Chapter Ten

Using Consciousness

Unconsciousness and Its Limits

There is a growing agreement among those who think about the problem of consciousness that consciousness is valuable and that it prevailed in evolution because of that value. There is less agreement, however, when it comes to the precise contribution that consciousness has made.

I began this book by calling attention to the unconscious nature of the emotions and showing how efficacious emotions and feelings can be, even when organisms do not know of their existence. It is reasonable to ask, then, what possible advantage can organisms derive from knowing that those emotions and feelings are taking place? Why is consciousness beneficial? Might we have been equally successful as living creatures without knowing that we have feelings?

I began addressing these questions in the previous chapter but a more detailed answer requires a consideration of the powers and limits of unconscious processing. I do not need to argue that both the thoughts currently present in our minds and the behaviors we exhibit are the result of a vast amount of processing of which we are not aware. The influence of unknown factors on the human mind has long been recognized. In antiquity, the unknown factors were called gods and destiny. Earlier in this century, the unknown factors came closer to our beings and were located in the subterranean of the mind. In the version usually identified with Sigmund Freud, a certain set of early individual experiences would have shaped the working of the subterranean. In another version, Carl Jung's, the shaping of the subterranean would have begun long ago in evolution. We do not need to endorse the mechanisms proposed by either Freud or Jung to acknowledge the existence and recognize the power of unconscious processes in human behavior. Throughout the century, and through work unrelated to the original proposals of Freud and Jung, the evidence for unconscious processing has not ceased to accumulate.

The field of social psychology has produced massive evidence for nonconscious influences in the human mind and behavior. The telling examples are too numerous to list but comprehensive reviews by J. Kihlstrom and A. Reber provide a good entry into the fascinating facts.[1]

Cognitive psychology and linguistics have produced their own powerful evidence.[2] For example, by the age of three, children make amazing usage of the rules of construction of their language, but they are not aware of this "knowledge," and neither are their parents. A good example comes from the manner in which three-year-olds form the following plurals perfectly:

dog + plural = dog *z*
cat + plural = cat *s*
bee + plural = bee *z*

The children add the voiced *z*, or the voiceless *s*, at the end of the right word but the selection does not depend on a conscious survey of that knowledge. The selection is unconscious. The knowledge of grammatical structure, to which Noam Chomsky's work pointed us in

midcentury, is not consciously present in most instances of its perfectly correct and effective usage.[3]

The examples from the field of neuropsychology are equally numerous and telling. For instance, the knowledge acquired through conditioning remains outside conscious survey and is expressed only indirectly; patients who can no longer consciously recognize faces can detect familiar faces nonconsciously; legally blind patients with certain brain lesions are able to point relatively accurately to a source of light that they cannot consciously see.[4] The retrieval of sensorimotor skills without consciousness of the knowledge expressed in the movement provides a good illustration of this situation.

The term *sensorimotor skill* refers to the sort of thing you acquire when you learn to swim, ride a bike, dance, or play a musical instrument. The learning of such skills involves multiple executions during which the performance of the task is progressively perfected. You do not learn to play the violin with one lesson, even if you happen to be the new Heifetz. It requires multiple trials. On the other hand, you can learn my face and my name in one shot.

There are reliable tasks to measure skill learning in the laboratory, such as mirror tracing or rotor pursuit. In the latter, for instance, you are asked to hold the tip of a stylus in contact with a minute dot, marked at the edge of a circular plate, while the plate keeps gyrating at fast speed. It takes time and several trials to master a good performance, which consists of keeping precise pace with the circular motion of the plate. It requires a fine coordination between the speed of the plate and the speed of arm movement. A computer automatically measures the performance by sensing the amount of time the stylus is in actual contact with the small dot.

Healthy individuals master this task in just a few sessions and when we plot the measurements of the performances across those sessions, we realize that there is a learning curve. The next session always has fewer errors than the session before, and the time needed to complete the task gets shorter. Normal subjects are thus learning a number of things concurrently. They are learning about the place

and the people who are administering the experiment; they are learning about the apparatus for the experiment; they are learning the instructions for the task; and they are learning to perform the task better and better. Practice does, indeed, make perfect, as mother always said, and eventually one cannot get any better: practice can get you to Carnegie Hall.

Now, let us repeat the experiment but change the participants, specifically patients with severe amnesia, such as David, who cannot learn any new face, or place, or word, or situation. You might expect that those patients would be unable to learn the task, but that is not so. They learn it perfectly and their actual performance is in no way distinguishable from the performance of the normal subjects. There is, however, a major difference between David, on the one hand, and the normal subjects: it pertains to what surrounds the performance rather than to the performance itself. The amnesic patients do not learn anything whatsoever about the place, the people, the apparatus, and the instructions for the experiment. All that they learn is to perform the task, and they need to be told, ever so gently, every time they confront the apparatus, what the task is all about. That they do it, and do it better and better each time, with fewer errors and at faster speed, is a clear indication that the deployment of the skill does not depend on the conscious survey of the facts describing the task. David does not remember what he thought about the difficulties he encountered in the first sessions, nor does he remember what he thought about how to correct the performance and hone the skill. He simply performs in a skilled manner. For him, as a conscious person, it is as if the situation is being encountered for the first time. And yet, outside of conscious survey of both instructions and skill knowledge, his brain is ready to deploy that skill.

No less remarkable is a fact that we were also able to demonstrate in these patients: knowledge of the skill remains available long after it was acquired. For instance, David could still perform as well as normal controls two years after skill acquisition. This indicates that knowledge had been consolidated.

You might say that while nonconscious skill execution such as this is interesting, it is of no worth to the patients and irrelevant to normal individuals. After all, we usually know the circumstances in which we learn a skill and the events connected with the learning. But the fact that sensorimotor skills can be deployed with little or no conscious survey is of great advantage in the performance of numerous tasks, minor and not so minor, in our daily lives. The lack of dependence on conscious survey automates a substantial part of our behavior and frees us in terms of attention and time—two scarce commodities in our lives—to plan and execute other tasks and create solutions for new problems.

Automation is also of great value in expert motor performances. Part of the technique of a fine musician or athlete can remain underneath consciousness, allowing the performer to concentrate on the higher-level guidance and control of the technique so as to perform according to the particular intention formulated for a certain piece.

WHEN A FACE-AGNOSIC patient (such as Emily, the patient I discussed in chapter 5) is shown, in random presentation, faces of people whom she has never met as well as faces of close relatives and friends, and when we simultaneously record her skin conductance with a polygraph, a dramatic dissociation takes place. To her conscious mind, the faces are all equally unrecognizable. Friends, relatives, and the truly unfamiliar generate the same void, and nothing comes to mind to permit the discovery of their identity. And yet, the presentation of virtually every face of a friend or relative generates a distinct skin-conductance response, while unknown faces do not. None of these responses is noticed by the patient. Moreover, the magnitude of the skin-conductance response is higher for the closest of relatives.

The interpretation is unequivocal. In spite of being unable to conjure up knowledge in image form, such that conscious survey would permit recognition, the patient's brain can still produce a specific response that occurs outside of conscious survey and betrays past knowledge of that particular stimulus. The finding illustrates the power of nonconscious processing, the fact that there can be specificity underneath consciousness.

PERHAPS THE MOST decisive example of high-level nonconscious processing comes from work performed in my laboratory in collaboration with Antoine Bechara and Hanna Damasio. The work requires a decision-making task and reveals that a number of decisions that can eventually be reached by using relevant knowledge and logic are facilitated by a nonconscious influence prior to knowledge and logic playing their full roles. It also reveals that emotions play an important role in driving the nonconscious signals. The task involves a game of cards, in which, unbeknownst to the player, some decks are good and some decks are bad. The knowledge as to which decks are good and which are bad is acquired gradually, as the player removes card after card from varied decks. The source of the knowledge is the fact that the picking of certain cards from certain decks leads to financial rewards or penalties. We began using this task to investigate decision making in patients with frontal lobe damage and recently we have used it to investigate emotion and consciousness both in patients with brain damage and in healthy individuals without neurological disease.

By the time normal players begin choosing consistently the good decks and begin avoiding the bad decks, they have no conscious depiction of the situation they are facing and have not formulated a conscious strategy for how to deal with the situation. At that point, however, the brains of these players are already producing systematic skin-conductance responses, immediately prior to selecting a card from the bad decks. No such responses ever appear prior to selecting cards from the good decks. These responses are indicative of a nonconscious bias, obviously connected with the relative badness or goodness of the decks. How the brain "gets to know," without consciousness,

that some decks are good and some decks are bad is the critical question. In the narrow sense of knowing, the brain does know the following implied associations: things that are rewarding cause pleasant states; things that are punishing cause unpleasant states; thus a certain object that is a consistent source of punishment is to be avoided. In this arrangement, the facts of past experience do not need to be made conscious. They do need to be connected by appropriate neural patterns with the current situation so that their preset influence can be exerted as a covert bias.[5] Yet, conscious humans can go beyond the state of processing described above. Not only can humans become conscious of the biases, i.e., know, in the broad sense, they can also reach appropriate conclusions through conscious reasoning and use those conclusions to avoid unpleasant decisions.

We know from the situation of patients who lose the covert biasing system—patients with damage to the ventromedial prefrontal cortex or to the amygdala—that the decision apparatus is impoverished to a dramatic degree. This indicates that the nonconscious system is deeply interwoven with the conscious reasoning system such that the disruption of the former leads to an impairment of the latter. But in the situation of a person without neurological disease, in which both the nonconscious and conscious systems are present and normal, it is apparent that the conscious component extends the reach and efficacy of the nonconscious system. Consciousness allows the player to discover if the strategy is correct and, in case it is not, to correct the strategy. Moreover, consciousness allows the player to represent the context of the game and decide if he or she should stop playing it or wonder about the possible value of the situation for the player or for the examiner.

The Merits of Consciousness

What is consciousness really good for, considering that so much adequate regulation of life can be achieved without conscious processing, that skills can be automated and preferences enacted without the influence of a knowing self? The simplest answer: consciousness is good for extending the mind's reach and, in so doing, improving the life of the organism whose mind has that higher reach.

Consciousness is valuable because it introduces a new means of achieving homeostasis. I am not referring to a more efficient means of balancing the internal milieu than the entirely nonconscious machinery we have long had in place in the brain stem and hypothalamus. Rather, I am referring to a new means of solving different kinds of problems that are connected, nonetheless, to the problems solved by previously existing means of homeostatic regulation. In other words, devices in the brain stem and hypothalamus can coordinate, nonconsciously and with great efficiency, the jobs of the heart, lungs, kidneys, endocrine system, and immunological system such that the parameters that permit life are maintained within the adequate range, while the devices of consciousness handle the problem of how an individual organism may cope with environmental challenges not predicted in its basic design such that the conditions fundamental for survival can still be met.

A fact compatible with this conclusion is the mismatch between the demands of the environment and the degree to which organisms can cope with these demands by means of automated and stereotyped devices. Nonconscious creatures are capable of regulating homeostasis internally and equally capable of breathing the air and finding the water and transforming the energy required for survival within the sort of environment to which they are suitably matched by evolution. Creatures with consciousness have some advantages over those that do not have consciousness. They can establish a link between the world of automatic regulation (the world of basic homeostasis that is interwoven with the proto-self) and the world of imagination (the world in which images of different modalities can be combined to produce novel images of situations that have not yet happened). The world of imaginary creations—the world of planning, the world of formulation of scenarios and prediction of outcomes—is linked to the world of the proto-self. The sense of self

links forethought, on the one hand, to preexisting automation, on the other.

Consciousness is not the sole means of generating adequate responses to an environment and thus achieving homeostasis. Consciousness is just the latest and most sophisticated means of doing so, and it performs its function by making way for the creation of novel responses in the sort of environment which an organism has not been designed to match, in terms of automated responses.

I would say that consciousness, as currently designed, constrains the world of imagination to be first and foremost about the individual, about an individual organism, about the self in the broad sense of the term. I would say that the effectiveness of consciousness comes from its unabashed connection to the nonconscious proto-self. This is the connection that guarantees that proper attention is paid to the matters of individual life by creating a *concern*. Perhaps the secret behind the efficacy of consciousness is selfness. In short, the power of consciousness comes from the effective connection it establishes between the biological machinery of individual life regulation and the biological machinery of thought. That connection is the basis for the creation of an individual concern which permeates all aspects of thought processing, focuses all problem-solving activities, and inspires the ensuing solutions. Consciousness is valuable because it centers knowledge on the life of an individual organism.

Evidence for the value of consciousness comes from considering the results of even its mildest impairments. When the mental aspect of self is suspended, the advantages of consciousness soon disappear. Individual life regulation is no longer possible in a complex environment. In the full personal and social sense, individuals remain capable of basic and immediate bodily maintenance. But their connection to the environment on which they depend is broken down, and, because of the breakdown, they cannot sustain such bodily maintenance. In fact, left to their own devices, death would ensue in a matter of hours because bodily maintenance would collapse. This, and comparable examples,

suggest that a state of consciousness which encompasses a sense of self as conceptualized in this book is indispensable for survival.

The imagetic level of "self in the act of knowing" is advantageous for the organism because it orients the entire apparatus of behavior and cognition toward self-preservation, as Spinoza would have wished, and eventually toward cooperation with the other, as we must wish.

Will We Ever Experience the Consciousness of Another?

I am often asked if, as a consequence of our greater understanding of consciousness, we will eventually be able to gain access to each other's mental experiences. My answer to the question has long been no, and my opinion has not changed. This may sound surprising at first glance, given that we are gathering so many new facts about neurobiology. However, as I see it, no amount of knowledge about the biology behind mental images is likely to produce, in the mind of the possessor of the knowledge, the equivalent of the experience of any mental image in the mind of the organism that creates it.

Imagine that, in a future that may not be too distant, an amazing new scanner allows you to scan my brain in unprecedented depth as I look, say, at San Francisco Bay. There we are, you, me, the amazing scanner, and San Francisco Bay. The scanner will focus not just on the level that is currently available, that of the so-called large-scale systems, but at a far deeper level. Imagine, for instance, that you can scan my retinas, my lateral geniculate nuclei, and all of the early visual cortical regions, separately and at different times, during the buildup of the visual image I am now forming of the sight before me. Furthermore, imagine that the scanning can take you to different cell layers of the varied cerebral cortices and subcortical nuclei, and that the spatial resolution is so good that you can see with clarity the patterns of neuron firings that correspond to the things both you and I

can look at outside our organisms. Imagine, finally, to push this science-fiction scenario beyond the current envelope but by no means beyond the plausible envelope, that your amazing scanner also provides you with a description of the physics and chemistry of the neural-activation patterns that you detect in my varied neuron ensembles.

Armed with the data from all of these high-powered scans and assuming that you have the equally high-powered computers to analyze the wealth of data in some meaningful way, you may well obtain a remarkable set of *correlates* of the contents of the image in mind. I am submitting to you, however, that by no means will you have obtained my *experience* of that image. This is a key issue to clarify in any discussion of the neurobiology of consciousness and mind. You and I can have an experience of the same landscape, but each of us will generate that experience according to our own individual perspective. Each of us will have a separate sense of individual ownership and individual agency. As you look at the patterns of activity in my brain which underlie my experience of San Francisco Bay, you are having your own personal experience of all those neural data but not my experience of San Francisco Bay. You have an experience of something that is highly correlated with my experience, but it is an experience of something different. You do *not* see what I see when you look at *my* brain activity. *You see a part of the activity of my brain as I see what I see.*

My own experience of the landscape comes easily, cheaply, and directly, with no need of intervening technology. I do not need to know a thing about the particular behavior of neurons and molecules in different areas of my brain in order to have the experience of San Francisco Bay. In fact, even when I recall in my mind all the knowledge of neurophysiology that I have pertinent to forming mental visual images of landscapes, it does not make one bit of difference to the forming of these current images or to my experience of them. It is nice to know a little bit about how the brain does its job, but it is not necessary at all to experience anything. It will be even nicer to know more about the brain but not because that will be helpful at all to experience the world.

The point should be clear then: We will know more and more about the physiology of mental image processing and that will give us a better and better understanding of the mechanisms behind mind and consciousness. That is perfectly compatible with the fact that such knowledge is not necessary for the experience of any images.

Now comes another problem. The fact that knowledge of the biology of image processing is irrelevant for the experience of those images is often taken to mean that it is simply not possible to discover the biology behind those images. Of course, the former claim has nothing to do with the latter. We have seen that our knowledge of the biological mechanisms behind the formation of images and their experience is one thing and our experience of those images is another. As far as we can fathom, no amount of knowledge about the neurophysiology of the formation and experience of mental images will ever produce the experience of those mental images in those who possess that knowledge, although greater knowledge will give us a more satisfactory explanation of how we come to have such experiences of images.

The philosopher Frank Jackson introduced a story about this problem that has become quite well known in philosophical circles and is often cited in discussions on this issue.[6] The story tells of Mary, a card-carrying neuroscientist, who has grown up in an enclosed black-and-white environment without ever experiencing colors, although she happens to know every available fact about the neurophysiology of color vision. One day Mary leaves her colorless cocoon, comes out into the real world, and experiences color for the first time, an entirely new and surprising thing for her. The first traditional point of this story is that Mary's superior knowledge of the neurophysiology of color had never given her the experience of color. So far so good. Unsurprisingly, I agree that such should be the case, according to what I explained above. Now, for the second and main point of the story, the one with which I cannot agree: the fact that Mary had never experienced color in spite of all her abundant knowledge of its biological underpinnings is taken as meaning that neurophysiological knowledge cannot be used to explain mental experience, that there is

an abyss between knowledge and experience that cannot be bridged scientifically.

I disagree with these conclusions on several counts. The first and most important is that explaining the mechanisms behind an experience and having the experience are entirely different matters as the little fiction with which I began this section illustrates. We should not conclude that neurophysiological knowledge is inadequate to explain the phenomenon just because having that neurophysiological knowledge is not equal to the experience of the phenomenon we are trying to explain. It should not be and could not be. The second reason for disagreement follows from the arguments presented earlier. The experience of a particular stimulus, including color, depends not just on the formation of an image but also on the sense of self in the act of knowing. Mary's fable is inadequate for the purpose it is used because it never deals neurophysiologically with the matter of her experience of color but simply with her formation of an image of color.[7]

Now, Mary could, of course, become knowledgeable about the neural underpinnings of consciousness. She might read this book. At that point, she would know something about how to explain general mechanisms of the mental experience of color, but that would still not allow her to have an experience of color. *Explaining* how to make something mental or something ours in scientific terms is an entirely different matter from *making* that something mental and ours *directly*.

THE RESISTANCE FOUND in some scientific quarters to the use of subjective observations is a revisitation of an old argument between behaviorists, who believed that only behaviors, not mental experiences, could be studied objectively, and cognitivists, who believed that studying only behavior did not do justice to human complexity. The mind and its consciousness are first and foremost private phenomena, much as they offer many public signs of their existence to the interested observer. The conscious mind and its constituent properties are real entities, not illusions, and they must be investigated as the personal, private, subjective experiences that they are.

The idea that subjective experiences are not scientifically accessible is nonsense. Subjective entities require, as do objective ones, that enough observers undertake rigorous observations according to the same experimental design; and they require that those observations be checked for consistency across observers and that they yield some form of measurement. Moreover, knowledge gathered from subjective observations, e.g., introspective insights, can inspire objective experiments, and, no less importantly, subjective experiences can be explained in terms of the available scientific knowledge. The idea that the nature of subjective experiences can be grasped effectively by the study of their behavioral correlates is wrong. Although both mind and behavior are biological phenomena, mind is mind and behavior is behavior. Mind and behavior can be correlated, and the correlation will become closer as science progresses, but in their respective specifications, mind and behavior are different. This is why, in all likelihood, I will never know your thoughts unless you tell me, and you will never know mine until I tell you.

Where Does Consciousness Rank in the Grand Scheme?

The conflation of so many meanings around the word *consciousness* renders it almost unusable without qualification, and this conflation is probably responsible for the supreme status to which consciousness has been elevated. The conflation has led to the unrestrained attribution to consciousness of properties of the human mind that we consider extremely refined and uniquely human, such as our ability to distinguish good from evil, our knowledge of the needs and wants of fellow humans, our sense of the place we occupy in the universe. The attribution has rendered consciousness untouchable. I see consciousness, instead, as allowing the mind to develop the properties we so admire but not as the substance of those properties. Consciousness is *not* conscience. It is *not* the same as love and honor and mercy; generosity and altruism; poetry and science; mathematical and technical

invention. Nor, for that matter, are moral turpitude, existential angst, or lack of creativity examples of bad states of consciousness. The consciousness of most criminals is not impaired. Their conscience may be.

The marvelous achievements that come from the human mind require consciousness in the same fundamental way that they require life, and that life requires digestion and a balanced internal chemical milieu. But none of those marvelous achievements is directly caused by consciousness. They are, instead, a direct consequence of a nervous system which, being capable of consciousness, is also equipped with a vast memory, with the powerful ability to categorize items in memory, with the novel ability to code the entire spectrum of knowledge

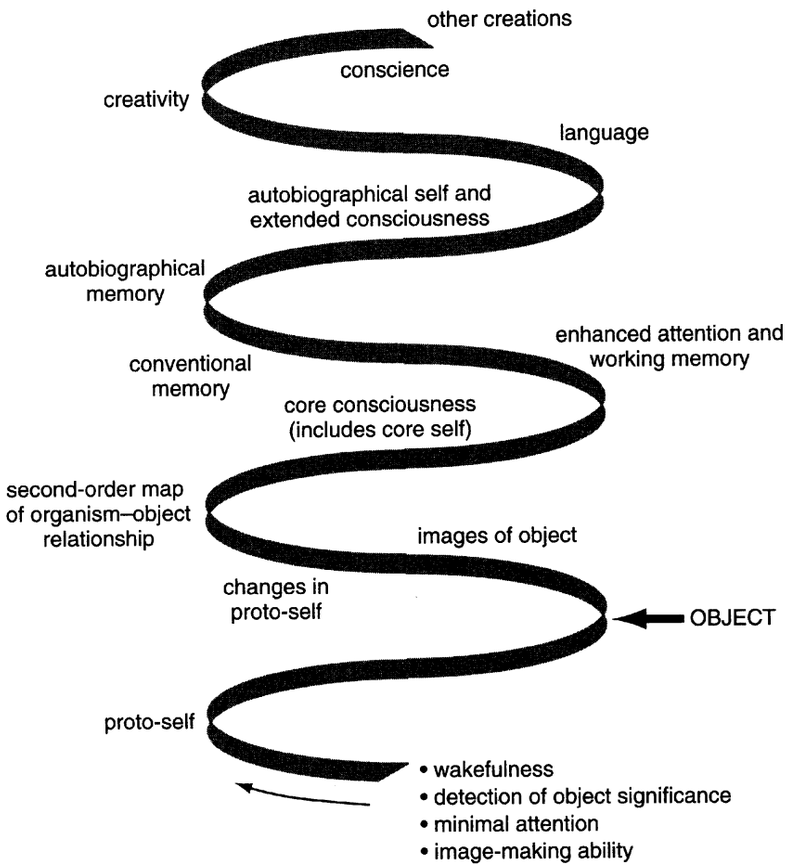

Figure 10.1. From wakefulness to conscience

in language form, and with an enhanced ability to hold knowledge in mental display and manipulate it intelligently. Each of these abilities, in turn, can be traced to myriad mental and neural components.

Core consciousness does not rank especially high in the order of operations which permit human beings to be what they are. It is part of the foundation of a complicated edifice, not one of the dreamy spires at its top. In rank order, core consciousness sits above, but not far from, other foundational capacities, such as action, emotion, and sensory representation, which we share with several nonhuman species.

The essence of those foundational capacities has probably changed little when we compare the human version to the nonhuman. For example, I see no evidence that emotion has become "better" in humans. What has become different is our sense of the role emotions play in our lives, and that difference is a consequence of the greater knowledge we have of the substance of our lives. Memory, language, and intelligence make the difference, not emotion. The same probably applies to consciousness. Extended consciousness occurs in minds endowed with core consciousness, but only when those minds can rely on superior memory, language, and intelligence, and when the organisms which construct those minds interact with suitable social environments. In short, consciousness is a grand permit into civilization but not civilization itself.

When I bring consciousness down from its current pedestal, I am not bringing the human mind down from its pedestal. It is just that what put the human mind on its pedestal and should keep it there are not only the biological phenomena subsumed by the term consciousness, but also many other phenomena which we need to describe, name, and attempt to understand scientifically. Nonetheless, I am ready to admit that we probably were banished from Eden because of consciousness. Consciousness is not the full taste of the fruit of knowledge, but innocent consciousness did start things along the way, many species ago and many millions of years before humans began to construct conceptions of their own nature.