FEELING & KNOWING

Making Minds Conscious

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Before We Begin

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The book you are about to read has some curious origins. It owes a lot to a privilege I have long enjoyed and a frustration I have often felt. The privilege consists in having had the luxury of space when I needed to explain complicated scientific ideas using the large number of pages of a standard nonfiction book. The frustration came from talking to many of my readers, over the years, and learning that some ideas that I wrote about with enthusiasm—and that I had been keenest to have readers discover and enjoy—were lost in the middle of long discussions and hardly noticed, let alone enjoyed. My private response, on such occasions, has been a firm but always postponed decision: to write *only* about the ideas I most care for and leave behind the connective tissue and the scaffolding meant to frame them. In brief, do what good poets and sculptors do so well: chip away at the nonessential and then chip some more; practice the art of haiku.

When Dan Frank, my editor at Pantheon, told me that I should write a focused and very brief book on consciousness, he could not have anticipated a more receptive and enthusiastic author. The book you have in your hands is not exactly what he ordered, because it is not *only* about consciousness, but it comes close. What I could not have anticipated is that the effort of reconsidering and paring down so much material, would help me confront facts that I had overlooked and develop new insights about not just consciousness but related processes. The road to discovery is twisted, to say the least.

It is not possible to make sense of what consciousness is and of how it developed without first addressing a number of important questions in the universe of biology, psychology, and neuroscience.

The first of those questions concerns *intelligences and minds.* We know that the most numerous living organisms on earth are unicellular, such as bacteria. Are they intelligent? Indeed they are,

remarkably so. Do they have minds? No, they do not, I believe, and neither do they have consciousness. They are autonomous creatures; they clearly have a form of "cognition" relative to their environment, and yet, instead of depending on minds and consciousness, they rely on *non-explicit competences*—based on molecular and sub-molecular processes—that govern their lives efficiently according to the dictates of homeostasis.

And what about humans? Do we have minds and only minds? The simple answer is no. We certainly have minds, populated by patterned sensory representations called images, *and* we also have the non-explicit competences that serve simpler organisms so well. We are governed by two types of intelligence, relying on two kinds of cognition. The first is the one humans have long studied and cherished. It is based on reasoning and creativity and depends on the manipulation of explicit patterns of information known as images. The second type is the non-explicit competence found in bacteria, the one variety of intelligence on which most lives on earth have depended and continue to depend. It remains hidden to mental inspection.

The second question we need to address deals with the ability to feel. *How are we able to feel pleasure and pain, well-being and sickness, happiness and sadness?* The traditional answer is well known: the brain allows us to feel, and all we need is to investigate the specific mechanisms behind specific feelings. My aim, however, is not to elucidate the chemical or neural correlates of one particular feeling or another, an important issue that neurobiology has been attempting to address with some success. My aim is different. I wish to know about the functional mechanisms that allow us to *experience in mind* a process that clearly takes place in the *physical realm of the body.* That intriguing pirouette—from physical body to mental experience—is conventionally attributed to the good offices of the brain, specifically to the activity of physical and chemical devices called neurons. Although it is apparent that the nervous system is required to accomplish that remarkable transition, *there is no evidence that it does so alone.* Moreover, the intriguing pirouette that allows the physical body to harbor mental experiences is regarded by many as impossible to explain.

In an attempt to answer the critical question, I focus on two observations. One of them relates to the unique anatomical and functional features of the interoceptive nervous system—the system responsible for signaling from the body to the brain. These features are radically different from those that can be found in other sensory channels, and although some of them have previously been documented, their significance has been overlooked. And yet they help explain the peculiar melding of "body signals" and "neural signals" that decisively contributes to experiencing the flesh.

Another pertinent observation concerns the equally unique relationship between the body and the nervous system, specifically the fact that the former entirely contains the latter within its borders. *The nervous system, including its natural core, the brain, is located in its entirety within the territory of the body proper and is fully conversant with it.* As a consequence, body and nervous system can *interact directly and abundantly.* Nothing comparable holds for the relation between the world external to our organisms and our nervous systems. An astonishing consequence of this peculiar arrangement is that feelings are not conventional perceptions of the body but rather *hybrids,* at home in both body and brain.

This hybrid condition may help explain *why there is a profound distinction but no opposition between feeling and reason,* why we are *feeling creatures that think and thinking creatures that feel.* We go through life feeling or reasoning or both, as required by the circumstances. Human nature benefits from an abundance of explicit and non-explicit types of intelligence and from the use of feeling and reason, each alone or in combination. Plenty of intellectual power, obviously, though not nearly enough for us to behave decently to our fellow humans, not to mention other living creatures.

Armed with important new facts, we are finally prepared to address consciousness directly. *How does the brain provide us with mental experiences that we unequivocally relate to our beings—to ourselves?* The possible answers, as we shall see, become disarmingly transparent.

Before we proceed, I need to say a few words about how I approach the investigation of mental phenomena. To be sure, the approach begins with the mental phenomena themselves, when singular individuals engage in introspection and report on their observations. Introspection has its limits, but it has no rival, let alone a substitute. It provides the only direct window into the phenomena we wish to understand, and it memorably served the scientific and artistic genius of William James, Sigmund Freud, Marcel Proust, and Virginia Woolf. More than one century later, we can claim some advances but their achievement remains extraordinary.

The results of introspection can now be connected and enriched by results obtained with other methods that also concern mental phenomena but investigate them obliquely by focusing on their (a) behavioral manifestations and (b) biological, neurophysiological, physicochemical, and social correlates. In recent decades several technical advances have revolutionized these methods and given them considerable power. The text you are about to read relies on results culled from integrating such formal scientific efforts with the results of introspection.

There is little merit in complaining about the flaws of self-observation and about its obvious limits or, for that matter, in complaining about the indirect nature of the sciences that concern mental phenomena. There is no other way of proceeding, and the multifaceted techniques that have become state of the art go a long way toward minimizing the difficulties.

One last word of caution: the facts generated by this multipronged approach require interpretation. They suggest ideas and theories meant to explain facts in the best possible way. Some ideas and theories fit the facts quite well and are rather convincing, but make no mistake: they, in turn, need to be treated as hypotheses, put to appropriate experimental tests, and supported, or not, by evidence. We should not confuse theory, no matter how seductive, with verified facts. On the other hand, it is also the case that in discussing phenomena as complex as mental events are, we often have to settle for plausibility when verification is nowhere near.

I

On Being

IN THE BEGINNING WAS NOT THE WORD

In the beginning was not the word; that much is clear. Not that the universe of the living was ever simple, quite the contrary. It was complex from its inception, four billion years ago. Life sailed forth without words or thoughts, without feelings or reasons, devoid of minds or consciousness. And yet living organisms sensed others like them and sensed their environments. By sensing I mean the detection of a "presence"—of another whole organism, of a molecule located on the surface of another organism or of a molecule secreted by another organism. Sensing is *not* perceiving, and it is *not* constructing a "pattern" based on something else to create a "representation" of that something else and produce an "image" in mind. On the other hand, sensing is the most elementary variety of cognition.

Even more surprising, living organisms responded *intelligently* to what they sensed. Responding with intelligence meant that the response helped the continuation of their life. For example, if what they sensed posed a problem, an intelligent response was one that solved the problem. Importantly, however, the smartness of these simple organisms did not rely on explicit knowledge of the sort our minds use today, the sort that requires representations and images. It relied on a concealed competence that took into account the goal of maintaining life and nothing but. This non-explicit intelligence was in charge of curating life, managing it in accordance with the rules and regulations of *homeostasis.* Homeostasis? Think of homeostasis as a collection of how-to rules, relentlessly executed according to an unusual manual of directions without any words or illustrations. The directions ensured that the parameters on which life depended—for example, the presence of nutrients, certain levels of temperature or pH —were maintained within optimal ranges.

Remember: in the beginning no words were spoken and no words were written, not even in the exacting manual of life regulations.

THE PURPOSE OF LIFE

I know that talking about the purpose of life can cause some discomfort, but considered from the innocent perspective of each living organism, life is inseparable from one apparent goal: its own maintenance, for as long as death from aging does not come calling.

Life's most direct path to achieving its own maintenance is by following the dictates of homeostasis, the intricate set of regulatory procedures that made life possible when it first bloomed in early single-cell organisms. Eventually, when multicellular and multisystem organisms became all the rage—that was about three and a half billion years later—homeostasis was assisted by newly evolved coordinating devices known as nervous systems. The stage was set for those nervous systems to not just manage actions but also represent patterns. Maps and images were on their way, and minds—the feeling and conscious minds that nervous systems made possible—became the result. Gradually, over a few hundred million years, homeostasis began to be partly governed by minds. All that was needed now for life to be managed even better, was creative reasoning based on memorized knowledge. Feelings, on the one hand, and creative reasoning, on the other, came to play important parts in the new level of governance that consciousness allowed. The developments amplified the purpose of life: survival, to be sure, but with an abundance of well-being derived in good part from the experience of its own intelligent creations.

The goal of survival and the dictates of homeostasis are still at work today, both in single-cell creatures such as bacteria and in ourselves. But the kind of intelligence that assists the process is different in single cells and in humans. Non-explicit, non-conscious intelligence is all that the simpler and mindless organisms have available. Their intelligence lacks the riches and the power generated by overt representations. Humans have both kinds of intelligence.

As we discuss life and the kinds of intelligent management that different species rely on, it becomes clear that we need to identify the

menu of specific and distinct strategies available to those creatures and give names to the functional steps they constitute. *Sensing* (detecting) is most basic, and I believe it is present in all living forms. *Minding* is next. It requires a nervous system and the creation of representations and images, the critical component of minds. Mental images flow relentlessly in time and are infinitely open to manipulation so as to yield novel images. As we will see, minding opens the way to *feeling* and *consciousness.* There is not much hope of elucidating consciousness if we do not insist on distinguishing these intermediate steps.

THE EMBARRASSMENT OF VIRUSES

The mention of intelligent but unminded competences makes me think of the tragedy we have been living through and of the unanswered questions that pertain to viruses. In spite of our success in managing polio and measles and HIV and coping with the inconvenience and dangers of the seasonal flu, viruses remain a major cause of scientific and medical humiliation. We are negligent in our preparation for viral epidemics, and we are ignorant when it comes to the science we need in order to speak about viruses clearly and deal with their consequences effectively.

We have made great progress in understanding the role of bacteria in evolution and their interdependence relative to humans, which is largely beneficial to us. The microbiome is now a part of how we understand ourselves, but nothing comparable holds for viruses. Our troubles begin with how to classify viruses and understand their role in the general economy of life. Are viruses alive? No, they are not. Viruses are not living organisms. But then why do we talk about "killing" viruses? What is the status of viruses in the big biological picture? Where do they fit in evolution? Why and how do they wreak havoc among real living things? The answers to these questions are often tentative and ambiguous, which is surprising given how much viruses cost in human suffering. Comparing viruses and bacteria is most informative. Viruses do not have energy metabolism, but bacteria do; viruses do not produce energy or waste, but bacteria do. Viruses cannot initiate movement. They are concoctions of nucleic acids—DNA or RNA—and some assorted proteins.

Viruses cannot reproduce on their own, but they can invade living organisms, hijack their life systems, and multiply. In brief, they are not living but can become parasitic of the living and make a "pseudo" living while, in most instances, destroying the life that allows them to continue their ambiguous existence and promoting the manufacture and dissemination of "their" nucleic acids. And on that point, in spite

of their nonliving status, we cannot deny viruses some fraction of the non-explicit variety of intelligence that animates all living organisms beginning with bacteria. Viruses carry a hidden competence that manifests itself only once they reach suitable living terrain.

BRAINS AND BODIES

Any theory that bypasses the nervous system in order to account for the existence of minds and consciousness is destined to failure. The nervous system is the critical contributor to the realization of minds, consciousness, and the creative reasoning that they allow. But any theory that relies *exclusively* on the nervous system to account for minds and consciousness is also bound to fail. Unfortunately, that is the case with most theories today. The hopeless attempts to explain consciousness exclusively in terms of nervous activity are partly responsible for the idea that consciousness is an inexplicable mystery. While it is true that consciousness, as we know it, only fully emerges in organisms endowed with nervous systems, it is also true that consciousness requires abundant interactions between the central part of those systems—the brain proper—and varied non-nervous parts of the body.

What the body brings to the marriage with a nervous system is its foundational biological intelligence, the non-explicit competence that governs life as it meets homeostatic demands and that eventually is expressed in the form of feeling. The fact that, in good part, feeling is only fully realized thanks to nervous systems does not change this fundamental reality.

What nervous systems bring to the marriage with the body is the possibility of making knowledge explicit, by way of constructing the spatial patterns that, as we will clarify later, constitute *images.* Nervous systems also help commit to memory the knowledge represented in images and open the way for the sort of image manipulation that enables reflection, planning, reasoning, and, ultimately, the generation of symbols and the creation of novel responses, artifacts, and ideas. The marriage of bodies and brains even manages to reveal some of the secret knowledge of biology, in other words, the rhymes and reasons of intelligent life.

NERVOUS SYSTEMS AS AFTERTHOUGHTS OF NATURE

Nervous systems came late in the history of life. No, nervous systems were not primary on any count. Nervous systems showed up to serve life, to make life possible when the complexity of organisms required high levels of functional coordination. And yes, nervous systems helped generate remarkable phenomena and functions that were not present before their arrival such as feelings, minds, consciousness, explicit reasoning, verbal languages, and mathematics. In a curious way, these "neuroauthorized" novelties expanded the achievements of the non-explicit biological intelligences and non-explicit cognitive abilities that were already in place and that had the singular purpose of serving life. The neural novelties worked toward optimizing homeostatic regulation and maintaining life more securely. This is precisely what nervous systems have been achieving by delivering the high levels of functional coordination required by complex multicellular and multisystem organisms. Complex, multicellular organisms with differentiated systems—endocrine, respiratory, digestive, immune, reproductive—were saved by nervous systems, and organisms with nervous systems came to be saved by the things nervous systems invented—mental images, feelings, consciousness, creativity, cultures.

Nervous systems are splendid "afterthoughts" of a non-minded, non-thinking, but pioneeringly prescient nature.

grade that comes in the form of a quality—pleasant or unpleasant, light or intense. This is precious and novel information, the kind of information that organisms confined to a "being" stage cannot obtain.

Not surprisingly, feelings are important contributors to the creation of a "self,"[3] a mental process animated by the state of the organism, and are anchored in its body frame (the frame constituted by muscular and skeletal structures), and oriented by the perspective provided by sensory channels such as vision and hearing.

Once being and feeling are structured and operational, they are ready to support and extend the sapience that constitutes the third member of the trio: *knowing.*

Feeling provides us with knowledge of life in the body and, without missing a beat, makes that knowledge conscious. (In chapters III and IV we shall explain how feelings manage to do so.) This is a pivotal, fundamental process, and yet, in a most ungrateful manner, we barely notice it, distracted as we are by the thunder of another branch of knowing, the one that is constructed by the sensory systems —vision, hearing, body sensations, taste, and smell—with the help of memory. The maps and images created on the basis of sensory information become the most abundant and diverse constituents of mind, side by side with ever present and related feelings. More often than not, they dominate the mental proceedings.

Curiously, each sensory system is, in and of itself, devoid of conscious experience. The visual system, for example, our retinas, visual pathways, and visual cortices, produces maps of the outside world and contributes the respective, explicit visual images. But the visual system would not allow us to automatically declare those images as our images, as occurring *inside* our organism. We would not relate those images to our beings, we would not be conscious of those images. Only the coordinated operation of the three kinds of processing—the kinds that have to do with being, feeling, and knowing—allows the images to be connected to our organism, literally *referred to it* and *placed within it.* Only then can experience emerge.

What follows from this momentous but unheralded physiological step is nothing short of extraordinary. Once experiences begin to be committed to memory, feeling and conscious organisms are capable of maintaining a more or less exhaustive history of their lives, a history

of their interactions with others and of their interaction with the environment, in brief, a history of each individual life as lived inside each individual organism, nothing less than the armature of personhood.