The STRANGE ORDER of THINGS

Life, Feeling, and the Making of Cultures

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BEGINNINGS

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This book is about one interest and one idea. I have long been intrigued in human affect—the world of emotions and feelings—and have spent many years investigating it: why and how we emote, feel, use feelings to construct our selves; how feelings assist or undermine our best intentions; why and how brains interact with the body to support such functions. I have new facts and interpretations to share on these matters.

As for the idea, it is very simple: feelings have not been given the credit they deserve as motives, monitors, and negotiators of human cultural endeavors. Humans have distinguished themselves from all other beings by creating a spectacular collection of objects, practices, and ideas, collectively known as cultures. The collection includes the arts, philosophical inquiry, moral systems and religious beliefs, justice, governance, economic institutions, and technology and science. Why and how did this process begin? A frequent answer to this question invokes an important faculty of the human mind—verbal language—along with distinctive features such as intense sociality and superior intellect. For those who are biologically inclined the answer also includes natural selection operating at the level of genes. I have no doubt that intellect, sociality, and language have played key roles in the process, and it goes without saying that the organisms capable of cultural invention, along with the specific faculties used in the invention, are present in humans by the grace of natural selection and genetic transmission. The idea is that something else was required to jump-start the saga of human cultures. That something else was a motive. I am referring specifically to feelings, from pain and suffering to well-being and pleasure.

Consider medicine, one of our most significant cultural enterprises. Medicine's combination of technology and science

began as a response to the pain and suffering caused by diseases of every sort, from physical trauma and infections to cancers, contrasted with the very opposite of pain and suffering: well-being, pleasures, the prospect of thriving. Medicine did not begin as an intellectual sport meant to exercise one's wits over a diagnostic puzzle or a physiological mystery. It began as a consequence of specific feelings of patients and specific feelings of early physicians, including but not limited to the compassion that may be born of empathy. Those motives remain today. No reader will have failed to notice how visits to the dentist and surgical procedures have changed for the better in our own lifetime. The primary motive behind improvements such as efficient anesthetics and precise instrumentation is the management of feelings of discomfort. The activity of engineers and scientists plays a commendable role in this endeavor, but it is a motivated role. The profit motive of the drug and instrumentation industries also plays a significant part because the public does need to reduce its suffering and industries respond to that need. The pursuit of profit is fueled by varied yearnings, a desire for advancement, prestige, even greed, which are none other than feelings. It is not possible to comprehend the intense effort to develop cures for cancers or Alzheimer's disease without considering feelings as motives, monitors, and negotiators of the process. Nor is it possible to comprehend, for example, the less intense effort with which Western cultures have pursued cures for malaria in Africa or the management of drug addictions most everywhere without considering the respective web of motivating and inhibiting feelings. Language, sociality, knowledge, and reason are the primary inventors and executors of these complicated processes. But feelings get to motivate them, stay on to check the results, and help negotiate the necessary adjustments.

The idea, in essence, is that cultural activity began and remains deeply embedded in feeling. The favorable *and* unfavorable interplay of feeling and reason must be acknowledged if we are to understand the conflicts and contradictions of the human condition.

How did humans come to be at the same time sufferers, mendicants, celebrants of joy, philanthropists, artists and scientists, saints and criminals, benevolent masters of the earth and monsters intent on destroying it? The answer to this question requires the contributions of historians and sociologists, for certain, as well as those of artists, whose sensibilities often intuit the hidden patterns of the human drama, but the answer also requires the contributions of different branches of biology.

As I considered how feelings could not only drive the first flush of cultures but remain integral to their evolution, I searched for a way to connect human life, as we know it today—equipped with minds, feelings, consciousness, memory, language, complex sociality, and creative intelligence—with early life, as early as 3.8 billion years ago. To establish the connection, I needed to suggest an order and a time line for the development and appearance of these critical faculties in the long history of evolution.

The actual order of appearance of biological structures and faculties that I uncovered violates traditional expectations and is as strange as the book title implies. In the history of life, events did not comply with the conventional notions that we humans have formed for how to build the beautiful instrument I like to call a cultural mind.

Intending to tell a story about the substance and consequences of human feeling, I came to recognize that our ways of thinking about minds and cultures are out of tune with biological reality. When a living organism behaves intelligently and winningly in a social setting, we assume that the behavior results from foresight, deliberation, complexity, all with the help of a nervous system. It is now clear, however, that such behaviors could also have sprung from the bare and spare equipment of a single cell, namely, in a bacterium, at the dawn of the biosphere. “Strange” is too mild a word to describe this reality.

We can envision an explanation that begins to accommodate the counterintuitive findings. The explanation draws on the mechanisms of life itself and on the conditions of its regulation, a

collection of phenomena that is generally designated by a single word: *homeostasis*. Feelings are the mental expressions of homeostasis, while homeostasis, acting under the cover of feeling, is the functional thread that links early life-forms to the extraordinary partnership of bodies and nervous systems. That partnership is responsible for the emergence of conscious, feeling minds that are, in turn, responsible for what is most distinctive about humanity: cultures and civilizations. Feelings are at the center of the book, but they draw their powers from homeostasis.

Connecting cultures to feeling and homeostasis strengthens their links to nature and deepens the humanization of the cultural process. Feelings and creative cultural minds were assembled by a long process in which genetic selection guided by homeostasis played a prominent role. Connecting cultures to feelings, homeostasis, and genetics counters the growing detachment of cultural ideas, practices, and objects from the process of life.

It should be evident that the connections I am establishing do not diminish the autonomy that cultural phenomena acquire historically. I am not reducing cultural phenomena to their biological roots or attempting to have science explain all aspects of the cultural process. The sciences alone cannot illuminate the entirety of human experience without the light that comes from the arts and humanities.

Discussions about the making of cultures often agonize over two conflicting accounts: one in which human behavior results from autonomous cultural phenomena, and another in which human behavior is the consequence of natural selection as conveyed by genes. But there is no need to favor one account over the other. Human behavior largely results from *both* influences in varying proportions and order.

Curiously, discovering the roots of human cultures in nonhuman biology does not diminish the exceptional status of humans at all. The exceptional status of each human being derives from the unique significance of suffering and flourishing in the context of our remembrances of the past and of the memories we have constructed of the future we incessantly anticipate.

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We humans are born storytellers, and we find it very satisfying to tell stories about how things began. We have reasonable success when the thing to be storied is a device or a relationship, love affairs and friendships being great themes for stories of origins. We are not so good and we are often wrong when we turn to the natural world. How did life begin? How did minds, feelings, or consciousness begin? When did social behaviors and cultures first appear? There is nothing easy about such an endeavor. When the laureate physicist Erwin Schrödinger turned his attention to biology and wrote his classic book *What Is Life?*, it should be noted that he did not title it *The "Origins" of Life*. He recognized a fool's errand when he saw it.

Still, the errand is irresistible. This book is dedicated to presenting some facts behind the making of minds that think, create narratives and meaning, remember the past and imagine the future; and to presenting some facts behind the machinery of feeling and consciousness responsible for the reciprocal connections among minds, the outside world, and its respective life. In their need to cope with the human heart in conflict, in their desire to reconcile the contradictions posed by suffering, fear, anger, and the pursuit of well-being, humans turned to wonder and awe and discovered music making, dancing, painting, and literature. They continued their efforts by creating the often beautiful and sometimes frayed epics that go by such names as religious belief, philosophical inquiry, and political governance. From cradle to grave, these were some of the ways in which the cultural mind addressed the human drama.

PART I

ABOUT LIFE AND ITS REGULATION (HOMEOSTASIS)

1

ON THE HUMAN CONDITION

A Simple Idea

When we are wounded and suffer pain, no matter the cause of the wound or the profile of the pain, we can do something about it. The range of situations that can cause human suffering includes not only physical wounds but the sorts of hurts that result from losing someone we love or being humiliated. The abundant recall of related memories sustains and amplifies suffering. Memory helps project the situation into the imagined future and lets us envision the consequences.

Humans would have been able to respond to suffering by attempting to understand their plight and by inventing compensations, corrections, or radically effective solutions. Along with suffering pain, humans were able to experience its very opposites, pleasure and enthusiasm, in a wide variety of situations, ranging from the simple and trivial to the sublime, from the pleasures that constitute responses to tastes and smells, food, wine, sex, and physical comforts, to the wonder of play, the awe and flourishing that arise from the contemplation of a landscape or the admiration and deep affection for another person. Humans also discovered that exerting power, dominating and even destroying others, and causing pure mayhem and pillage could produce not only strategically valuable results but also pleasure. Here, too, humans would have been able to use the existence of such feelings for a practical purpose: as a motive for questioning why pain exists in the first place and perhaps to

puzzle at the bizarre fact that under certain circumstances the suffering of others could be rewarding. Perhaps they would have used the related feelings—among them fear, surprise, anger, sadness, and compassion—as a guide to imagining ways of countering suffering and its sources. They would have realized that among the variety of social behaviors available to them, some—fellowship, friendship, care, love—were the very opposite of aggression and violence and were transparently associated with the well-being of not only others but their own.

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Why would feelings succeed in moving the mind to act in such an advantageous manner? One reason comes from what feelings accomplish *in* the mind and do *to* the mind. In standard circumstances, feelings tell the mind, without any word being spoken, of the good or bad direction of the life process, at any moment, within its respective body. By doing so, feelings naturally qualify the life process as conducive or not to well-being and flourishing.[1]

Another reason why feelings would succeed where plain ideas fail has to do with the unique nature of feelings. Feelings are not an independent fabrication of the brain. They are the result of a cooperative partnership of body and brain, interacting by way of free-ranging chemical molecules and nerve pathways. This particular and overlooked arrangement guarantees that feelings disturb what might otherwise be an indifferent mental flow. The source of feeling is life on the wire, balancing its act between flourishing and death. As a result, feelings are mental stirrings, troubling or glorious, gentle or intense. They can stir us subtly, in an intellectualized sort of way, or intensely and noticeably, grabbing the owner's attention firmly. Even at their most positive, they tend to disturb the peace and break the quiet.[2]

The simple idea, then, is that feelings of pain and feelings of pleasure, from degrees of well-being to malaise and sickness, would have been the catalysts for the processes of questioning, understanding, and problem solving that most profoundly distinguish human minds from the minds of other living species.

By questioning, understanding, and problem solving, humans would have been able to develop intriguing solutions for the predicaments of their lives *and* to construct the means to promote their flourishing. They would have perfected ways of nourishing, clothing, and sheltering themselves, nursing their physical wounds, and beginning the invention of what became medicine. When the pain and the suffering were caused by others—by how they felt about others, by how they perceived others to feel about them—or when the pain was caused by considering their own conditions, such as confronting the inevitability of death, humans would have drawn on their expanding individual and collective resources and invented a variety of responses that ranged from moral prescriptions and principles of justice to modes of social organization and governance, artistic manifestations, and religious beliefs.

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It is not possible to tell exactly when these developments would have taken place. Their pace varied significantly depending on the specific populations and their geographic location. We know for certain that by 50,000 years ago such processes were well under way around the Mediterranean, in central and southern Europe, and in Asia, regions where *Homo sapiens* was present, though not without the company of Neanderthals. This was long after *Homo sapiens* first appeared, about 200,000 years ago or earlier.[3] Thus we can think of the beginnings of human cultures as occurring among hunter-gatherers, well before the cultural invention known as agriculture, about 12,000 years ago, and before the invention of writing and money. The dates by which writing systems emerged in varied places are a good illustration of how multicentered were the processes of cultural evolution. Writing was first developed in Sumer (in Mesopotamia) and in Egypt, between 3500 and 3200 B.C. But a different writing system was later developed in Phoenicia and eventually used by Greeks and Romans. About 600 B.C., writing also developed independently in Mesoamerica, under the Mayan civilization, in the region of contemporary Mexico.

We can thank Cicero and ancient Rome for the word “culture”

applied to the universe of ideas. Cicero used the term to describe the cultivation of the soul—*cultura animi*—and he must have been thinking of the tilling of the land and its result, the perfecting and improvement of plant growth. What applied to the land might as well apply to the mind.

There is little doubt about the principal meaning of the word "culture" today. Dictionaries tell us that "culture" refers to manifestations of intellectual achievement regarded collectively, and unless otherwise specified, the word refers to *human* culture. The arts, philosophical inquiry, religious beliefs, moral faculties, justice, political governance, economic institutions—markets, banks—technology, and science are the main categories of endeavor and achievement that are conveyed by the word "culture." The ideas, attitudes, customs, manners, practices, and institutions that distinguish one social group from another belong to the overall scope of culture as does the notion that cultures are transmitted across peoples and generations by language and by the very objects and rituals that the cultures created in the first place. Whenever I refer to cultures or to the cultural mind in this book, this is the scope of phenomena I am considering.

There is another common usage of the word "culture." Amusingly, it refers to the laboratory cultivation of microorganisms such as bacteria: it alludes to bacteria *in* culture, not to the culture-like behaviors of bacteria that we will discuss in a moment. One way or another, bacteria were fated to be part of the grand story of culture.

FEELINGS AND THE MAKING OF CULTURES

Feelings contribute in three ways to the cultural process:

1. as *motives* of the intellectual creation
   a) by prompting the detection and diagnosis of homeostatic deficiencies;
   b) by identifying desirable states worthy of creative effort;

2. as *monitors* of the success or failure of cultural instruments and practices;
3. as participants in the *negotiation* of adjustments required by the cultural process over time.

Feeling Versus Intellect

Conventionally, the human cultural enterprise is explained in terms of exceptional human intellect, a brilliant extra feather in the cap of organisms assembled by unthinking genetic programs over evolutionary time. Feelings rarely earn a mention. The expansion of human intelligence and language, and the exceptional degree of human sociality, are the stars of cultural development. At first glance, there are good reasons to accept this account as reasonable. It is unthinkable to explain human cultures without factoring in the intelligence behind the novel instruments and practices we call culture. It goes without saying that the contributions of language are decisive for the development and transmission of cultures. As for sociality, a contributor that was often ignored, its indispensable role is now apparent. Cultural practices depend on social phenomena at which human adults excel—for example, how two individuals jointly contemplating the same object share an intention regarding that object.[4] And yet something seems to be missing from the intellectual account. It is as if creative intelligence would have materialized without a powerful prompt and would have marched along without a background motive besides pure reason. Presenting survival as a motive will not do because it removes the reasons why survival would be a matter of concern. It is as if creativity would not be embedded in the complex edifice of affect. It is also as if the continuation and monitoring of the process of cultural invention would have been possible by cognitive means alone, without the actual *felt* value of life outcomes, good or bad, having a say in the proceedings. If your pain is medicated with treatment A or treatment B, you rely on feelings to declare which treatment

makes the pain less intense, or fully resolved, or unchanged. Feelings work as *motives* to respond to a problem and as *monitors* of the success of the response or lack thereof.

Feelings, and more generally affect of any sort and strength, are the unrecognized presences at the cultural conference table. Everyone in the room senses their presence, but with few exceptions no one talks to them. They are not addressed by name.

In the complementary picture that I am drawing here, exceptional human intellect, individually and socially, would not have been moved to invent intelligent cultural practices and instruments without powerful justifications. Feelings of every sort and shade, caused by actual or imagined events, would have provided the motives and recruited the intellect. Cultural responses would have been created by human beings intent on changing their life situation for the better, for the more comfortable, for the more pleasant, for the more conducive to a future with well-being and with fewer of the troubles and losses that would have inspired such creations in the first place, ultimately and practically, not just for a more survivable future but for a better lived one.

The humans who first devised the Golden Rule, that we should treat others the way we want others to treat us, formulated the precept with the help of what they felt when they were treated badly or when they saw others badly treated. Logic played a role as it worked on facts, to be sure, but some of the critical facts were feelings.

Suffering or flourishing, at the polar ends of the spectrum, would have been prime motivators of the creative intelligence that produced cultures. But so would the experiences of affects related to fundamental desires—hunger, lust, social fellowship—or to fear, anger, the desire for power and prestige, hatred, the drive to destroy opponents and whatever they owned or collected. In fact, we find affect behind many aspects of sociality, guiding the constitution of groups small and large and manifesting itself in the bonds that individuals created around their desires and around the wonder of play, as well as behind conflicts over resources and mates, which were expressed in aggression and violence.

Other powerful motivators included the experiences of

elevation, awe, and transcendence that arise from the contemplation of beauty, natural or crafted, from the prospect of finding the means to make ourselves and others prosper, from arriving at a possible solution of metaphysical and scientific mysteries, or, for that matter, from the sheer confrontation with mysteries unsolved.

How Original Was the Human Cultural Mind?

Several intriguing questions arise at this point. On the face of what I have just written, the cultural enterprise originated as a human project. But are the problems that cultures solve exclusively human, or do they concern other living beings as well? And what about the solutions that the human cultural mind advances? Are they a completely original human invention, or were they used, at least in part, by beings that preceded us in evolution? The confrontation with pain, suffering, and the certainty of death, contrasted with the unattained possibility of well-being and flourishing, could well have been—most certainly was—behind some of the creative human processes that gave rise to the now staggeringly complex instruments of culture. But is it not the case that such human constructions were assisted by older biological strategies and instruments that preceded them? When we observe the great apes, we sense the presence of precursors to our cultural humanity. It is known that Darwin was astonished when, in 1838, he first observed the behaviors of Jenny, an orangutan that had recently arrived in the London Zoo. So was Queen Victoria. She found Jenny to be "disagreeably human."[5] Chimpanzees can create simple tools, use them intelligently to feed themselves, and even visually transmit the invention to others. Some aspects of their social behaviors (and those of bonobos in particular) are arguably cultural. So are behaviors of species as far apart as elephants and marine mammals. Thanks to genetic transmission, mammals possess an elaborate affective apparatus that, in many respects, resembles ours in its emotional roster. To deny mammals the feelings related to their emotionality is no longer a tenable position. Feelings could also have played a

motivating role to account for the "cultural" manifestations of nonhumans. Importantly, the reason why their cultural achievements turned out to be so modest would be related to the lesser development or absence of traits such as shared intentionality and verbal language, and, more generally, the modesty of their intellect.

But things are not so simple. Given the complexity and wide-ranging positive and negative consequences of cultural practices and tools, it would be reasonable to expect that their conception would have been intentional and possible only in minded creatures, as nonhuman primates certainly are, perhaps after a holy alliance of feeling and creative intelligence could devote itself to the problems raised by existence in a group. Before cultural manifestations could emerge in evolution, one would first have had to wait for the evolutionary development of minds and feeling —complete with consciousness, so that feeling could be experienced subjectively—and then wait some more for the development of a healthy dose of mind-directed creativity. So goes the conventional wisdom, but that is not true as we are about to see.

Humble Beginnings

Social governance has humble beginnings, and neither the minds of *Homo sapiens* nor of other mammalian species were present at its natural birth. Very simple unicellular organisms relied on chemical molecules to *sense and respond,* in other words, to detect certain conditions in their environments, including the presence of others, and to guide the actions that were needed to organize and maintain their lives in a social environment. It is known that bacteria growing in fertile terrain, rich in the nutrients they need, can afford to live relatively independent lives; bacteria living in terrain where nutrients are scarce band together in clumps. Bacteria can sense the numbers in the groups they form and in an unthinking way assess group strength, and they can, depending on the strength of the group, engage or not in a battle

for the defense of their territory. They can physically align themselves to form a palisade, and they can secrete molecules that constitute a thin veil, a film that protects their ensemble and probably plays a role in the bacteria's resistance against the action of antibiotics. By the way, this is what goes on routinely in our throats when we get a cold and develop pharyngitis or laryngitis. When bacteria gain a lot of throat territory, we become hoarse and lose our voices. "Quorum sensing" is the process that assists bacteria in these adventures. The achievement is so spectacular that it makes one think of capabilities such as feeling, consciousness, and reasoned deliberation, except that bacteria do not have any such capabilities; they have rather the powerful *antecedents* to those capabilities. I will argue that they lack the mental expression of those antecedents. Bacteria do not engage in phenomenology.[6]

Bacteria are the earliest form of life, dating back to almost four billion years ago. Their body consists of one cell, and the cell does not even have a nucleus. They have no brain. They have no mind in the sense that I and the reader do. They appear to lead a simple life, operating according to the rules of homeostasis, but there is nothing simple about the flexible chemistries that they operate and that allow them to breathe the unbreathable and eat the uneatable.

In the complex, albeit un-minded, social dynamic they create, bacteria can cooperate with other bacteria, genomically related or not. And in their un-minded existence, it turns out they even assume what can only be called a sort of "moral attitude." The closest members of their social group, their family so to speak, are mutually identifiable by the surface molecules they produce or chemicals they secrete, which are in turn related to their individual genomes. But groups of bacteria have to cope with the adversity of their environments and often have to compete with other groups in order to gain territory and resources. For a group to be successful, its members need to cooperate. What can happen during the group effort is fascinating. When bacteria detect "defectors" in their group, which really means that certain members fail to help with the defense effort, they shun them even if they are genomically related and therefore part of their family.

Bacteria will not cooperate with kin bacteria that do not pull their weight and help with the group endeavor; in other words, they snub noncooperative turncoat bacteria. Cheaters, after all, gain access to energy resources and defense that the rest of the group is providing at great cost, at least for a while. The variety of possible bacterial "conduct" is remarkable.[7] In one telling experiment designed by the microbiologist Steven Finkel, several populations of bacteria were to fend for resources inside flasks equipped with different proportions of the necessary nutrients. In one particular condition, over multiple generations, the experiment revealed three distinct successful bacteria groups: two that fought each other to the death and suffered major losses in the process, and one that had sailed discreetly over time, without any frontal engagement. All three groups made it into the future, a future as long as twelve thousand generations. We do not have to be very imaginative to sense comparable patterns in big-creature societies. Societies of cheaters or of peaceable, law-abiding citizens come to mind. It is easy to conjure up a colorful cast of characters, abusers, bullies, thugs, and thieves, but also quiet dissimulators who do very well, just not brilliantly, and, last but not least, the wonderful altruists.[8]

One would be very foolish to reduce the sophistication of humanly developed moral rules and application of justice to the spontaneous behavior of bacteria. We should not confuse the formulation and thoughtful application of a rule of law with the strategy schema used by bacteria when they end up joining forces with a cooperative non-kin, the usual enemy, instead of the kin, their usual friend. In their un-minded orientation to survival, they join with others working toward the same goal. Following the same undeliberated rule, the group response to overall attacks consists of automatically seeking strength in numbers following the equivalent of the principle of least action.[9] Their obeisance of homeostatic imperatives is strict. Moral principles and the law obey the same core rules, but not only. Moral principles and laws are the result of intellectual analyses of the conditions humans have faced and of the management of power by the group inventing and promulgating laws. They are grounded in feeling, knowledge, and reasoning, processed in a mental space, with the

use of language.

One would be equally foolish, however, not to recognize that simple bacteria have governed their lives for billions of years according to an automatic schema that foreshadows several behaviors and ideas that humans have used in the construction of cultures. Nothing in our human conscious minds tells us overtly that these strategies have existed for so long in evolution or when they first appeared, although when we introspect and search our minds for how we should act, we do find "hunches and tendencies," hunches and tendencies that are informed by feelings or *are* feelings. Those feelings gently or forcefully guide our thoughts and actions in a certain direction, providing scaffolding for intellectual elaborations and even suggesting justifications for our actions: for example, welcoming and embracing those who help us when we are in need; shunning those who are indifferent to our plight; punishing those who abandon us or betray us. But we would never have known that bacteria do smart things that work in the same direction without the current science that has so revealed. Our natural behavioral tendencies have guided us toward a conscious elaboration of basic and nonconscious principles of cooperation and struggle that have been present in the behavior of numerous forms of life. Those principles have also guided, over long spans of time and in numerous species, the evolutionary assembly of affect and its key components: all the emotive responses generated by sensing varied internal and external stimuli that engage appetitive drives—thirst, hunger, lust, attachment, care, fellowship—and recognizing situations that require emotional responses such as joy, fear, anger, and compassion. Those principles, which as noted earlier are easily recognizable in mammals, are ubiquitous in the history of life. It is apparent that natural selection and genetic transmission have been hard at work in shaping and sculpting such modes of reacting in social environments to construct the scaffolding of the human cultural mind. Together, subjective feelings and creative intelligence have operated in that setting and created cultural instruments that serve the needs of our lives. If that is indeed the case, the human unconscious literally goes back to early life-forms, deeper and further than Freud or Jung ever dreamed.

From the Life of Social Insects

Now consider this. A small number of invertebrate species, a mere 2 percent of all species of insects, is capable of social behaviors that do rival in complexity many human social achievements. Ants, bees, wasps, and termites are the prominent examples.[10] Their genetically set and inflexible routines enable the survival of the group. They divide labor intelligently within the group to deal with the problems of finding energy sources, transform them into products useful for their lives, and manage the flow of those products. They do so to the point of changing the number of workers assigned to specific jobs depending on the energy sources available. They act in a seemingly altruistic manner whenever sacrifice is needed. In their colonies, they build nests that constitute remarkable urban architectural projects and provide efficient shelter, traffic patterns, and even systems of ventilation and waste removal, not to mention a security guard for the queen. One almost expects them to have harnessed fire and invented the wheel. Their zeal and discipline put to shame, any day, the governments of our leading democracies. These creatures acquired their complex social behaviors from their biology, not from Montessori schools or Ivy League colleges. But in spite of having come by these astounding abilities as early as 100 million years ago, ants and bees, individually or as colonies, do not grieve for the loss of their mates when they disappear and do not ask themselves about their place in the universe. They do not inquire about their origin, let alone their destiny. Their seemingly responsible, socially successful behavior is not guided by a sense of responsibility, to themselves or to others, or by a corpus of philosophical reflections on the condition of being an insect. It is guided by the gravitational pull of their life regulation needs as it acts on their nervous systems and produces certain repertoires of behavior selected over numerous evolving generations, under the control of their fine-tuned genomes. Members of a colony do not think as much as they act, by which I mean that upon registering a particular need—theirs, or the group's, or the queen's—they do not ponder alternatives for how to fulfill such a need in any way comparable to ours. They simply fulfill it. Their repertoire of

actions is limited, and in many instances it is confined to one option. The general schema of their elaborate sociality does resemble that of human cultures, but it is a fixed schema. E. O. Wilson calls social insects "robotic" and for good reason.

Now, back to humans. We humans do ponder alternatives for our behavior, do mourn the loss of others, do want to do something about our losses and about maximizing our gains, and do ask questions about our origin and destiny and propose answers, and we are so disorderly in our bubbling and conflicting creativities that we are often a mess. We do not know exactly when humans began grieving, reacting to losses and gains, commenting on their condition, and asking inconvenient questions about the wherefrom and whereto of their lives. We know for certain, based on artifacts from the burial sites and caves that have been explored to date, that 50,000 years ago some of these processes were well established. But note how, amazingly, this is a mere evolutionary instant when we compare, say, 50 *thousand* years of humanity to 100 *million* years of the lives of social insects, not to mention a few *billion* years of history for bacteria.

Although we do not descend directly from bacteria or social insects, I believe it is instructive to reflect on these three lines of evidence: bacteria devoid of brains or minds that defend their turf, wage warfare, and act according to something equivalent to a code of conduct; enterprising insects that create cities, systems of governance, and functional economies; and humans who invent flutes, write poetry, believe in God, conquer the planet and the space around, fight diseases to alleviate suffering but also destroy other humans for their own gain, invent the Internet, find ways to turn it into an instrument of progress and of catastrophe, and, to boot, ask questions about bacteria, about ants and bees, and about themselves.

Homeostasis

How can we reconcile the seemingly reasonable idea that feelings

motivated intelligent cultural solutions for problems posed by the human condition with the fact that un-minded bacteria exhibit socially efficacious behaviors whose contours foreshadow some human cultural responses? What is the thread that links these two sets of biological manifestations, whose emergence is separated by billions of years of evolution? I believe that the common ground and the thread can be found in the dynamics of *homeostasis*.

Homeostasis refers to the fundamental set of operations at the core of life, from the earliest and long-vanished point of its beginning in early biochemistry to the present. Homeostasis is the powerful, unthought, unspoken imperative, whose discharge implies, for every living organism, small or large, nothing less than enduring and prevailing. The part of the homeostatic imperative that concerns "enduring" is transparent: it produces survival and is taken for granted without any specific reference or reverence whenever the evolution of any organism or species is considered. The part of homeostasis that concerns "prevailing" is more subtle and rarely acknowledged. It ensures that *life is regulated within a range that is not just compatible with survival but also conducive to flourishing, to a projection of life into the future of an organism or a species*.

Feelings are the very revelation to each individual mind of the status of life within the respective organism, a status expressed along a range that runs from positive to negative. Deficient homeostasis is expressed by largely negative feelings, while positive feelings express appropriate levels of homeostasis and open organisms to advantageous opportunities. Feelings and homeostasis relate to each other closely and consistently. Feelings are the subjective experiences of the state of life—that is, of homeostasis—in all creatures endowed with a mind and a conscious point of view. We can think of feelings as mental deputies of homeostasis.[11]

I bemoaned the neglect of feelings in the natural history of cultures, but the situation is even worse in relation to homeostasis and life itself. Homeostasis and life are left out altogether. Talcott Parsons, one of the most prominent sociologists of the twentieth century, did invoke the notion of homeostasis in relation to social systems, but in his hands the concept was not connected to life or

chapters 4 through 9, the making of minds—and of feelings in particular—is grounded on *interactions* of the nervous system and its organism. *Nervous systems make minds not by themselves but in cooperation with the rest of their own organisms.* This is a departure from the traditional view of brains as the sole source of minds.

Although the emergence of feelings is far more recent than the beginnings of homeostasis, it still occurred long before humans entered the scene. Not all creatures are endowed with feelings, but *all* living creatures are equipped with the regulation devices that were precursors to feelings (some of which are discussed in chapters 7 and 8).

As we consider the behavior of bacteria and social insects, suddenly early life is modest in name only. The actual beginnings of what eventually became human life, human cognition, and the cast of mind that I like to call cultural go back to a vanishing point in the history of the earth. It is not enough to say that our minds and cultural successes are grounded in brains that share numerous features with the brains of our mammalian relatives. We have to add that our minds and cultures are linked to the ways and means of ancient unicellular life and of many intermediate life-forms. One might say, figuratively, that our minds and cultures have borrowed from the past liberally, without embarrassment or apology.

Early Organisms and Human Cultures

It is important to insist that identifying links between biological processes, on the one hand, and mental and sociocultural phenomena, on the other, does not signify that the shape of societies and the makeup of cultures can be fully explained by the biological mechanisms we are outlining. Certainly I suspect that the development of codes of conduct, regardless of where or when they appeared, has been inspired by the homeostatic imperative. Such codes have generally aimed at the reduction of risks and dangers for individuals and social groups and have indeed

resulted in a reduction of suffering and the promotion of human welfare. They have strengthened social cohesion, which is, in and of itself, favorable to homeostasis. But beyond the fact that they were conceived by humans, Hammurabi's Code, the Ten Commandments, the U.S. Constitution, and the Charter of the United Nations were shaped by specifics of the circumstances of their time and place and by the particular humans who developed such codes. There are several formulas behind such developments rather than one single comprehensive formula, although parts of any of the possible formulas are universal.

Biological phenomena can prompt and shape events that become cultural phenomena, and must have done so at the dawn of cultures via the interplay of affect and reason, in specific circumstances defined by the individuals, the groups, their location, their past, and so forth. Also, the intervention of affect was not confined to an initial motive. It recurred in the role of monitor of the process and continued to intervene into the future of many cultural inventions as required by the everlasting negotiations between affect and reason. But the critical biological phenomena—feelings and intellect within cultural minds—are only one part of the story. Cultural selection needs to be factored in, and to do so we require the scholarship of history, geography, and sociology, among many other disciplines. At the same time, we need to recognize that the adaptations and faculties used by cultural minds were the result of natural selection and genetic transmission.

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Genes were instrumental in the traversals from early life to human life today. That much is obvious and true but begs the question of how genes came to be and to do so. A more complete answer, perhaps, is that even at the earliest, long-vanished point, the physical and chemical conditions of the life process were responsible for establishing homeostasis in the ample sense of the term and everything else flowed from that fact, including the machinery of genes. This happened in cells without nuclei (or prokaryotes). Later, homeostasis was behind the selection of cells

with nuclei (or eukaryotes). Later still come complex organisms with many cells. Eventually, such multicellular organisms elaborated existing "whole-body systems" into the endocrine, immune, circulatory, and nervous systems. Such systems gave rise to minds, feelings, consciousness, the machinery of affect, and complex movements. Without such whole-body systems, multicellular organisms would not have been able to operate their "global" homeostasis.

The brains that have helped human organisms invent cultural ideas, practices, and instruments were assembled by genetic inheritance, naturally selected over billions of years. By contrast, the products of the human cultural mind and the history of humans have been subject mostly to cultural selection and have been transmitted to us largely by cultural means.

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In the march toward the human cultural mind, the presence of feelings would have allowed homeostasis to make a dramatic leap because they could represent mentally the state of life within the organism. Once feelings were added to the mental mix, the homeostatic process was enriched by direct knowledge of the state of life and, of necessity, that knowledge was conscious. Eventually, each feeling-driven, conscious mind could mentally represent, with an explicit reference to the experiencer subject, two critical sets of facts and events: (1) the conditions in the inner world of its own organism; and (2) the conditions of its organism's environment. The latter prominently included the behaviors of other organisms in a variety of complex situations generated by social interactions as well as by shared intentions, many of them dependent on the individual drives, motivations, and emotions of the participants. As learning and memory advanced, individuals became able to establish, recall, and manipulate memories of facts and events, opening the way to a new level of intelligence based on knowledge and feeling. Into this process of intellectual expansion came verbal language, providing easily manipulable and transmissible correspondences between ideas and words and sentences. From there on, the creative flood could not be

contained. Natural selection had just conquered yet another theater of operations, that of the ideas behind certain actions, practices, and artifacts. Cultural evolution could now join genetic evolution.

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The prodigious human mind and the complicated brain that enables it distract us from the long line of biological antecedents that account for their presence. The splendor of mind and brain achievements makes it possible to imagine that human organisms and minds could spring forth fully formed, like a phoenix, parentage unknown or very recent. Behind such prodigies, however, there are long chains of precedents and amazing degrees of competition and cooperation. How easy it is to overlook, in the story of our minds, the fact that life in complex organisms could only have endured and prevailed if it were curated and that brains came to be favored in evolution because they became so good at assisting with the curatorial job, especially after they were able to help organisms fabricate conscious minds rich in feeling and thinking. In the end, human creativity is rooted in life and in the breathtaking fact that life comes equipped with a precise mandate: resist and project itself into the future, no matter what. It may be helpful to consider these humble but powerful origins as we cope with the instabilities and uncertainties of the present.

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Contained within life's imperative and its seeming homeostatic magic, coiled as it were, there were instructions for immediate survival: the regulation of metabolism and repair of cellular components, rules for behavior in a group, and standards for the measurement of positive and negative departures from homeostatic balance so that appropriate responses could be launched. But the imperative also harbored the tendency to seek future security in more complex and robust structures, a relentless plunge into the future. The realization of this tendency was achieved by myriad cooperations, along with the mutations, and fierce competition that enabled natural selection. Early life was

foreshadowing many future developments that we can now observe in human minds imbued with feeling and consciousness and enriched by the cultures that such minds have constructed. Complex, conscious, feeling minds inspired and steered the expansion of intelligence and language and generated novel instruments of dynamic homeostatic regulation external to living organisms. The intentions expressed by such new instruments are still consonant with the early life imperative, still aimed at not just enduring but prevailing.

Why, then, are the results of these extraordinary developments so inconsistent, not to say erratic? Why so much derailed homeostasis and so much suffering over human history? A preliminary answer, which we will address later in the book, is that cultural instruments first developed in relation to the homeostatic needs of individuals and of groups as small as nuclear families and tribes. The extension to wider human circles was not and could not have been contemplated. Within wider human circles, cultural groups, countries, even geopolitical blocs, often operate as individual organisms, not as parts of one larger organism, subject to a single homeostatic control. Each uses the respective homeostatic controls to defend the interests of *its* organism. Cultural homeostasis is merely a work in progress often undermined by periods of adversity. We might venture that the ultimate success of cultural homeostasis depends on a fragile civilizational effort aimed at reconciling different regulation goals. This is why the calm desperation of F. Scott Fitzgerald—"so we beat on, boats against the current, borne back ceaselessly into the past"—remains a prescient and appropriate way of describing the human condition.[13]

and you get a theatrical representation of the vulnerability and risk of life. And now think that the jongleur also wants to impress you with his elegance and speed, his brilliance, and then you realize that he is already considering an even better act.[3]

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In brief, each cell manifested, and all cells forever so, a powerful, seemingly indomitable "intention" to maintain itself alive and to sail forth. That indomitable intention fails only in circumstances of disease or aging, when the cell literally implodes in a process known as apoptosis. Let me stress that I do not think cells have intentions, desires, or wills, in the same way that minded and conscious beings do, but they can behave as if they do and they did. When the reader or I have an intention or desire or will, we can represent several aspects of the process explicitly in *mental* form; individual cells cannot, at least not in the same way. Still, non-consciously, their actions aim at persistence into the future and these actions are the consequences of particular chemical substrates and interactions.

This indomitable intention corresponds to the "force" that the philosopher Spinoza intuited and named the *conatus*. We now understand that it is present at the microscopic scale of each living cell, and we can envision it projected, at the macroscopic scale, everywhere we look in nature: to our whole organisms, made up of trillions of cells, to the billions of neurons in our brains, to the minds that arise in our embodied brains, and to the countless cultural phenomena that the collectives of human organisms have been constructing and tinkering with for millennia.

The continuous attempt at achieving a state of positively regulated life is a defining part of our existence—the first reality of our existence, as Spinoza would say when he described the relentless endeavor of each being to preserve itself. A blend of striving, endeavor, and tendency comes close to rendering the Latin *conatus*, as used by Spinoza in propositions 6, 7, and 8 of the *Ethics*, part 3. In Spinoza's own words, "Each thing, as far as it can be its own power, strives to persevere in its being," and "The striving by which each thing strives to persevere in its being is

nothing but the actual essence of the thing." Interpreted with the advantage of current hindsight, Spinoza says that the living organism is constructed so as to maintain the coherence of its structures and functions, for as long as possible, against the odds that threaten it. It is interesting to note that Spinoza reached these conclusions before Maupertuis advanced the principle of least action (Spinoza died almost half a century before). He would have welcomed the support.[4]

In spite of the transformations that the body undergoes as it develops, renews its constituent parts, and ages, the *conatus* insists on maintaining the same individual, respecting the original architectural plan, and thus allowing for the sort of animation that is associated with that plan. The animation can vary in scope, corresponding to life processes merely sufficient to survive or to achieve optimal life processes.

The poet Paul Éluard wrote about the *dur désir de durer*, another way of describing the *conatus* but with the alliterative beauty of a memorable collection of French sounds. I can translate it, pallidly, as the "determined desire to endure." And William Faulkner wrote of the human desire to "endure and prevail." He, too, was referring, with remarkable intuition, to the projection of the *conatus* in the human mind.[5]

Life on the Move

There are plenty of bacteria around us, on us, and inside us, today, but there are no examples left around of those very early bacteria of 3.8 billion years ago. What they were like, what early life was like exactly, needs to be pieced together from different strands of evidence. Between the beginnings and now, there are sparsely documented gaps. How life arose, precisely, is open to informed conjecture.

At first blush, in the wake of the discovery of the structure of DNA, the elucidation of the role of RNA, and the breaking of the genetic code, it must have appeared that life had to come from the genetic material, but that idea was up against a major difficulty:

the likelihood of such complex molecules assembling themselves spontaneously as the first step in the construction of life was low to nil.[6]

The puzzlement and equivocation were perfectly understandable. The 1953 discovery (by Francis Crick and James Watson and Rosalind Franklin) of the double-helix structure of DNA was and remains one of the peak moments of the history of science and deservedly influenced the formulations of life that followed. DNA was inevitably seen as the molecule of life and, by extension, the molecule of its beginning. But how could a molecule so complex put itself together spontaneously in the primordial soup? Seen from that perspective, the likelihood of life's spontaneous emergence was so negligible that it justified Francis Crick's skepticism that it would have originated on Earth. He and his colleague Leslie Orgel, at the Salk Institute, thought that life might have come from outer space, brought in by rocket ships, unmanned. This was a version of Enrico Fermi's idea that aliens from other planets would have come to Earth and brought life with them. As intriguing as this claim is, it simply pushed the problem out to another planet. The aliens would have vanished, in the meantime, or perhaps be in our midst but unrecognized. The Hungarian physicist Leo Szilard ventured that of course they were still among us "but they call themselves Hungarians."[7] This is especially amusing because another notable Hungarian, the biologist and chemical engineer Tibor Gánti, was a critic of the idea that life had been shipped from elsewhere, a notion that Crick eventually abandoned.[8] Still the puzzlement over the emergence of life produced widely divergent views, from some of the most distinguished biologists of the twentieth century. Jacques Monod, for example, was a "life skeptic" and believed that the universe was "not pregnant with life," while Christian de Duve thought exactly the opposite.

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Today we are still faced with two competing views: one we may call "replicator first" and the other "metabolism first." The replicator-first view is attractive because the machinery of

genetics is reasonably well understood and so compelling. When people pause to consider the origin of life, which surprisingly people rarely do, replicator first is the default account. Because genes help manage life and can transmit life, why would they not have started the life ball rolling? Richard Dawkins, for example, favors this view.[9] The primordial soup would beget replicator molecules, which would beget living bodies, which then slave for an assigned lifetime to protect the integrity of genes and their selective, triumphant march along evolution. Stanley Miller and Harold Urey had reported, also in 1953, that the equivalent of a lightning storm inside a test tube could produce amino acids, the building blocks of proteins, thus making simple chemical beginnings plausible.[10] Eventually, elaborate bodies such as ours, equipped with brains and minds and creative intelligence, would come into being to do, once again, the gene's bidding. Whether one finds this account plausible or compelling is a matter of taste. The difficulty is not to be taken lightly, because nothing is that transparent on the issue of life's origins. In favor of this view, a scenario has been advanced in which geological conditions about 3.8 billion years ago would have been compatible with the spontaneous assembly of some of the RNA nucleotides. The RNA world would account for the chemical autocatalytic cycles that define metabolism and for genetic transmission. In a variation on this theme, catalytic RNAs would do double duty, replicate and do the chemistry.

The version of events that I find most persuasive, however, calls for metabolism first. In the beginning, it was plain chemistry, as Tibor Gánti would propose. The primordial soup contained key ingredients, and there were enough favorable conditions, such as thermal vents and lightning storms, you name it, that certain molecules and certain chemical pathways were assembled and initiated their ceaseless protometabolic operations. Living matter would have begun as a chemical sleight of hand, a result of cosmic chemistry and of its inevitability, but living matter would be imbued with the homeostatic imperative, and that would set the agenda. In addition to the forces selecting for increasingly stable molecular and cellular conformations, which achieved life persistence and positive energy balances, there was a set of