emotions all. And what would Spock have done when faced with a predator or an invading Klingon? Do a headstand? Prove the four-color map theorem? Presumably a part of his brain quickly mobilized his faculties to scope out how to flee and to take steps to avoid the vulnerable predicament in the future. That is, he had fear. Spock may not have been impulsive or demonstrative, but he must have had drives that impelled him to deploy his intellect in pursuit of certain goals rather than others.

A conventional computer program is a list of instructions that the machine executes until it reaches STOP. But the intelligence of aliens, robots, and animals needs a more flexible method of control. Recall that intelligence is the pursuit of goals in the face of obstacles. Without goals, the very concept of intelligence is meaningless. To get into my locked apartment, I can force open a window, call the landlord, or try to reach the latch through the mail slot. Each of these goals is attained by a chain of subgoals. My fingers won't reach the latch, so the subgoal is to find pliers. But my pliers are inside, so I set up a sub-subgoal of finding a store and buying new pliers. And so on. Most artificial intelligence systems are built around means and ends, like the production system in Chapter 2 with its stack of goal symbols displayed on a bulletin board and the software demons that respond to them.

But where does the topmost goal, the one that the rest of the program tries to attain, come from? For artificial intelligence systems, it comes from

the programmer. The programmer designs it to diagnose soybean diseases or predict the next day's Dow Jones Industrial Average. For organisms, it comes from natural selection. The brain strives to put its owner in circumstances like those that caused its ancestors to reproduce. (The brain's goal is not reproduction itself; animals don't know the facts of life, and people who do know them are happy to subvert them, such as when they use contraception.) The goals installed in *Homo sapiens*, that problem-solving, social species, are not just the Four Fs. High on the list are understanding the environment and securing the cooperation of others.

And here is the key to why we have emotions. An animal cannot pursue all its goals at once. If an animal is both hungry and thirsty, it should not stand halfway between a berry bush and a lake, as in the fable about the indecisive ass who starved between two haystacks. Nor should it nibble a berry, walk over and take a sip from the lake, walk back to nibble another berry, and so on. The animal must commit its body to one goal at a time, and the goals have to be matched with the best moments for achieving them. Ecclesiastes says that to every thing there is a season, and a time to every purpose under heaven: a time to weep, and a time to laugh; a time to love, and a time to hate. Different goals are appropriate when a lion has you in its sights, when your child shows up in tears, or when a rival calls you an idiot in public.

The emotions are mechanisms that set the brain's highest-level goals. Once triggered by a propitious moment, an emotion triggers the cascade of subgoals and sub-subgoals that we call thinking and acting. Because the goals and means are woven into a multiply nested control structure of subgoals within subgoals within subgoals, no sharp line divides thinking from feeling, nor does thinking inevitably precede feeling or vice versa (notwithstanding the century of debate within psychology over which comes first). For example, fear is triggered by a signal of impending harm like a predator, a clifftop, or a spoken threat. It lights up the short-term goal of fleeing, subduing, or deflecting the danger, and gives the goal high priority, which we experience as a sense of urgency. It also lights up the longer-term goals of avoiding the hazard in the future and remembering how we got out of it this time, triggered by the state we experience as relief. Most artificial intelligence researchers believe that freely behaving robots (as opposed to the ones bolted to the side of an assembly line) will have to be programmed with something like emotions merely for them to know at every moment what to do next. (Whether the robots would be *sentient* of these emotions is another question, as we saw in Chapter 2.)

Fear also presses a button that readies the body for action, the so-called fight-or-flight response. (The nickname is misleading because the response prepares us for *any* time-sensitive action, such as grabbing a baby who is crawling toward the top of a stairwell.) The heart thumps to send blood to the muscles. Blood is rerouted from the gut and skin, leaving butterflies and clamminess. Rapid breathing takes in oxygen. Adrenaline releases fuel from the liver and helps the blood to clot. And it gives our face that universal deer-in-the-headlights look.

Each human emotion mobilizes the mind and body to meet one of the challenges of living and reproducing in the cognitive niche. Some challenges are posed by physical things, and the emotions that deal with them, like disgust, fear, and appreciation of natural beauty, work in straightforward ways. Others are posed by people. The problem in dealing with people is that people can deal back. The emotions that evolved in response to other people's emotions, like anger, gratitude, shame, and romantic love, are

played on a complicated chessboard, and they spawn the passion and intrigue that misleads the Romantic. First let's explore emotions about things, then emotions about people.

THE SUBURBAN SAVANNA

The expression "a fish out of water" reminds us that every animal is adapted to a habitat. Humans are no exception. We tend to think that animals just go where they belong, like heat-seeking missiles, but the animals must experience these drives as emotions not unlike ours. Some places are inviting, calming, or beautiful; others are depressing or scary. The topic in biology called "habitat selection" is, in the case of *Homo sapiens*, the same as the topic in geography and architecture called "environmental aesthetics": what kinds of places we enjoy being in.

Until very recently our ancestors were nomads, leaving a site when they had used up its edible plants and animals. The decision of where to go next was no small matter. Cosmides and Tooby write:

Imagine that you are on a camping trip that lasts a lifetime. Having to carry water from a stream and firewood from the trees, one quickly learns to appreciate the advantages of some campsites over others. Dealing with exposure on a daily basis quickly gives one an appreciation for sheltered sites, out of the wind, snow, or rain. For hunter-gatherers, there is no escape from this way of life: no opportunities to pick up food at the grocery store, no telephones, no emergency services, no artificial water supplies, no fuel deliveries, no cages, guns, or animal control officers to protect one from the predatory animals. In these circumstances, one's life depends on the operation of mechanisms that cause one to prefer habitats that provide sufficient food, water, shelter, information, and safety to support human life, and that cause one to avoid those that do not.

Homo sapiens is adapted to two habitats. One is the African savanna, in which most of our evolution took place. For an omnivore like our ancestors, the savanna is a hospitable place compared with other ecosystems. Deserts have little biomass because they have little water. Temperate forests lock up much of their biomass in wood. Rainforests—or, as they used to be called, jungles—place it high in the canopy, relegating omnivores on the ground to being scavengers who gather the bits that fall from above. But the savanna—grasslands dotted with clumps of trees—is rich in biomass, much of it in the flesh of large animals, because grass replenishes itself quickly when grazed. And most of the biomass is conveniently placed a meter or two from the ground. Savannas also offer expansive views, so predators, water, and paths can be spotted from afar. Its trees provide shade and an escape from carnivores.

Our second-choice habitat is the rest of the world. Our ancestors, after evolving on the African savannas, wandered into almost every nook and cranny of the planet. Some were pioneers who left the savanna and then other areas in turn, as the population expanded or the climate changed. Others were refugees in search of safety. Foraging tribes can't stand one another. They frequently raid neighboring territories and kill any stranger who blunders into theirs.

We could afford this wanderlust because of our intellect. People explore a new landscape and draw up a mental resource map, rich in details about water, plants, animals, routes, and shelter. And if they can, they make their

new homeland into a savanna. Native Americans and Australian aborigines used to burn huge swaths of woodland, opening them up for colonization by grasses. The ersatz savanna attracted grazing animals, which were easy to hunt, and exposed visitors before they got too close.

The biologist Gordon Orians, an expert on the behavioral ecology of birds, recently turned his eye to the behavioral ecology of humans. With Judith Heerwagen, Stephen Kaplan, Rachel Kaplan, and others, he argues that our sense of natural beauty is the mechanism that drove our ancestors into suitable habitats. We innately find savannas beautiful, but we also like a landscape that is easy to explore and remember, and that we have lived in long enough to know its ins and outs.

In experiments on human habitat preference, American children and adults are shown slides of landscapes and asked how much they would like to visit or live in them. The children prefer savannas, even though they have never been to one. The adults like the savannas, too, but they like the deciduous and coniferous forests—which resemble much of the habitable United States—just as much. No one likes the deserts and the rainforests. One interpretation is that the children are revealing our species' default habitat preference, and the adults supplement it with the land with which they have grown familiar.

Of course, people do not have a mystical longing for ancient homelands. They are merely pleased by the landscape features that savannas tend to have. Orians and Heerwagen surveyed the professional wisdom of gardeners, photographers, and painters to learn what kinds of landscapes people find beautiful. They treated it as a second kind of data on human tastes in habitats, supplementing the experiments on people's reactions to slides. The landscapes thought to be the loveliest, they found, are dead ringers for an optimal savanna: semi-open space (neither completely exposed, which leaves one vulnerable, nor overgrown, which impedes vision and movement), even ground cover, views to the horizon, large trees, water, changes in elevation, and multiple paths leading out. The geographer Jay Appleton succinctly captured what makes a landscape appealing: prospect and refuge, or seeing without being seen. The combination allows us to learn the lay of the land safely.

The land itself must be legible, too. Anyone who has lost a trail in a dense forest or seen footage of sand dunes or snow drifts in all directions knows the terror of an environment lacking a frame of reference. A landscape is just a very big object, and we recognize complex objects by locating their parts in a reference frame belonging to the object (see Chapter 4). The reference frames in a mental map are big landmarks, like trees, rocks, and ponds, and long paths or boundaries, like rivers and mountain ranges. A vista without these guideposts is unsettling. Kaplan and Kaplan found another key to natural beauty, which they call mystery. Paths bending around hills, meandering streams, gaps in foliage, undulating land, and partly blocked views grab our interest by hinting that the land may have important features that could be discovered by further exploration.

People also love to look at animals and plants, especially flowers. If you are reading this book at home or in other pleasant but artificial surroundings, chances are you can look up and find animal, plant, or flower motifs in the decorations. Our fascination with animals is obvious. We eat them, they eat us. But our love of flowers, which we don't eat except in salads in overpriced restaurants, needs an explanation. We ran into it in Chapters 3 and 5. People are intuitive botanists, and a flower is a rich source of data. Plants blend into a sea of green and often can be identified

only by their flowers. Flowers are harbingers of growth, marking the site of future fruit, nuts, or tubers for creatures smart enough to remember them.

Some natural happenings are deeply evocative, like sunsets, thunder, gathering clouds, and fire. Orians and Heerwagen note that they tell of an imminent and consequential change: darkness, a storm, a blaze. The emotions evoked are arresting, forcing one to stop, take notice, and prepare for what's to come.

Environmental aesthetics is a major factor in our lives. Mood depends on surroundings: think of being in a bus terminal waiting room or a lakeside cottage. People's biggest purchase is their home, and the three rules of home buying—location, location, and location—pertain, apart from nearness to amenities, to grassland, trees, bodies of water, and prospect (views). The value of the house itself depends on its refuge (cozy spaces) and mystery (nooks, bends, windows, multiple levels). And people in the unlikeliest of ecosystems strive for a patch of savanna to call their own. In New England, any land that is left alone quickly turns into a scruffy deciduous forest. During my interlude in suburbia, every weekend my fellow burghers and I would drag out our lawn mowers, leaf blowers, weed whackers, limb loppers, branch pruners, stem snippers, hedge clippers, and wood chippers in a Sisyphean effort to hold the forest at bay. Here in Santa Barbara, the land wants to be an arid chaparral, but decades ago the city fathers dammed wilderness creeks and tunneled through mountains to bring water to thirsty lawns. During a recent drought, homeowners were so desperate for verdant vistas that they sprayed their dusty yards with green paint.

FOOD FOR THOUGHT

Great green gobs of greasy grimy gopher guts,
Mutilated monkey meat,
Concentrated chicken feet.
Jars and jars of petrified porpoise pus,
And me without my spoon!

—fondly remembered camp song, sung to the tune of "The Old Gray Mare"; lyricist unknown

Disgust is a universal human emotion, signaled with its own facial expression and codified everywhere in food taboos. Like all the emotions, disgust has profound effects on human affairs. During World War II, American pilots in the Pacific went hungry rather than eat the toads and bugs that they had been taught were perfectly safe. Food aversions are tenacious ethnic markers, persisting long after other traditions have been abandoned.

Judged by the standards of modern science, disgust is manifestly irrational. People who are sickened by the thought of eating a disgusting object will say it is unsanitary or harmful. But they find a sterilized cockroach every bit as revolting as one fresh from the cupboard, and if the sterilized roach is briefly dunked into a beverage, they will refuse to drink it. People won't drink juice that has been stored in a brand-new urine collection bottle; hospital kitchens have found this an excellent way to stop pilferage. People won't eat soup if it is served in a brand-new bedpan or if it has been stirred with a new comb or flyswatter. You can't pay most people to eat fudge baked in the shape of dog feces or to hold rubber vomit from a novelty store between their lips. One's own saliva is not disgusting as long as it is in one's mouth, but most people won't eat from a bowl of soup into which they have spat.

Most Westerners cannot stomach the thought of eating insects, worms, toads, maggots, caterpillars, or grubs, but these are all highly nutritious and have been eaten by the majority of peoples throughout history. None of our rationalizations makes sense. You say that insects are contaminated because they touch feces or garbage? But many insects are quite sanitary. Termites, for example, just munch wood, but Westerners feel no better about eating them. Compare them with chickens, the epitome of palatability ("Try it—it tastes like chicken!"), which commonly eat garbage and feces. And we all savor tomatoes made plump and juicy from being fertilized with manure. Insects carry disease? So does all animal flesh. Just do what the rest of the world does—cook them. Insects have indigestible wings and legs? Pull them off, as you do with peel-and-eat shrimp, or stick to grubs and maggots. Insects taste bad? Here is a report from a British entomologist who was studying Laotian foodways and acquired a firsthand knowledge of his subject matter:

None distasteful, a few quite palatable, notably the giant waterbug. For the most part they were insipid, with a faint vegetable flavour, but would not anyone tasting bread, for instance, for the first time, wonder why we eat such a flavourless food? A toasted dungbeetle or soft-bodied spider has a nice crisp exterior and soft interior of soufflé consistency which is by no means unpleasant. Salt is usually added, sometimes chili or the leaves of scented herbs, and sometimes they are eaten with rice or added to sauces or curry. Flavour is exceptionally hard to define, but lettuce would, I think, best describe the taste of termites, cicadas, and crickets; lettuce and raw potato that of the giant *Nephila* spider, and concentrated Gorgonzola cheese that of the giant waterbug (*Lethocerus indicus*). I suffered no ill effects from the eating of these insects.

The psychologist Paul Rozin has masterfully captured the psychology of disgust. Disgust is a fear of incorporating an offending substance into one's body. Eating is the most direct way to incorporate a substance, and as my camp song shows, it is the most horrific thought that a disgusting substance can arouse. Smelling or touching it is also unappealing. Disgust deters people from eating certain things, or, if it's too late, makes them spit or vomit them out. The facial expression says it all: the nose is wrinkled, constricting the nostrils, and the mouth is opened and the tongue pushed forward as if to squeegee offending material out.

Disgusting things come from animals. They include whole animals, parts of animals (particularly parts of carnivores and scavengers), and body products, especially viscous substances like mucus and pus and, most of all, feces, universally considered disgusting. Decaying animals and their parts are particularly revolting. In contrast, plants are sometimes distasteful, but distaste is different from disgust. When people avoid plant products—say, lima beans or broccoli—it is because they taste bitter or pungent. Unlike disgusting animal products, they are not felt to be unspeakably vile and polluting. Probably the most complicated thought anyone ever had about a disfavored vegetable was Clarence Darrow's: "I don't like spinach, and I'm glad I don't, because if I liked it I'd eat it, and I just hate it." Inorganic and non-nutritive stuff like sand, cloth, and bark are simply avoided, without strong feelings.

Not only are disgusting things always from animals, but things from animals are almost always disgusting. The nondisgusting animal parts are the exception. Of all the parts of all the animals in creation, people eat an

infinitesimal fraction, and everything else is untouchable. Many Americans eat only the skeletal muscle of cattle, chickens, swine, and a few fish. Other parts, like guts, brains, kidneys, eyes, and feet, are beyond the pale, and so is any part of any animal not on the list: dogs, pigeons, jellyfish, slugs, toads, insects, and the other millions of animal species. Some Americans are even pickier, and are repulsed by the dark meat of chicken or chicken on the bone. Even adventurous eaters are willing to sample only a small fraction of the animal kingdom. And it is not just pampered Americans who are squeamish about unfamiliar animal parts. Napoleon Chagnon safeguarded his supply of peanut butter and hot dogs from his begging Yanomamö informants by telling them they were the feces and penises of cattle. The Yanomamö, who are hearty eaters of caterpillars and grubs, had no idea what cattle were but lost their appetite and left him to eat in peace.

A disgusting object contaminates everything it touches, no matter how brief the contact or how invisible the effects. The intuition behind not drinking a beverage that has been stirred with a flyswatter or dunked with a sterilized roach is that invisible contaminating bits—children call them cooties—have been left behind. Some objects, such as a new comb or bedpan, are tainted merely because they are designed to touch something disgusting, and others, such as a chocolate dog turd, are tainted by mere resemblance. Rozin observes that the psychology of disgust obeys the two laws of sympathetic magic—voodoo—found in many traditional cultures: the law of contagion (once in contact, always in contact) and the law of similarity (like produces like).

Though disgust is universal, the list of nondisgusting animals differs from culture to culture, and that implies a learning process. As every parent knows, children younger than two put everything in their mouths, and psychoanalysts have had a field day interpreting their lack of revulsion for feces. Rozin and his colleagues studied the development of disgust by offering children various foods that American adults find disgusting. To the horror of their onlooking parents, sixty-two percent of toddlers ate imitation dog feces ("realistically crafted from peanut butter and odorous cheese"), and thirty-one percent ate a grasshopper.

Rozin suggests that disgust is learned in the middle school-age years, perhaps when children are scolded by their parents or they see the look on their parents' faces when they approach a disgusting object. But I find that unlikely. First, all the subjects older than toddlers behaved virtually the same as the adults did. For example, four-year-olds wouldn't eat imitation feces or drink juice with a grasshopper in it; the only difference between them and the adults was that the children were less sensitive to contamination by brief contact. (Not until the age of eight did the children reject juice briefly dipped with a grasshopper or with imitation dog feces.) Second, children above the age of two are notoriously finicky, and their parents struggle to get them to eat new substances, not to avoid old ones. (The anthropologist Elizabeth Cashdan has documented that children's willingness to try new foods plummets after the third birthday.) Third, if children had to learn what to avoid, then all animals would be palatable except for the few that are proscribed. But as Rozin himself points out, all animals are disgusting except for a few that are permitted. No child has to be taught to revile greasy grimy gopher guts or mutilated monkey meat.

Cashdan has a better idea. The first two years, she proposes, are a sensitive period for learning about food. During those years mothers control children's food intake and children eat whatever they are permitted. Then their tastes spontaneously shrink, and they stomach only the foods

they were given during the sensitive period. Those distastes can last to adulthood, though adults occasionally overcome them from a variety of motives: to dine with others, to appear macho or sophisticated, to seek thrills, or to avert starvation when familiar fare is scarce.

What is disgust for? Rozin points out that the human species faces "the omnivore's dilemma." Unlike, say, koalas, who mainly eat eucalyptus leaves and are vulnerable when those become scarce, omnivores choose from a vast menu of potential foods. The downside is that many are poison. Many fish, amphibians, and invertebrates contain potent neurotoxins. Meats that are ordinarily harmless can house parasites like tapeworms, and when they spoil, meats can be downright deadly, because the microorganisms that cause putrefaction release toxins to deter scavengers and thereby keep the meat for themselves. Even in industrialized countries food contamination is a major danger. Until recently anthrax and trichinosis were serious hazards, and today public health experts recommend draconian sanitary measures so people won't contract salmonella poisoning from their next chicken salad sandwich. In 1996 a world crisis was set off by the discovery that Mad Cow Disease, a pathology found in some British cattle that makes their brains spongy, might do the same to people who eat the cattle.

Rozin ventured that disgust is an adaptation that deterred our ancestors from eating dangerous animal stuff. Feces, carrion, and soft, wet animal parts are home to harmful microorganisms and ought to be kept outside the body. The dynamics of learning about food in childhood fit right in. Which animal parts are safe depends on the local species and their endemic diseases, so particular tastes cannot be innate. Children use their older relatives the way kings used food tasters: if they ate something and lived, it is not poison. Thus very young children are receptive to whatever their parents let them eat, and when they are old enough to forage on their own, they avoid everything else.

But how can one explain the irrational effects of similarity—the revulsion for rubber vomit, chocolate dog turds, and sterilized roaches? The answer is that these items were *crafted* to evoke the same reaction in people that the objects themselves evoke. That is why novelty shops *sell* rubber vomit. The similarity effect merely shows that reassurance by an authority or by one's own beliefs do not disconnect an emotional response. It is no more irrational than other reactions to modern simulacra, such as being engrossed by a movie, aroused by pornography, or terrified on a roller coaster.

What about our feeling that disgusting things contaminate everything they touch? It is a straightforward adaptation to a basic fact about the living world: germs multiply. Microorganisms are fundamentally different from chemical poisons such as those manufactured by plants. The danger of a chemical depends on its dose. Poisonous plants are bitter-tasting because both the plant and the plant-eater have an interest in the plant-eater stopping after the first bite. But there is no safe dose for a microorganism, because they reproduce exponentially. A single, invisible, untastable germ can multiply and quickly saturate a substance of any size. Since germs are, of course, transmittable by contact, it is no surprise that anything that touches a yucky substance is itself forever yucky, even if it looks and tastes the same. Disgust is intuitive microbiology.

Why are insects and other small creatures like worms and toads—what Latin Americans call "animalitos"—so easy to revile? The anthropologist Marvin Harris has shown that cultures avoid animalitos when larger

animals are available, and eat them when they are not. The explanation has nothing to do with sanitation, since bugs are safer than meat. It comes from optimal foraging theory, the analysis of how animals ought to—and usually do—allocate their time to maximize the rate of nutrients they consume. Animalitos are small and dispersed, and it takes a lot of catching and preparing to get a pound of protein. A large mammal is hundreds of pounds of meat on the hoof, available all at once. (In 1978 a rumor circulated that McDonald's was extending the meat in Big Macs with earthworms. But if the corporation were as avaricious as the rumor was meant to imply, the rumor could not be true: worm meat is far more expensive than beef.) In most environments it is not only more efficient to eat larger animals, but the small ones should be avoided altogether—the time to gather them would be better spent hunting for a bigger payoff. Animalitos are thus absent from the diets of cultures that have bigger fish to fry, and since, in the minds of eaters, whatever is not permitted is forbidden, those cultures find them disgusting.

What about food taboos? Why, for example, are Hindus forbidden to eat beef? Why are Jews forbidden to eat pork and shellfish and to mix meat with milk? For thousands of years, rabbis have offered ingenious justifications of the Jewish dietary laws. Here are a few listed in the *Encyclopedia Judaica*:

From Aristeas, first century BC: "The dietary laws are ethical in intent, since abstention from the consumption of blood tames man's instinct for violence by instilling in him a horror of bloodshed. . . . The injunction against the consumption of birds of prey was intended to demonstrate that man should not prey on others."

From Isaac ben Moses Arama: "The reason behind all the dietary prohibitions is not that any harm may be caused to the body, but that these foods defile and pollute the soul and blunt the intellectual powers, thus leading to confused opinions and a lust for perverse and brutish appetites which lead men to destruction, thus defeating the purpose of creation."

From Maimonides: "All the food which the Torah has forbidden us to eat have some bad and damaging effect on the body. . . . The principal reason why the Law forbids swine's flesh is to be found in the circumstances that its habits and its food are very dirty and loathsome. . . . The fat of the intestines is forbidden because it fattens and destroys the abdomen and creates cold and clammy blood. . . . Meat boiled in milk is undoubtedly gross food, and makes a person feel overfull."

From Abraham ibn Ezra: "I believe it is a matter of cruelty to cook a kid in its mother's milk."

From Nahmanides: "Now the reason for specifying fins and scales is that fish which have fins and scales get nearer to the surface of the water and are found more generally in freshwater areas. . . . Those without fins and scales usually live in the lower muddy strata which are exceedingly moist and where there is no heat. They breed in musty swamps and eating them can be injurious to health."

With all due respect to rabbinical wisdom, these arguments can be

demolished by any bright twelve-year-old, and as a former temple Sunday School teacher I can attest that they regularly are. Many Jewish adults still believe that pork was banned as a public health measure, to prevent trichinosis. But as Harris points out, if that were true the law would have been a simple advisory against undercooking pork: "Flesh of swine thou shalt not eat until the pink has been cooked from it."

Harris observes that food taboos often make ecological and economic sense. The Hebrews and the Muslims were desert tribes, and pigs are animals of the forest. They compete with people for water and nutritious foods like nuts, fruits, and vegetables. Kosher animals, in contrast, are ruminants like sheep, cattle, and goats, which can live off scraggly desert plants. In India, cattle are too precious to slaughter because they are used for milk, manure, and pulling plows. Harris' theory is as ingenious as the rabbis' and far more plausible, though he admits that it can't explain everything. Ancient tribes wandering the parched Judaean sands were hardly in danger of squandering their resources by herding shrimp and oysters, and it is unclear why the inhabitants of a Polish shtetl or a Brooklyn neighborhood should obsess over the feeding habits of desert ruminants.

Food taboos are obviously an ethnic marker, but by itself that observation explains nothing. Why do people wear ethnic badges to begin with, let alone a costly one like banning a source of nutrients? The social sciences assume without question that people submerge their interests to the group, but on evolutionary grounds that is unlikely (as we shall see later in the chapter). I take a more cynical view.

In any group, the younger, poorer, and disenfranchised members may be tempted to defect to other groups. The powerful, especially parents, have an interest in keeping them in. People everywhere form alliances by eating together, from potlatches and feasts to business lunches and dates. If I can't eat with you, I can't become your friend. Food taboos often prohibit a favorite food of a neighboring tribe; that is true, for example, of many of the Jewish dietary laws. That suggests that they are weapons to keep potential defectors in. First, they make the merest prelude to cooperation with outsiders—breaking bread together—an unmistakable act of defiance. Even better, they exploit the psychology of disgust. Taboo foods are absent during the sensitive period for learning food preferences, and that is enough to make children grow up to find them disgusting. That deters them from becoming intimate with the enemy ("He invited me over, but what will I do if they serve . . . EEEEUUUW!!"). Indeed, the tactic is self-perpetuating because children grow up into parents who don't feed the disgusting things to *their* children. The practical effects of food taboos have often been noticed. A familiar theme in novels about the immigrant experience is the protagonist's torment over sampling taboo foods. Crossing the line offers a modicum of integration into the new world but provokes open conflict with parents and community. (In *Portnoy's Complaint*, Alex describes his mother as pronouncing *hamburger* as if it were *Hitler*.) But since the elders have no desire for the community to see the taboos in this light, they cloak them in talmudic sophistry and bafflegab.

THE SMELL OF FEAR

Language-lovers know that there is a word for every fear. Are you afraid of wine? Then you have *oenophobia*. Tremulous about train travel? You suffer from *siderodromophobia*. Having misgivings about your

mother-in-law is *pentheraphobia*, and being petrified of peanut butter sticking to the roof of your mouth is *arachibutyrophobia*. And then there's Franklin Delano Roosevelt's affliction, the fear of fear itself, or *phobophobia*.

But just as not having a word for an emotion doesn't mean that it doesn't exist, having a word for an emotion doesn't mean that it does exist. Word-watchers, verbivores, and sesquipedalians love a challenge. Their idea of a good time is to find the shortest word that contains all the vowels in alphabetical order or to write a novel without the letter *e*. Yet another joy of lex is finding names for hypothetical fears. That is where these improbable phobias come from. Real people do not tremble at the referent of every euphonious Greek or Latin root. Fears and phobias fall into a short and universal list.

Snakes and spiders are always scary. They are the most common objects of fear and loathing in studies of college students' phobias, and have been so for a long time in our evolutionary history. D. O. Hebb found that chimpanzees born in captivity scream in terror when they first see a snake, and the primatologist Marc Hauser found that his laboratory-bred cotton-top tamarins (a South American monkey) screamed out alarm calls when they saw a piece of plastic tubing on the floor. The reaction of foraging peoples is succinctly put by Irven DeVore: "Hunter-gatherers will not suffer a snake to live." In cultures that revere snakes, people still treat them with great wariness. Even Indiana Jones was afraid of them!

The other common fears are of heights, storms, large carnivores, darkness, blood, strangers, confinement, deep water, social scrutiny, and leaving home alone. The common thread is obvious. These are the situations that put our evolutionary ancestors in danger. Spiders and snakes are often venomous, especially in Africa, and most of the others are obvious hazards to a forager's health, or, in the case of social scrutiny, status. Fear is the emotion that motivated our ancestors to cope with the dangers they were likely to face.

Fear is probably several emotions. Phobias of physical things, of social scrutiny, and of leaving home respond to different kinds of drugs, suggesting that they are computed by different brain circuits. The psychiatrist Isaac Marks has shown that people react in different ways to different frightening things, each reaction appropriate to the hazard. An animal triggers an urge to flee, but a precipice causes one to freeze. Social threats lead to shyness and gestures of appeasement. People really do faint at the sight of blood, because their blood pressure drops, presumably a response that would minimize the further loss of one's own blood. The best evidence that fears are adaptations and not just bugs in the nervous system is that animals that have evolved on islands without predators lose their fear and are sitting ducks for any invader—hence the expression "dead as a dodo."

Fears in modern city-dwellers protect us from dangers that no longer exist, and fail to protect us from dangers in the world around us. We ought to be afraid of guns, driving fast, driving without a seatbelt, lighter fluid, and hair dryers near bathtubs, not of snakes and spiders. Public safety officials try to strike fear in the hearts of citizens using everything from statistics to shocking photographs, usually to no avail. Parents scream and punish to deter their children from playing with matches or chasing a ball into the street, but when Chicago schoolchildren were asked what they were most afraid of, they cited lions, tigers, and snakes, unlikely hazards in the Windy City.

Of course, fears do change with experience. For decades psychologists

thought that animals learn new fears the way Pavlov's dogs learned to salivate to a bell. In a famous experiment, John B. Watson, the founder of behaviorism, came up behind an eleven-month-old boy playing with a tame white rat and suddenly clanged two steel bars together. After a few more clangs, the boy became afraid of the rat and other white furry things, including rabbits, dogs, a sealskin coat, and Santa Claus. The rat, too, can learn to associate danger with a previously neutral stimulus. A rat shocked in a white room will flee it for a black room every time it is dumped there, long after the shocker has been unplugged.

But in fact creatures cannot be conditioned to fear just any old thing. Children are nervous about rats, and rats are nervous about bright rooms, before any conditioning begins, and they easily associate them with danger. Change the white rat to some arbitrary object, like opera glasses, and the child never learns to fear it. Shock the rat in a black room instead of a white one, and that nocturnal creature learns the association more slowly and unlearns it more quickly. The psychologist Martin Seligman suggests that fears can be easily conditioned only when the animal is evolutionarily prepared to make the association.

Few, if any, human phobias are about neutral objects that were once paired with some trauma. People dread snakes without ever having seen one. After a frightening or painful event, people are more prudent around the cause, but they do not fear it; there are no phobias for electrical outlets, hammers, cars, or air-raid shelters. Television clichés notwithstanding, most survivors of a traumatic event do not get the screaming meemies every time they face a reminder of it. Vietnam veterans resent the stereotype in which they hit the dirt whenever someone drops a glass.

A better way to understand the learning of fears is to think through the evolutionary demands. The world is a dangerous place, but our ancestors could not have spent their lives cowering in caves; there was food to gather and mates to win. They had to calibrate their fears of typical dangers against the actual dangers in the local environment (after all, not *all* spiders are poisonous) and against their own ability to neutralize the danger: their know-how, defensive technology, and safety in numbers.

Marks and the psychiatrist Randolph Nesse argue that phobias are innate fears that have never been unlearned. Fears develop spontaneously in children. In their first year, babies fear strangers and separation, as well they should, for infanticide and predation are serious threats to the tiniest hunter-gatherers. (The film *A Cry in the Dark* shows how easily a predator can snatch an unattended baby. It is an excellent answer to every parent's question of why the infant left alone in a dark bedroom is screaming bloody murder.) Between the ages of three and five, children become fearful of all the standard phobic objects—spiders, the dark, deep water, and so on—and then master them one by one. Most adult phobias are childhood fears that never went away. That is why it is city-dwellers who most fear snakes.

As with the learning of safe foods, the best guides to the local dangers are the people who have survived them. Children fear what they see their parents fear, and often unlearn their fears when they see other children coping. Adults are just as impressionable. In wartime, courage and panic are both contagious, and in some therapies, the phobic watches as an aide plays with a boa constrictor or lets a spider crawl up her arm. Even monkeys watch one another to calibrate their fear. Laboratory-raised rhesus macaques are not afraid of snakes when they first see them, but if they watch a film of another monkey being frightened by a snake, they fear it, too. The monkey in the movie does not instill the fear so much as awaken it,

for if the film shows the monkey recoiling from a flower or a bunny instead of a snake, the viewer develops no fear.

The ability to conquer fear selectively is an important component of the instinct. People in grave danger, such as pilots in combat or Londoners during the blitz, can be remarkably composed. No one knows why some people can keep their heads when all about them are losing theirs, but the main calming agents are predictability, allies within shouting distance, and a sense of competence and control, which the writer Tom Wolfe called The Right Stuff. In his book by that name about the test pilots who became Mercury astronauts, Wolfe defined the right stuff as "the ability [of a pilot] to go up in a hurtling piece of machinery and put his hide on the line and then have the moxie, the reflexes, the experience, the coolness, to pull it back in the last yawning moment." That sense of control comes from "pushing the outside of the envelope": testing, in small steps, how high, how fast, how far one can go without bringing on disaster. Pushing the envelope is a powerful motive. Recreation, and the emotion called "exhilaration," come from enduring relatively safe events that look and feel like ancestral dangers. These include most noncompetitive sports (diving, climbing, spelunking, and so on) and the genres of books and movies called "thrillers." Winston Churchill once said, "Nothing in life is so exhilarating as to be shot at without result."

THE HAPPINESS TREADMILL

The pursuit of happiness is an inalienable right, says the Declaration of Independence in its list of self-evident truths. The greatest happiness of the greatest number, wrote Jeremy Bentham, is the foundation of morality. To say that everyone wants to be happy sounds trite, almost circular, but it raises a profound question about our makeup. What is this thing that people strive for?

At first happiness might seem like just desserts for biological fitness (more accurately, the states that would have led to fitness in the environment in which we evolved). We are happier when we are healthy, well-fed, comfortable, safe, prosperous, knowledgeable, respected, non-celibate, and loved. Compared to their opposites, these objects of striving are conducive to reproduction. The function of happiness would be to mobilize the mind to seek the keys to Darwinian fitness. When we are unhappy, we work for the things that make us happy; when we are happy, we keep the status quo.

The problem is, how much fitness is worth striving for? Ice Age people would have been wasting their time if they had fretted about their lack of camping stoves, penicillin, and hunting rifles or if they had striven for them instead of better caves and spears. Even among modern foragers, very different standards of living are attainable in different times and places. Lest the perfect be the enemy of the good, the pursuit of happiness ought to be calibrated by what can be attained through reasonable effort in the current environment.

How do we know what can reasonably be attained? A good source of information is what other people have attained. If they can get it, perhaps so can you. Through the ages, observers of the human condition have pointed out the tragedy: people are happy when they feel better off than their neighbors, unhappy when they feel worse off.

But, O! how bitter a thing it is to look into happiness through another

man's eyes!

—William Shakespeare (*As You Like It*, V, ii).

Happiness, n. An agreeable sensation arising from contemplating the misery of others.

—Ambrose Bierce

It is not enough to succeed. Others must fail.

—Gore Vidal

Ven frait zich a hoiker? Ven er zet a gresseren hoiker far zich. (When does a hunchback rejoice? When he sees one with a larger hump.)

—Yiddish saying

Research on the psychology of happiness has borne out the curmudgeons. Kahneman and Tversky give an everyday example. You open your paycheck and are delighted to find you have been given a five percent raise—until you learn that your co-workers have been given a ten percent raise. According to legend, the diva Maria Callas stipulated that any opera house she sang in had to pay her one dollar more than the next highest paid singer in the company.

People today are safer, healthier, better fed, and longer-lived than at any time in history. Yet we don't spend our lives walking on air, and presumably our ancestors were not chronically glum. It is not reactionary to point out that many of the poor in today's Western nations live in conditions that yesterday's aristocrats could not have dreamed of. People in different classes and countries are often content with their lot until they compare themselves to the more affluent. The amount of violence in a society is more closely related to its inequality than to its poverty. In the second half of the twentieth century, the discontent of the Third World, and later the Second, have been attributed to their glimpses through the mass media of the First.

The other major clue to the attainable is how well off you are now. What you have now is attainable, by definition, and chances are you can do at least a little bit better. Evolutionary theory predicts that a man's reach should exceed his grasp, but not by much. Here we have the second tragedy of happiness: people adapt to their circumstances, good or bad, the way their eyes adapt to sun or darkness. From that neutral point, improvement is happiness, loss is misery. Again, the sages said it first. The narrator of E. A. Robinson's poem (and later Simon and Garfunkel's song) envies the factory owner, Richard Cory, who "glittered when he walked."

So on we worked, and waited for the light,
And went without the meat, and cursed the bread;
And Richard Cory, one calm summer night,
Went home and put a bullet through his head.

The futility of striving has led many dark souls to deny that happiness is possible. For the show-business personality Oscar Levant, "Happiness is not something you experience, it's something you remember." Freud said that the goal of psychotherapy was "to transform hysterical misery into common unhappiness." A colleague, consulting with me by email about a troubled graduate student, wrote, "sometimes i wish i was young then i remember that wasn't so great either."

But here the curmudgeons are only partly right. People do come to feel

the same across an astonishing range of good and bad fortunes. But the baseline that people adapt to, on average, is not misery but satisfaction. (The exact baseline differs from person to person and is largely inherited.) The psychologists David Myers and Ed Diener have found that about eighty percent of people in the industrialized world report that they are at least "fairly satisfied with life," and about thirty percent say they are "very happy." (As far as we can tell, the reports are sincere.) The percentages are the same for all ages, for both sexes, for blacks and whites, and over four decades of economic growth. As Myers and Diener remark, "Compared with 1957, Americans have twice as many cars per person—plus microwave ovens, color TVs, VCRs, air conditioners, answering machines, and $12 billion worth of new brand-name athletic shoes a year. So, are Americans happier than they were in 1957? They are not."

Within an industrialized country, money buys only a little happiness: the correlation between wealth and satisfaction is positive but small. Lottery winners, after their jolt of happiness has subsided, return to their former emotional state. On the brighter side, so do people who have suffered terrible losses, such as paraplegics and survivors of the Holocaust.

These findings do not necessarily contradict the singer Sophie Tucker when she said, "I have been poor and I have been rich. Rich is better." In India and Bangladesh, wealth predicts happiness much better than it does in the West. Among twenty-four Western European and American nations, the higher the gross national product per capita, the happier the citizens (though there are many explanations). Myers and Diener point out that wealth is like health: not having it makes you miserable, but having it does not guarantee happiness.

The tragedy of happiness has a third act. There are twice as many negative emotions (fear, grief, anxiety, and so on) as positive ones, and losses are more keenly felt than equivalent gains. The tennis star Jimmy Connors once summed up the human condition: "I hate to lose more than I like to win." The asymmetry has been confirmed in the lab by showing that people will take a bigger gamble to avoid a sure loss than to improve on a sure gain, and by showing that people's mood plummets more when imagining a loss in their lives (for example, in course grades, or in relationships with the opposite sex) than it rises when imagining an equivalent gain. The psychologist Timothy Ketelaar notes that happiness tracks the effects of resources on biological fitness. As things get better, increases in fitness show diminishing returns: more food is better, but only up to a point. But as things get worse, decreases in fitness can take you out of the game: not enough food, and you're dead. There are many ways to become infinitely worse off (from an infection, starvation, getting eaten, a fall, ad infinitum) and not many ways to become vastly better off. That makes prospective losses more worthy of attention than gains; there are more things that make us unhappy than things that make us happy.

Donald Campbell, an early evolutionary psychologist who studied the psychology of pleasure, described humans as being on a "hedonic treadmill," where gains in well-being leave us no happier in the long run. Indeed, the study of happiness often sounds like a sermon for traditional values. The numbers show that it is not the rich, privileged, robust, or good-looking who are happy; it is those who have spouses, friends, religion, and challenging, meaningful work. The findings can be overstated, because they apply to averages, not individuals, and because cause and effect are hard to tease apart: being married might make you happy, but being happy might help you get and stay married. But Campbell echoed millennia of wise men

and women when he summed up the research: "The direct pursuit of happiness is a recipe for an unhappy life."

THE SIRENS' SONG

When we say that someone is led by emotion rather than reason, we often mean that the person sacrifices long-term interests for short-term gratification. Losing one's temper, surrendering to a seducer, blowing one's paycheck, and turning tail at the dentist's door are examples. What makes us so short-sighted?

The ability to defer a reward is called self-control or delay of gratification. Social scientists often treat it as a sign of intelligence, of the ability to anticipate the future and plan accordingly. But discounting the future, as economists call it, is part of the logic of choice for any agent that lives longer than an instant. Going for the quick reward instead of a distant payoff is often the rational strategy.

Which is better, a dollar now or a dollar a year from now? (Assume there is no inflation.) A dollar now, you might say, because you can invest it and have more than a dollar in a year. Unfortunately, the explanation is circular: the reason that interest exists in the first place is to pay people to give up the dollar that they would rather have now than a year from now. But economists point out that even if the explanation is misplaced, the answer is right: now really *is* better. First, a dollar now is available if a pressing need or opportunity arises in less than a year. Second, if you forgo the dollar now, you have no guarantee that you will get it back a year from now. Third, you might die within a year and never get to enjoy it. It is rational, therefore, to discount the future: to consume a resource now unless investing it brings a high enough return. The interest rate you should demand depends on how important the money is to you now, how likely you are to get it back, and how long you expect to live.

The struggle to reproduce is a kind of economy, and all organisms, even plants, must "decide" whether to use resources now or save them for the future. Some of these decisions are made by the body. We grow frail with age because our genes discount the future and build strong young bodies at the expense of weak old ones. The exchange pays off over the generations because an accident may cause the body to die before it gets old, in which case any sacrifice of vigor for longevity would have gone to waste. But most decisions about the future are made by the mind. At every moment we choose, consciously or unconsciously, between good things now and better things later.

Sometimes the rational decision is "now," particularly when, as the sayings go, life is short or there is no tomorrow. The logic is laid bare in firing-squad jokes. The condemned man is offered the ceremonial last cigarette and responds, "No thanks, I'm trying to quit." We laugh because we know it is pointless for him to delay gratification. Another old joke makes it clear why playing it safe is not always called for. Murray and Esther, a middle-aged Jewish couple, are touring South America. One day Murray inadvertently photographs a secret military installation, and soldiers hustle the couple off to prison. For three weeks they are tortured in an effort to get them to name their contacts in the liberation movement. Finally they are hauled in front of a military court, charged with espionage, and sentenced to death by firing squad. The next morning they are lined up in front of the wall and the sergeant asks them if they have any last requests. Esther wants to know if she can call her daughter in Chicago. The

sergeant says that's not possible, and turns to Murray. "This is crazy," Murray shouts, "we're not spies!" and he spits in the sergeant's face. "Murray!" Esther cries. "Please! Don't make trouble!"

Most of the time we are pretty sure that we will not die in minutes. But we all die sometime, and we all risk forgoing the opportunity to enjoy something if we defer it too long. In our ancestors' nomadic lifestyle, without an ability to accumulate possessions or to count on long-lived social institutions like depositors' insurance, the payoffs for consumption must have been even higher. But even if they were not, *some* urge to indulge now had to have been built into our emotions. Most likely, we evolved a mechanism to estimate our longevity and the opportunities and risks posed by different choices (eating now or later, setting up camp or pushing on) and to tune the emotions accordingly.

The political scientist James Q. Wilson and the psychologist Richard Herrnstein have pointed out that many criminals act as if they discount the future steeply. A crime is a gamble whose payoff is immediate and whose possible cost comes later. They attributed the discounting to low intelligence. The psychologists Martin Daly and Margo Wilson have a different explanation. In the American inner cities, life expectancy for young males is low, and they know it. (In *Hoop Dreams*, the documentary about aspiring basketball players in a Chicago ghetto, there is an arresting scene in which the mother of one of the boys rejoices that he is alive on his eighteenth birthday.) Moreover, the social order and long-term ownership rights which would guarantee that investments are repaid are tenuous. These are precisely the circumstances in which steeply discounting the future—taking risks, consuming rather than investing—is adaptive.

More puzzling is *myopic* discounting: the tendency in all of us to prefer a large late reward to a small early one, but then to flip our preference as time passes and both rewards draw nearer. A familiar example is deciding before dinner to skip dessert (a small early reward) in order to lose weight (a large late one), but succumbing to temptation when the waiter takes the dessert orders. Myopic discounting is easy to produce in the lab: give people (or pigeons, for that matter) two buttons, one delivering a small reward now, the other delivering a larger reward later, and the subject will flip from choosing the large reward to choosing the small reward as the small one becomes imminent. The weakness of the will is an unsolved problem in economics and psychology alike. The economist Thomas Schelling asks a question about the "rational consumer" that can also be posed of the adapted mind:

How should we conceptualize this rational consumer whom all of us know and who some of us are, who in self-disgust grinds his cigarettes down the disposal swearing that this time he means never again to risk orphaning his children with lung cancer and is on the street three hours later looking for a store that's still open to buy cigarettes; who eats a high-calorie lunch knowing that he will regret it, does regret it, cannot understand how he lost control, resolves to compensate with a low-calorie dinner, eats a high-calorie dinner knowing he will regret it, and does regret it; who sits glued to the TV knowing that again tomorrow he'll wake early in a cold sweat unprepared for that morning meeting on which so much of his career depends; who spoils the trip to Disneyland by losing his temper when his children do what he knew they were going to do when he resolved not to lose his temper when they did it?

Schelling notes the strange ways in which we defeat our self-defeating

lifetime—losing a finger, acquiring a tattoo, having her nose pierced—were not passed on to you. The only change you could have inherited was a mutation of one of the genes in the egg that was to become you. Genes, not bodies, replicate, and that means that genes, not bodies, should be selfish.

DNA, of course, has no feelings; "selfish" means "acting in ways that make one's own replication more likely." The way for a gene to do that in an animal with a brain is to wire the brain so that the animal's pleasures and pains cause it to act in ways that lead to more copies of the gene. Often that means causing an animal to enjoy the states that make it survive and reproduce. A full belly is satisfying because full bellies keep animals alive and moving and reproducing, leading to more copies of the genes that build brains that make full bellies feel satisfying.

By building a brain that makes eating fun, a gene helps to spread copies of itself lying in the animal's gonads. The actual DNA that helps build a brain, of course, doesn't itself get passed into the egg or sperm; only the copies of the gene inside the gonads do. But here is an important twist. The genes in an animal's gonads are not the *only* extant copies of the brain-building genes; they are merely the most convenient ones for the brain-building gene to help replicate. *Any* copy capable of replicating, anywhere in the world, is a legitimate target, if it can be identified and if steps can be taken to help it replicate. A gene that worked to replicate copies of itself inside some *other* animal's gonads could do as well as a gene that worked to replicate copies of itself inside *its own* animal's gonads. As far as the gene is concerned, a copy is a copy; which animal houses it is irrelevant. To a brain-building gene, the only thing special about that animal's gonads is the *certainty* that copies of the gene will be found in those gonads (the certainty comes from the fact that the cells in an animal's body are genetic clones). That is why the brain-building genes make animals enjoy their own well-being so much. If a gene could build a brain that could tell when copies of itself were sitting in *another* animal's gonads, it would make the brain enjoy the *other* animal's well-being, and make it act in ways that increased that other animal's well-being.

When does a copy of a gene in one animal also sit inside another? When the animals are related. In most animals there is a one-in-two chance that any gene in a parent will have a copy lying inside its offspring, because offspring get half their genes from each parent. There is also a one-in-two chance that a copy is lying inside a full sibling, because full siblings inherit their genes from the same pair of parents. There is a one-in-eight chance that a copy is lying inside a first cousin, and so on. A gene that built a brain that made its owner help its relatives would indirectly help to replicate itself. The biologist William Hamilton noted that if the benefit to the relative, multiplied by the probability that a gene is shared, exceeds the cost to the animal, that gene would spread in the population. Hamilton developed and formalized an idea that had been entertained by several other biologists as well, most famously in a wisecrack by the biologist J. B. S. Haldane when he was asked if he would lay down his life for his brother. "No," he said, "but for two brothers or eight cousins."

When an animal behaves to benefit another animal at a cost to itself, biologists call it altruism. When altruism evolves because the altruist is related to the beneficiary so the altruism-causing gene benefits itself, they call it kin selection. But when we look into the psychology of the animal doing the behaving, we can give the phenomenon another name: love.

The essence of love is feeling pleasure in another's well-being and pain in its harm. These feelings motivate acts that benefit the loved one, like

nurturing, feeding, and protecting. We now understand why many animals, including humans, love their children, parents, grandparents, grandchildren, siblings, aunts, uncles, nephews, nieces, and cousins: people helping relatives equals genes helping themselves. The sacrifices made for love are modulated by the degree of relatedness: people make more sacrifices for their children than for their nephews and nieces. They are modulated by the expected reproductive life of the beneficiary: parents sacrifice more for children, who have a longer life ahead of them, than children sacrifice for parents. And they are modulated by the beneficiary's own feelings of love. People love their grandmothers not because their grandmothers are expected to reproduce, but because their grandmothers love *them*, and love the rest of their family. That is, you help people who enjoy helping you and helping your relatives. That is also why men and women fall in love. The other parent of my child has as much of a genetic stake in the child as I do, so what is good for her is good for me.

Many people think that the theory of the selfish gene says that "animals try to spread their genes." That misstates the facts and it misstates the theory. Animals, including most people, know nothing about genetics and care even less. People love their children not because they want to spread their genes (consciously or unconsciously) but because they can't help it. That love makes them try to keep their children warm, fed, and safe. What is selfish is not the real motives of the person but the metaphorical motives of the genes that built the person. Genes "try" to spread *themselves* by wiring animals' brains so the animals love their kin and try to keep warm, fed, and safe.

The confusion comes from thinking of people's genes as their true self, and the motives of their genes as their deepest, truest, unconscious motives. From there it's easy to draw the cynical and incorrect moral that all love is hypocritical. That confuses the real motives of the person with the metaphorical motives of the genes. Genes are not puppetmasters; they acted as the recipe for making the brain and body and then they got out of the way. They live in a parallel universe, scattered among bodies, with their own agendas.

Most discussions of the biology of altruism are really not about the biology of altruism. It's easy to see why nature documentaries, with their laudable conservationist ethic, disseminate the agitprop that animals act in the interests of the group. One subtext is, Don't hate the wolf that just ate Bambi; he's acting for the greater good. The other is, Protecting the environment is nature's way; we humans had better shape up. The opposing theory of the selfish gene has been bitterly attacked out of the fear that it vindicates the philosophy of Gordon Gekko in *Wall Street*: greed is good, greed works. Then there are those who believe in selfish genes but urge us to face up to the sad truth: at heart, Mother Teresa is really selfish.

I think moralistic science is bad for morals and bad for science. Surely paving Yosemite is unwise, Gordon Gekko is bad, and Mother Teresa is good regardless of what came out in the latest biology journals. But I suppose it is only human to feel a *frisson* when learning about what made us what we are. So I offer a more hopeful way of reflecting on the selfish gene.

The body is the ultimate barrier to empathy. Your toothache simply does not hurt me the way it hurts you. But genes are not imprisoned in bodies; the same gene lives in the bodies of many family members at once. The dispersed copies of a gene call to one another by endowing bodies with emotions. Love, compassion, and empathy are invisible fibers that connect

genes in different bodies. They are the closest we will ever come to feeling someone else's toothache. When a parent wishes she could take the place of a child about to undergo surgery, it is not the species or the group or her body that wants her to have that most unselfish emotion; it is her selfish genes.

Animals are nice not just to their relatives. The biologist Robert Trivers developed a suggestion from George Williams on how another kind of altruism could evolve (where altruism, again, is defined as behavior that benefits another organism at a cost to the behaver). Dawkins explains it with a hypothetical example. Imagine a species of bird that suffers from a disease-carrying tick and must spend a good deal of time removing them with its beak. It can reach every part of its body but the top of its head. Every bird would benefit if some other bird groomed its head. If the birds in a group all responded to the sight of a head presented to them by grooming it, the group would prosper. But what would happen if a mutant presented its head for grooming but never groomed anyone else? These freeloaders would be parasite-free, *and* could use the time they saved not grooming others to look for food. With that advantage they would eventually dominate the population, even if it made the group more vulnerable to extinction. The psychologist Roger Brown explains, "One can imagine a pathetic final act in which all birds on stage present to one another heads that none will groom."

But say a different, grudge-bearing mutant arose. This mutant groomed strangers, groomed birds that in the past had groomed it, but refused to groom birds that had refused to groom it. Once a few of them had gained a toehold, these grudgers could prosper, because they would groom one another and not pay the costs of grooming the cheaters. And once they were established, neither indiscriminate groomers nor cheaters could drive them out, though in some circumstances cheaters could lurk as a minority.

The example is hypothetical, illustrating how altruism among non-kin—what Trivers called reciprocal altruism—can evolve. It is easy to confuse the thought experiment with a real observation; Brown remarks, "When I have used the example in teaching, it has sometimes come back to me on exams as a real bird, often as 'Skinner's pigeons,' sometimes the black-headed gull, and once the robin." Some species do practice reciprocal altruism, but not many, because it evolves only under special conditions. An animal must be able to grant a large benefit to another at a small cost to itself, and the roles must commonly reverse. The animals must devote part of their brains to recognizing each other as individuals (see Chapter 2), and, if repayment comes long after the favor, to remembering who helped them and who refused, and to deciding how to grant and withhold favors accordingly.

Humans are, of course, a brainy species, and are zoologically unusual in how often they help unrelated individuals (Chapter 3). Our lifestyles and our minds are particularly adapted to the demands of reciprocal altruism. People have food, tools, help, and information to trade. With language, information is an ideal trade good because its cost to the giver—a few seconds of breath—is minuscule compared with the benefit to the recipient. Humans are obsessed with individuals; remember the Blick twins from Chapter 2, one of whom bit a police officer but neither of whom could be punished because each benefited from reasonable doubt that he and not his twin did the deed. And the human mind is equipped with goal-setting demons that regulate the doling out of favors; as with kin-directed altruism, reciprocal altruism is behaviorist shorthand for a set of thoughts and

emotions. Trivers and the biologist Richard Alexander have shown how the demands of reciprocal altruism are probably the source of many human emotions. Collectively they make up a large part of the moral sense.

The minimal equipment is a cheater-detector and a tit-for-tat strategy that begrudges a gross cheater further help. A gross cheater is one who refuses to reciprocate at all, or who returns so little that the altruist gets back less than the cost of the initial favor. Recall from Chapter 5 that Cosmides has shown that people do reason unusually well about cheaters. But the real intrigue begins with Trivers' observation that there is a more subtle way to cheat. A subtle cheater reciprocates enough to make it worth the altruist's while, but returns less than he is capable of giving, or less than the altruist would give if the situation were reversed. That puts the altruist in an awkward position. In one sense she is being ripped off. But if she insists on equity, the subtle cheater could break off the relationship altogether. Since half a loaf is better than none, the altruist is trapped. She does have one kind of leverage, though. If there are *other* trading partners in the group who don't cheat at all, or who cheat subtly but less stingily, she can give them her business instead.

The game has become more complicated. Selection favors cheating when the altruist will not find out or when she will not break off her altruism if she does find out. That leads to better cheater-detectors, which leads to more subtle cheating, which leads to detectors for more subtle cheating, which leads to tactics to get away with subtle cheating without being detected by the subtle-cheater-detectors, and so on. Each detector must trigger an emotion demon that sets up the appropriate goal—continuing to reciprocate, breaking off the relationship, and so on.

Here is how Trivers reverse-engineered the moralistic emotions as strategies in the reciprocity game. (His assumptions about the causes and consequences of each emotion are well supported by the literature in experimental social psychology and by studies of other cultures, though they are hardly necessary, as real-life examples no doubt will flood into mind.)

Liking is the emotion that initiates and maintains an altruistic partnership. It is, roughly, a willingness to offer someone a favor, and is directed to those who appear willing to offer favors back. We like people who are nice to us, and we are nice to people whom we like.

Anger protects a person whose niceness has left her vulnerable to being cheated. When the exploitation is discovered, the person classifies the offending act as unjust and experiences indignation and a desire to respond with moralistic aggression: punishing the cheater by severing the relationship and sometimes by hurting him. Many psychologists have remarked that anger has moral overtones; almost all anger is righteous anger. Furious people feel they are aggrieved and must redress an injustice.

Gratitude calibrates the desire to reciprocate according to the costs and benefits of the original act. We are grateful to people when their favor helps us a lot and has cost them a lot.

Sympathy, the desire to help those in need, may be an emotion for earning gratitude. If people are most grateful when they most need the favor, a person in need is an opportunity to make an altruistic act go farthest.

Guilt can rack a cheater who is in danger of being found out. H. L. Mencken defined *conscience* as "the inner voice which warns us that someone might be looking." If the victim responds by cutting off all future aid, the cheater will have paid dearly. He has an interest in preventing the

rupture by making up for the misdeed and keeping it from happening again. People feel guilty about private transgressions because they may become public; confessing a sin before it is discovered is evidence of sincerity and gives the victim better grounds to maintain the relationship. *Shame*, the reaction to a transgression after it has been discovered, evokes a public display of contrition, no doubt for the same reason.

Lily Tomlin said, "I try to be cynical, but it's hard to keep up." Trivers notes that once these emotions evolved, people had an incentive to mimic them to take advantage of other people's reactions to the real thing. Sham generosity and friendship may induce genuine altruism in return. Sham moral anger when no real cheating took place may nonetheless win reparations. Sham guilt may convince a wronged party that the cheater has reformed his ways, even if cheating is about to resume. Feigning dire straits may evoke genuine sympathy. Sham sympathy which gives the appearance of helping may elicit real gratitude. Sham gratitude may mislead an altruist into expecting a favor to be reciprocated. Trivers notes that none of this hypocrisy need be conscious; indeed, as we shall see, it is most effective when it is not.

The next round in this evolutionary contest is, of course, developing an ability to discriminate between real emotions and sham emotions. We get the evolution of *trust* and *distrust*. When we see someone going through the motions of generosity, guilt, sympathy, or gratitude rather than showing signs of the genuine emotion, we lose the desire to cooperate. For example, if a cheater makes amends in a calculating manner rather than out of credible guilt, he may cheat again when circumstances allow him to get away with it. The search for signs of trustworthiness makes us into mind readers, alert for any twitch or inconsistency that betrays a sham emotion. Since hypocrisy is easiest to expose when people compare notes, the search for trustworthiness makes us avid consumers of gossip. In turn, our reputation becomes our most valuable possession, and we are motivated to protect (and inflate) it with conspicuous displays of generosity, sympathy, and integrity and to take umbrage when it is impugned.

Are you keeping up? The ability to guard against sham emotions can in turn be used as a weapon against real emotions. One can protect one's own cheating by imputing false motives to someone else—by saying that a person really isn't aggrieved, friendly, grateful, guilty, and so on, when she really is. No wonder Trivers was the first to propose that the expansion of the human brain was driven by a cognitive arms race, fueled by the emotions needed to regulate reciprocal altruism.

Like kin selection, reciprocal altruism has been condemned as painting, even condoning, a bleak picture of human motives. Is sympathy nothing but a cheap way to buy gratitude? Is niceness just a business tactic? Not at all. Go ahead and think the worst about the sham emotions. But the reason the real ones are felt is not that they are hoped to help the feeler; it is that they in fact helped the feeler's ancestors. And it's not just that you shouldn't visit the iniquities of the fathers upon the children; the fathers may never have been iniquitous to begin with. The first mutants who felt sympathy and gratitude may have prospered not by their own calculation but because the feelings made it worth their neighbors' while to cooperate with them. The emotions themselves may have been kind and heartfelt in every generation; indeed, once sham-emotion-detectors evolved, they would be most effective when they *are* kind and heartfelt. Of course, the genes are metaphorically selfish in endowing people with beneficent emotions, but who cares about

the moral worth of deoxyribonucleic acid?

Many people still resist the idea that the moral emotions are designed by natural selection to further the long-term interests of individuals and ultimately their genes. Wouldn't it be better for everyone if we were built to enjoy what was best for the group? Companies wouldn't pollute, public service unions wouldn't strike, citizens would recycle bottles and take the bus, and those teenagers would stop ruining a quiet Sunday afternoon with their jet-skis.

Once again I think it is unwise to confuse how the mind works with how it would be nice for the mind to work. But perhaps some comfort may be taken in a different way of looking at things. Perhaps we should *rejoice* that people's emotions aren't designed for the good of the group. Often the best way to benefit one's group is to displace, subjugate, or annihilate the group next door. Ants in a colony are closely related, and each is a paragon of unselfishness. That's why ants are one of the few kinds of animal that wage war and take slaves. When human leaders have manipulated or coerced people into submerging their interests into the group's, the outcomes are some of history's worst atrocities. In *Love and Death*, Woody Allen's pacifist character is urged to defend the czar and Mother Russia with the dubious call to duty that under French rule he would have to eat croissants and rich food with heavy sauces. People's desire for a comfortable life for themselves, their family, and their friends may have braked the ambitions of many an emperor.

THE DOOMSDAY MACHINE

It is 1962, and you are the president of the United States. You have just learned that the Soviet Union has dropped an atomic bomb on New York. You know they will not attack again. In front of you is the phone to the Pentagon, the proverbial button, with which you can retaliate by bombing Moscow.

You are about to press the button. The nation's policy is to retaliate in kind against a nuclear attack. The policy was designed to deter attackers; if you don't follow through, the deterrent would have been a sham.

On the other hand, you are thinking, the damage has been done. Killing millions of Russians will not bring millions of dead Americans back to life. The bomb will add radioactive fallout to the atmosphere, harming your own citizens. And you will go down in history as one of the worst mass murderers of all time. Retaliation now would be sheer spite.

But then, it is precisely this line of thinking that emboldened the Soviets to attack. They *knew* that once the bomb fell you would have nothing to gain and much to lose by retaliating. They thought they were calling your bluff. So you had better retaliate to show them it wasn't a bluff.

But then again, what's the point of proving *now* that you weren't bluffing *then*? The present cannot affect the past. The fact remains that if you push the button, you will snuff out millions of lives for no reason.

But wait—the Soviets knew you would think it is pointless to prove you weren't bluffing after they tried to call your bluff. That's why they called your bluff. The very fact that you are thinking this way brought on the catastrophe—so you shouldn't think this way.

But not thinking this way *now* is too late . . .

You curse your freedom. Your predicament is that you have the choice to retaliate, and since retaliating is not in your interests, you may decide not to do it, exactly as the Soviets anticipated. If only you didn't *have* the

choice! If only your missiles had been wired to a reliable nuclear-fireball-detector and went off automatically. The Soviets would not have dared to attack, because they would have known retaliation was certain.

This train of reasoning was taken to its logical conclusion in the novel and film *Dr. Strangelove*. A deranged American officer has ordered a nuclear bomber to attack the Soviet Union, and it cannot be recalled. The president and his advisors meet in the war room with the Soviet ambassador to persuade him, and by telephone the Soviet leader, that the imminent attack is an accident and that the Soviets should not retaliate. They learn it is too late. The Soviets had installed the Doomsday Machine: a network of underground nuclear bombs that is set off automatically if the country is attacked or if anyone tries to disarm it. The fallout will destroy all human and animal life on earth. They installed the machine because it was cheaper than pinpoint missiles and bombers, and because they feared the United States might be building one and wanted to prevent a Doomsday gap. President Muffley (played by Peter Sellers) confers with the country's top nuclear strategist, the brilliant Dr. Strangelove (played by Peter Sellers):

"But," Muffley said, "is it really possible for it to be triggered automatically and at the same time impossible to untrigger?"

. . . Doctor Strangelove said quickly, "But precisely. Mister President, it is not only possible, it is essential. That is the whole idea of this machine. Deterrence is the art of producing in the enemy the fear to attack. And so because of the automated and irrevocable decision-making process which rules out human meddling, the Doomsday Machine is terrifying, simple to understand, and completely credible and convincing." . . .

President Muffley said, "But this is fantastic, Doctor Strangelove. How can it be triggered automatically?"

Strangelove said, "Sir, it is remarkably simple to do that. When you merely wish to bury bombs there is no limit to the size. . . . After they are buried they are connected to a gigantic complex of computers. A specific and closely defined set of circumstances under which the bombs are to be exploded is programmed into the tape memory banks. . . ." Strangelove turned so he looked directly at [the Soviet Ambassador]. "There is only one thing I don't understand, Mister Ambassador. The whole point of the Doomsday Machine is lost if you keep it a secret. Why didn't you tell the world?"

[The ambassador] turned away. He said quietly but distinctly, "It was to be announced at the Party Congress on Monday. As you know, the Premier loves surprises."

The German-accented, leather-gloved, wheelchair-bound Dr. Strangelove, with his disconcerting tic of giving the Nazi salute, is one of cinema's all-time eeriest characters. He was meant to symbolize a kind of intellectual who until recently was prominent in the public's imagination: the nuclear strategist, paid to think the unthinkable. These men, who included Henry Kissinger (on whom Sellers based his portrayal), Herman Kahn, John von Neumann, and Edward Teller, were stereotyped as amoral nerds who cheerfully filled blackboards with equations about megadeaths and mutual assured destruction. Perhaps the scariest thing about them was their paradoxical conclusions—for example, that safety in the nuclear age comes from exposing one's cities and protecting one's missiles.

But the unsettling paradoxes of nuclear strategy apply to *any* conflict

between parties whose interests are partly competing and partly shared. Common sense says that victory goes to the side with the most intelligence, self-interest, coolness, options, power, and clear lines of communication. Common sense is wrong. Each of these assets can be a liability in contests of strategy (as opposed to contests of chance, skill, or strength), where behavior is calculated by predicting what the other guy will do in response. Thomas Schelling has shown that the paradoxes are ubiquitous in social life. We shall see that they offer great insight into the emotions, particularly the headstrong passions that convinced the Romantics that emotion and reason were opposites. But first let's put the emotions aside and just examine the logic of conflicts of strategy.

Take bargaining. When two people haggle over a car or a house, a bargain is struck when one side makes the final concession. Why does he concede? Because he is sure she will not. The reason she won't concede is that she thinks he will concede. She thinks he will because she thinks he thinks she thinks he will. And so on. There always is a range of prices that the buyer and seller would both accept. Even if a particular price within that range is not the best price for one party, it is preferable to canceling the deal outright. Each side is vulnerable to being forced to settle for the worst acceptable price because the other side realizes that he or she would have no choice if the alternative was to reach no agreement at all. But when both parties can guess the range, *any* price within the range is a point from which at least one party would have been willing to back off, and the other party knows it.

Schelling points out that the trick to coming out ahead is "a voluntary but irreversible sacrifice of freedom of choice." How do you persuade someone that you will not pay more than $16,000 for a car that is really worth $20,000 to you? You can make a public, enforceable $5,000 bet with a third party that you won't pay more than $16,000. As long as $16,000 gives the dealer a profit, he has no choice but to accept. Persuasion would be futile; it's against your interests to compromise. By tying your own hands, you improve your bargaining position. The example is fanciful, but real ones abound. The dealer appoints a salesperson who is not authorized to sell at less than a certain price even if he says he wants to. A homebuyer cannot get a mortgage if the bank's appraiser says he paid too much. The homebuyer exploits that powerlessness to get a better price from the seller.

Not only can power be a liability in conflicts of strategy, communication can be, too. When you are haggling from a pay phone with a friend about where to meet for dinner, you can simply announce that you will be at Ming's at six-thirty and hang up. The friend has to accede if she wants to meet you at all.

Paradoxical tactics also enter into the logic of promises. A promise can secure a favor only when the beneficiary of the promise has good reason to believe it will be carried out. The promiser is thus in a *better* position when the beneficiary knows that the promiser is *bound* by his promise. The law gives companies the right to sue and the right to be sued. The right to be sued? What kind of "right" is that? It is a right that confers the power to make a promise: to enter into contracts, borrow money, and engage in business with someone who might be harmed as a result. Similarly, the law that empowers banks to foreclose on a mortgage makes it worth the bank's while to grant the mortgage, and so, paradoxically, benefits the *borrower*. In some societies, Schelling notes, eunuchs got the best jobs because of what they could not do. How does a hostage persuade his kidnapper not to kill him to prevent him from identifying the kidnapper in court? One option is

to deliberately blind himself. A better one is to confess to a shameful secret that the kidnapper can use as blackmail. If he has no shameful secret, he can create one by having the kidnapper photograph him in some unspeakably degrading act.

Threats, and defenses against threats, are the arena in which Dr. Strangelove really comes into his own. There are boring threats, in which the threatener has an interest in carrying out the threat—for example, when a homeowner threatens a burglar that she will call the police. The fun begins when carrying out the threat is costly to the threatener, so its value is only as a deterrent. Again, freedom is costly; the threat is credible only when the threatener has no choice but to carry it out and the target knows it. Otherwise, the target can threaten the threatener right back by refusing to comply. The Doomsday Machine is an obvious example, though the secrecy defeated its purpose. A hijacker who threatens to blow up a plane if anyone tries to disarm him will have a better chance of seeing Cuba if he wears explosives that go off with the slightest jostling. A good way to win the teenagers' game of chicken, in which two cars approach each other at high speed and the first driver to swerve loses face, is to conspicuously remove your own steering wheel and throw it away.

With threats, as with promises, communication can be a liability. The kidnapper remains incommunicado after making the ransom demand so he cannot be persuaded to give up the hostage for a smaller ransom or a safe escape. Rationality is also a liability. Schelling points out that "if a man knocks at the back door and says that he will stab himself unless you give him $10, he is more likely to get the $10 if his eyes are bloodshot." Terrorists, kidnappers, hijackers, and dictators of small countries have an interest in appearing mentally unbalanced. An absence of self-interest is also an advantage. Suicide bombers are almost impossible to stop.

To defend yourself *against* threats, make it impossible for the threatener to make you an offer you can't refuse. Again, freedom, information, and rationality are handicaps. "Driver does not know combination to safe," says the sticker on the delivery truck. A man who is worried that his daughter may be kidnapped can give away his fortune, leave town and remain incommunicado, lobby for a law that makes it a crime to pay ransom, or break the hand with which he signs checks. An invading army may burn bridges behind it to make retreat impossible. A college president tells protesters he has no influence on the town police, and genuinely wants no influence. A racketeer cannot sell protection if the customer makes sure he is not at home when the racketeer comes around.

Because an expensive threat works both ways, it can lead to a cycle of self-incapacitation. Protesters attempt to block the construction of a nuclear power plant by lying down on the railroad tracks leading to the site. The engineer, being reasonable, has no choice but to stop the train. The railroad company counters by telling the engineer to set the throttle so that the train moves very slowly and then to jump out of the train and walk beside it. The protesters must scramble. Next time the protesters handcuff themselves to the tracks; the engineer does not dare leave the train. But the protesters must be certain the engineer sees them in enough time to stop. The company assigns the next train to a nearsighted engineer.

In these examples, many of them from Schelling, the paradoxical power comes from a physical constraint like handcuffs or an institutional constraint like the police. But strong passions can do the same thing. Say a bargainer publicly announces that he will not pay more than $16,000 for

the car, and everyone knows he could not tolerate the shame of going back on his word. The unavoidable shame is as effective as the enforceable bet, and he will get the car at his price. If Mother Teresa offered to sell you her car, you would not insist on a guarantee because presumably she is constitutionally incapable of cheating you. The hothead who can figuratively explode at any moment enjoys the same tactical advantage as the hijacker who can literally explode at any moment. In *The Maltese Falcon*, Sam Spade (Humphrey Bogart) dares the henchmen of Kasper Gutman (Sidney Greenstreet) to kill him, knowing that they need him to retrieve the falcon. Gutman replies, "That's an attitude, sir, that calls for the most delicate judgment on both sides, because as you know, sir, in the heat of action men are likely to forget where their best interests lie, and let their emotions carry them away." In *The Godfather*, Vito Corleone tells the heads of the other crime families, "I'm a superstitious man. And if some unlucky accident should befall my son, if my son is struck by a bolt of lightning, I will blame some of the people here."

Dr. Strangelove meets The Godfather. Is passion a doomsday machine? People consumed by pride, love, or rage have lost control. They may be irrational. They may act against their interests. They may be deaf to appeals. (The man running amok calls to mind a doomsday machine that has been set off.) But though this be madness, yet there is method in it. Precisely these sacrifices of will and reason are effective tactics in the countless bargains, promises, and threats that make up our social relations.

The theory stands the Romantic model on its head. The passions are no vestige of an animal past, no wellspring of creativity, no enemy of the intellect. The intellect is designed to relinquish control to the passions so that they may serve as guarantors of its offers, promises, and threats against suspicions that they are lowballs, double-crosses, and bluffs. The apparent firewall between passion and reason is not an ineluctable part of the architecture of the brain; it has been programmed in deliberately, because only if the passions are in control can they be credible guarantors.

The doomsday-machine theory has been proposed independently by Schelling, Trivers, Daly and Wilson, the economist Jack Hirshleifer, and the economist Robert Frank. Righteous anger, and the attendant thirst for redress or vengeance, is a credible deterrent if it is uncontrollable and unresponsive to the deterrer's costs. Such compulsions, though useful in the long run, can drive people to fight far out of proportion to the stakes. In 1982 Argentina annexed the British colony of the Falklands, desolate islands with virtually no economic or strategic importance. In earlier decades it might have made sense for Britain to defend them as an immediate deterrent to anyone with designs on the rest of its empire, but at that point there was no empire left to defend. Frank points out that for what they spent to reclaim the islands, Britain could have given each Falklander a Scottish castle and a lifetime pension. But most Britons were proud that they stood up to the Argentinians. The same sense of fairness makes us sue expensively for small amounts or seek a refund for a defective product despite red tape that costs us more in lost wages than the product was worth.

The lust for revenge is a particularly terrifying emotion. All over the world, relatives of the slain fantasize day and night about the bittersweet moment when they might avenge a life with a life and find peace at last. The emotion strikes us as primitive and dreadful because we have contracted the government to settle our scores for us. But in many societies an irresistible thirst for vengeance is one's only protection against deadly

raids. Individuals may differ in the resolve with which they will suffer costs to carry out vengeance. Since that resolve is an effective deterrent only if it is advertised, it is accompanied by the emotion traditionally referred to as honor: the desire to publicly avenge even minor trespasses and insults. The hair-trigger of honor and revenge can be tuned to the degree of threat in the environment. Honor and vengeance are raised to godly virtues in societies that lie beyond the reach of law enforcement, such as remote horticulturalists and herders, the pioneers of the Wild West, street gangs, organized crime families, and entire nation-states when dealing with one another (in which case the emotion is called "patriotism"). But even within a modern state society where it serves no purpose, the emotion of vengeance cannot easily be turned off. Most legal theories, even from the highest-minded philosophers, acknowledge that retribution is one of the legitimate goals of criminal punishment, over and above the goals of deterring potential criminals and incapacitating, deterring, and rehabilitating the offender. Enraged crime victims, long disenfranchised from the American legal system, have recently pressed for a say in plea-bargaining and sentencing decisions.

As Strangelove explained, the whole point of a doomsday machine is lost if you keep it a secret. That principle may explain one of the longest-standing puzzles of the emotions: why we advertise them on our face.

Darwin himself never argued that facial expressions were naturally selected adaptations. In fact, his theory was downright Lamarckian. Animals have to move their faces for practical reasons: they bare the teeth to bite, widen the eyes for a panoramic view, and pull back the ears to protect them in a fight. These measures turned into habits that the animal performed when it merely anticipated an event. The habits were then passed to their offspring. It may seem strange that Darwin was no Darwinian in one of his most famous books, but remember that Darwin was fighting on two fronts. He had to explain adaptations to satisfy his fellow biologists, but he also made much of pointless features and animal vestiges in humans to combat creationists, who argued that functional design was a sign of God's handiwork. If God had really designed humans from scratch, Darwin asked, why would he have installed features that are useless to us but similar to features that are useful to animals?

Many psychologists still can't understand why broadcasting one's emotional state might be beneficial. Wouldn't the proverbial smell of fear just egg on one's enemies? One psychologist has tried to revive an old idea that facial muscles are tourniquets that send more blood to the parts of the brain that have to cope with the current challenge. Aside from being hydraulically improbable, the theory cannot explain why we are more expressive when there are other people around.

But if the passionate emotions are guarantors of threats and promises, advertising is their reason for being. But here a problem arises. Remember that real emotions create a niche for sham emotions. Why whip yourself into a rage when you can *simulate* a rage, deter your enemies, and not pay the price of pursuing dangerous vengeance if it fails? Let *others* be doomsday machines, and you can reap the benefits of the terror they sow. Of course, when counterfeit facial expressions begin to drive out the real ones, people call each other's bluffs, and the facial expressions, real and fake, become worthless.

Facial expressions are useful only if they are hard to fake. As a matter of fact, they *are* hard to fake. People don't really believe that the grinning

flight attendant is happy to see them. That is because a social smile is formed with a different configuration of muscles from the genuine smile of pleasure. A social smile is executed by circuits in the cerebral cortex that are under voluntary control; a smile of pleasure is executed by circuits in the limbic system and other brain systems and is involuntary. Anger, fear, and sadness, too, recruit muscles that can't be controlled voluntarily, and the genuine expressions are hard to fake, though we can pantomime an approximation. Actors must simulate facial expressions for a living, but many cannot avoid a mannered look. Some great actors, like Laurence Olivier, are highly coordinated athletes who have doggedly learned to control every muscle. Others learn method acting, inspired by Konstantin Stanislavsky, in which actors make themselves *feel* an emotion by remembering or imagining a charged experience, and the expression pops on the face reflexively.

The explanation is incomplete, because it raises another question: *why* did we never evolve the ability to control our expressions? You can't just say that it would hurt everyone if counterfeit expressions were circulated. True enough, but in a world of honest emoters the faker would prosper, so fakers should always drive out emoters. I don't know the answer, but there are obvious places to look. Zoologists worry about the same problem: how can honest animal signals, like cries, gestures, and advertisements of health, evolve in a world of would-be fakers? One answer is that honest signals can evolve if they are too expensive to fake. For example, only a healthy peacock can afford a splendiferous tail, so healthy peacocks bear the burden of a cumbersome tail as a display of conspicuous consumption that only they can afford. When the healthiest peacocks display, the less healthy ones have no choice but to follow, because if they hide their health altogether the peahens will assume the worst, namely that they are at death's door.

Is there anything about emotional expressions that would make it inherently costly to put them under voluntary control? Here is a guess. In designing the rest of the human, natural selection had good engineering reasons to segregate the voluntary, cognitive systems from the systems that control housekeeping and physical-plant functions such as the regulation of heartbeat, breathing rate, blood circulation, sweat, tears, and saliva. None of your conscious beliefs are pertinent to how fast your heart ought to beat, so there's no point in letting you control it. In fact, it would be downright dangerous, since you might forget to pump when you got distracted, or you might try out your own harebrained ideas on what the best pulse rate should be.

Now, say selection handcuffed each emotion to a physiological control circuit, and the activity of the circuit was visible to an observer as flushing, blushing, blanching, sweating, trembling, quavering, croaking, weeping, and the facial reflexes Darwin discussed. An observer would have good reason to believe that the emotion was genuine, since a person could not fake it unless he had voluntary control of his heart and other organs. Just as the Soviets would have wanted to show everyone the wiring of the Doomsday Machine to *prove* that it was automatic and irreversible and their description of it no bluff, people might have an interest in showing everyone that an emotion is holding their body hostage and their angry words are no bluff. If so, it would explain why emotions are so intimately tied to the body, a fact that puzzled William James and a century of psychologists after him.

The handcuffing may have been easy for natural selection, because the major human emotions seem to have grown out of evolutionary precursors (anger from fighting, fear from fleeing, and so on), each of which engaged a

suite of involuntary physiological responses. (This might be the grain of truth in the Romantic and triune-brain theories: modern emotions may *exploit* the involuntariness of older reflexes, even if they did not inherit it by default.) And once the handcuffs were in place for honest emoters, everyone else would have had little choice but to don them too, like the unhealthy peacocks forced to muster tails. A chronic poker face would suggest the worst: that the emotions a person declares in word and deed are shams.

This theory is unproven, but no one can deny the phenomenon. People are vigilant for sham emotions and put the most faith in involuntary physiological giveaways. That underlies an irony of the telecommunications age. Long-distance phone service, electronic mail, faxes, and videoconferencing should have made the face-to-face business meeting obsolete. But meetings continue to be a major expense for corporations and support entire industries like hotels, airlines, and rental cars. Why do we insist on doing business in the flesh? Because we do not trust someone until we see what makes him sweat.

FOOLS FOR LOVE

Why does romantic love leave us bewitched, bothered, and bewildered? Could it be another paradoxical tactic like handcuffing oneself to railroad tracks? Quite possibly. Offering to spend your life and raise children with someone is the most important promise you'll ever make, and a promise is most credible when the promiser can't back out. Here is how the economist Robert Frank has reverse-engineered mad love.

Unsentimental social scientists and veterans of the singles scene agree that dating is a marketplace. People differ in their value as potential marriage partners. Almost everyone agrees that Mr. or Ms. Right should be good-looking, smart, kind, stable, funny, and rich. People shop for the most desirable person who will accept them, and that is why most marriages pair a bride and a groom of approximately equal desirability. Mate-shopping, however, is only part of the psychology of romance; it explains the statistics of mate choice, but not the final pick.

Somewhere in this world of five billion people there lives the best-looking, richest, smartest, funniest, kindest person who would settle for you. But your dreamboat is a needle in a haystack, and you may die single if you insist on waiting for him or her to show up. Staying single has costs, such as loneliness, childlessness, and playing the dating game with all its awkward drinks and dinners (and sometimes breakfasts). At some point it pays to set up house with the best person you have found so far.

But that calculation leaves your partner vulnerable. The laws of probability say that someday you will meet a more desirable person, and if you are always going for the best you can get, on that day you will dump your partner. But your partner has invested money, time, childrearing, and forgone opportunities in the relationship. If your partner was the most desirable person in the world, he or she would have nothing to worry about, because you would never want to desert. But failing that, the partner would have been foolish to enter the relationship.

Frank compares the marriage market with the rental market. Landlords desire the best of all tenants but settle for the best they can find, and renters want the best of all apartments but settle for the best they can find. Each invests in the apartment (the landlord may paint it the tenant's favorite color; the tenant may install permanent decorations), so each

would be harmed if the other suddenly terminated the agreement. If the tenant could leave for a better flat, the landlord would have to bear the costs of an unrented unit and the search for a new tenant; he would have to charge a high rent to cover that risk, and would be loath to paint. If the landlord could evict the tenant for a better one, the tenant would have to search for a new home; she would be willing to pay only a low rent, and would not bother to keep the apartment in good shape, if she had to expose herself to that risk. If the best tenant were renting the best apartment, the worries would be moot; neither would want to end the arrangement. But since both have to compromise, they protect themselves by signing a lease that is expensive for either to break. By agreeing to restrict his own freedom to evict, the landlord can charge a higher rent. By agreeing to restrict her own freedom to leave, the tenant can demand a lower rent. Lack of choice works to each one's advantage.

Marriage laws work a bit like leases, but our ancestors had to find some way to commit themselves before the laws existed. How can you be sure that a prospective partner won't leave the minute it is rational to do so—say, when a 10-out-of-10 moves in next door? One answer is, don't accept a partner who wanted you for rational reasons to begin with; look for a partner who is committed to staying with you because you are you. Committed by what? Committed by an emotion. An emotion that the person did not decide to have, and so cannot decide not to have. An emotion that was not triggered by your objective mate-value and so will not be alienated by someone with greater mate-value. An emotion that is guaranteed not to be a sham because it has physiological costs like tachycardia, insomnia, and anorexia. An emotion like romantic love.

"People who are sensible about love are incapable of it," wrote Douglas Yates. Even when courted by the perfect suitor, people are unable to will themselves to fall in love, often to the bewilderment of the matchmaker, the suitor, and the person himself or herself. Instead it is a glance, a laugh, a manner that steals the heart. Remember from Chapter 2 that spouses of one twin are not attracted to the other; we fall in love with the individual, not with the individual's qualities. The upside is that when Cupid does strike, the lovestruck one is all the more credible in the eyes of the object of desire. Murmuring that your lover's looks, earning power, and IQ meet your minimal standards would probably kill the romantic mood, even though the statement is statistically true. The way to a person's heart is to declare the opposite—that you're in love because you can't help it. Tipper Gore's Parents' Music Resource Center notwithstanding, the sneering, body-pierced, guitar-smashing rock musician is typically not singing about drugs, sex, or Satan. He is singing about love. He is courting a woman by calling attention to the irrationality, uncontrollability, and physiological costs of his desire. I want you so bad, it's driving me mad, Can't eat, can't sleep, Heart beats like a big bass drum, You're the only one, Don't know why I love you like I do, You drive me crazy, Can't stop lovin' you, Ain't nobody can do it to me the way you can, I like the way you walk, I like the way you talk, et cetera, et cetera.

Of course, one can well imagine a woman not being swept off her feet by these proclamations. (Or a man, if it is a woman doing the declaring.) They set off a warning light in the other component of courtship, smart shopping. Groucho Marx said that he would not belong to any club that would have him as a member. Usually people do not want any suitor who wants them too badly too early, because it shows that the suitor is desperate (so they should wait for someone better), and because it shows that the suitor's

ardor is too easily triggered (hence too easily triggerable by someone else). The contradiction of courtship—flaunt your desire while playing hard to get—comes from the two parts of romantic love: setting a minimal standard for candidates in the mate market, and capriciously committing body and soul to one of them.

THE SOCIETY OF FEELINGS

Mental life often feels like a parliament within. Thoughts and feelings vie for control as if each were an agent with strategies for taking over the whole person, you. Might our mental agents use paradoxical tactics with one another—handcuffs, doomsday machines, unbreakable contracts with third parties? The analogy is imperfect because natural selection designs people to compete but does not design organs, including mental agents, to compete; the interests of the whole person are paramount. But the whole person has many goals, like food, sex, and safety, and that requires a division of labor among mental agents with different priorities and kinds of expertise. The agents are bound by an entente that benefits the whole person over a lifetime, but over the short term the agents may outwit one another with devious tactics.

Self-control is unmistakably a tactical battle between parts of the mind. Schelling observes that the tactics people use to control themselves are interchangeable with the tactics they use to control others. How do you prevent your child from scratching his hives in his sleep? Put mittens on him. How do you prevent yourself from scratching your hives in your sleep? Put mittens on yourself. If Odysseus had not plugged his shipmates' ears, they would have done it on their own. The self that wants a trim body outwits the self that wants dessert by throwing out the brownies at the opportune moment when it is in control.

So we do seem to use paradoxical tactics against ourselves. The agent in control at one time makes a voluntary but irreversible sacrifice of freedom of choice for the whole body, and gets its way in the long run. That is the bright spot in this whole depressing discussion of selfish genes and doomsday machines. Social life is not always the equivalent of global thermonuclear war because the part of us with the longest view of the future, when in control of the body, can voluntarily sacrifice freedom of choice for the body at other times. We sign contracts, submit to laws, and hitch our reputations to public declarations of loyalty to friends and mates. These are not tactics to defeat someone else, but tactics to defeat the darker parts of ourselves.

One more speculation on the battle inside the head. No one knows what, if anything, grief is for. Obviously the loss of a loved one is unpleasant, but why should it be devastating? Why the debilitating pain that stops people from eating, sleeping, resisting diseases, and getting on with life? Jane Goodall describes a young chimp, Flint, who after the death of his beloved mother became depressed and died himself as if of a broken heart.

Some have suggested that grief is an enforced interlude for reassessment. Life will never be the same, so one must take time to plan how to cope with a world that has been turned upside down. Perhaps grief also gives people time to contemplate how a lapse of theirs may have allowed the death and how they might be more careful in the future. There may be an element of truth to the suggestion. Bereaved people find that they ache all over again every time they discover another habit to unlearn, like setting out an extra plate or buying groceries for two. And blaming

oneself is a common symptom. But the pain of grief makes planning harder, not easier, and is too extreme and long-lasting to be useful as a strategy session.

William James wrote, "It takes a mind debauched by learning to carry the process of making the natural seem strange so far as to ask for the 'why' of any instinctive human act." Though legitimate to a scientist, the question "Why do we grieve?" is preposterous to common sense. If you didn't grieve when someone died, could you really have loved him when he was alive? It's logically possible but seems psychologically impossible; grief is the other side of love. And there may lie the answer. Perhaps grief is an internal doomsday machine, pointless once it goes off, useful only as a deterrent. What parents have not lain awake contemplating the horror of losing a child? Or worried themselves sick with awful images when a child is late or lost? These thoughts are powerful reminders to protect and cherish a loved one in the face of myriad other demands on one's time and thoughts. Like all deterrents, grief would be effective only if it is certain and terrible.

KIDDING OURSELVES

The playwright Jerome K. Jerome once said, "It is always the best policy to tell the truth, unless, of course, you are an exceptionally good liar." It's hard to be a good liar, even when it comes to your own intentions, which only you can verify. Intentions come from emotions, and emotions have evolved displays on the face and body. Unless you are a master of the Stanislavsky method, you will have trouble faking them; in fact, they probably evolved *because* they were hard to fake. Worse, lying is stressful, and anxiety has its own telltale markers. They are the rationale for polygraphs, the so-called lie detectors, and humans evolved to be lie detectors, too. Then there is the annoying fact that some propositions logically entail others. Since *some* of the things you say will be true, you are always in danger of exposing your own lies. As the Yiddish saying goes, a liar must have a good memory.

Trivers, pursuing his theory of the emotions to its logical conclusion, notes that in a world of walking lie detectors the best strategy is to believe your own lies. You can't leak your hidden intentions if you don't think that they *are* your intentions. According to his theory of self-deception, the conscious mind sometimes hides the truth from itself the better to hide it from others. But the truth is useful, so it should be registered somewhere in the mind, walled off from the parts that interact with other people. There is an obvious similarity to Freud's theory of the unconscious and the defense mechanisms of the ego (such as repression, projection, denial, and rationalization), though the explanation is completely different. George Orwell stated it in *1984:* "The secret of ruler-ship is to combine a belief in one's own infallibility with a power to learn from past mistakes."

The neuroscientist Michael Gazzaniga has shown that the brain blithely weaves false explanations about its motives. Split-brain patients have had their cerebral hemispheres surgically disconnected as a treatment for epilepsy. Language circuitry is in the left hemisphere, and the left half of the visual field is registered in the isolated right hemisphere, so the part of the split-brain person that can talk is unaware of the left half of his world. The right hemisphere is still active, though, and can carry out simple commands presented in the left visual field, like "Walk" or "Laugh." When the patient (actually, the patient's left hemisphere) is asked why he walked out (which we know was a response to the command presented to the right

hemisphere), he ingenuously replies, "To get a Coke." When asked why he is laughing, he says, "You guys come up and test us every month. What a way to make a living!"

Our confabulations, not coincidentally, present us in the best light. Literally hundreds of experiments in social psychology say so. The humorist Garrison Keillor describes the fictitious community of Lake Wobegon, "where the women are strong, the men are good-looking, and all the children are above average." Indeed, most people claim they are above average in any positive trait you name: leadership, sophistication, athletic prowess, managerial ability, even driving skill. They rationalize the boast by searching for an *aspect* of the trait that they might in fact be good at. The slow drivers say they are above average in safety, the fast ones that they are above average in reflexes.

More generally, we delude ourselves about how benevolent and how effective we are, a combination that social psychologists call beneffectance. When subjects play games that are rigged by the experimenter, they attribute their successes to their own skill and their failures to the luck of the draw. When they are fooled in a fake experiment into thinking they have delivered shocks to another subject, they derogate the victim, implying that he deserved the punishment. Everyone has heard of "reducing cognitive dissonance," in which people invent a new opinion to resolve a contradiction in their minds. For example, a person will recall enjoying a boring task if he had agreed to recommend it to others for paltry pay. (If the person had been enticed to recommend the task for generous pay, he accurately recalls that the task was boring.) As originally conceived of by the psychologist Leon Festinger, cognitive dissonance is an unsettled feeling that arises from an inconsistency in one's beliefs. But that's not right: there is no contradiction between the proposition "The task is boring" and the proposition "I was pressured into lying that the task was fun." Another social psychologist, Eliot Aronson, nailed it down: people doctor their beliefs only to eliminate a contradiction with the proposition "I am nice and in control." Cognitive dissonance is always triggered by blatant evidence that you are not as beneficent and effective as you would like people to think. The urge to reduce it is the urge to get your self-serving story straight.

Sometimes we have glimpses of our own self-deception. When does a negative remark sting, cut deep, hit a nerve? When some part of us knows it is true. If every part knew it was true, the remark would not sting; it would be old news. If no part thought it was true, the remark would roll off; we could dismiss it as false. Trivers recounts an experience that is all too familiar (at least to me). One of his papers drew a published critique, which struck him at the time as vicious and unprincipled, full of innuendo and slander. Rereading the article years later, he was surprised to find that the wording was gentler, the doubts more reasonable, the attitude less biased than he had remembered. Many others have made such discoveries; they are almost the definition of "wisdom."

If there were a verb meaning "to believe falsely," it would not have any significant first person, present indicative.

—Ludwig Wittgenstein

There's one way to find out if a man is honest: ask him; if he says yes, you know he's crooked.

—Mark Twain

Our enemies' opinion of us comes closer to the truth than our own.
—François La Rochefoucauld

Oh wad some power the giftie gie us
To see oursels as ithers see us!
—Robert Burns

No one can examine the emotions without seeing in them the source of much human tragedy. I don't think we should blame the animals; it's clear enough how natural selection engineered our instincts to suit our needs. We shouldn't blame selfish genes, either. They endow us with selfish motives, but they just as surely endow us with the capacity for love and a sense of justice. What we should appreciate and fear is the cunning designs of the emotions themselves. Many of their specs are not for gladness and understanding: think of the happiness treadmill, the Sirens' song, the sham emotions, the doomsday machines, the caprice of romance, the pointless punishment of grief. But self-deception is perhaps the cruelest motive of all, for it makes us feel right when we are wrong and emboldens us to fight when we ought to surrender. Trivers writes,

Consider an argument between two closely bound people, say, husband and wife. Both parties believe that one is an altruist—of long standing, relatively pure in motive, and much abused—while the other is characterized by a pattern of selfishness spread over hundreds of incidents. They only disagree over who is altruistic and who selfish. It is noteworthy that the argument may appear to burst forth spontaneously, with little or no preview, yet as it rolls along, two whole landscapes of information processing appear to lie already organized, waiting only for the lightning of anger to show themselves.

In cartoons and movies, the villains are mustache-twirling degenerates, cackling with glee at their badness. In real life, villains are convinced of their rectitude. Many biographers of evil men start out assuming that their subjects are cynical opportunists and reluctantly discover that they are ideologues and moralists. If Hitler was an actor, concluded one, he was an actor who believed in the part.

Still, thanks to the complexity of our minds, we need not be perpetual dupes of our own chicanery. The mind has many parts, some designed for virtue, some designed for reason, some clever enough to outwit the parts that are neither. One self may deceive another, but every now and then a third self sees the truth.