CHAPTER ONE

Consciousness: Philosophical Paradox or Scientific Object?

The subject of consciousness has not lacked for human attention. In the past, it was the exclusive domain of philosophers, but recently both psychologists and neuroscientists have begun to attack the so-called mind-body problem or, in Schopenhauer's suggestive phrase, "the world knot." In this chapter we briefly review classical and modern approaches to consciousness. We point out various positions taken by philosophers, psychologists, and neuroscientists, rejecting some of the more flagrant ones, such as dualism or extreme reductionism. We suggest that consciousness can be considered a scientific subject and that it is not the sole province of philosophers.

Everyone knows what consciousness is: It is what abandons you every evening when you fall asleep and reappears the next morning when you wake up. This deceptive simplicity reminds us of what William James said of attention at the turn of the century: "Everyone knows what attention is. It is the taking possession by the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought."[1] More than one hundred years later, many think that neither attention nor consciousness is understood in any fundamental sense.

This lack of understanding is certainly not because of lack of attention in philosophical or scientific circles. Ever since René Descartes, few subjects

have preoccupied philosophers so consistently as the riddle of consciousness. For Descartes, as for James more than two centuries later, to be conscious was synonymous with "to think": James's stream of thought, for example, was nothing but the stream of consciousness. The *cogito ergo sum*, "I think therefore I am," which Descartes posed as the foundation of his philosophy in his *Meditationes de Prima Philosophia*,[2] was a direct recognition of the centrality of consciousness with respect to both ontology (what is) and epistemology (what and how we know).

If taken too seriously, "I am conscious, therefore I exist" can lead to solipsism, the view that nothing exists but one's individual consciousness, evidently not a view that can appeal to two authors who are sharing the writing of a book. More realistically (pun intended), that starting point leads to idealistic positions that emphasize mind over matter—ideas; perception; thought; or, in one word, consciousness. By taking mind as a starting point, however, idealistic philosophies must take pains to explain matter—which is not necessarily a better predicament than starting from mere matter to derive mind.

Descartes argued that there is an absolute distinction between mental and material substance. The defining characteristic of matter, he thought, is to be extended, to occupy space, and thus be susceptible to physical explanation, whereas the defining characteristic of mind is to be conscious or, in a broad sense of the term, to think. In this view, mental substance exists in the form of individual minds. In this way, Descartes inaugurated dualism, a position that is unsatisfactory scientifically but appears intuitively simple and appealing until one attempts to explain the connection between the mind and the body (see figure 1.1). Since the days of Descartes, philosophers have suggested versions of dualism or related alternatives. For example, a related theory is epiphenomenalism, which agrees with other theories in holding that mental events and physical events are different but maintains that the only true causes of mental experiences are physical events, with mind as a causally inefficacious by-product. In the words of Thomas Huxley, "consciousness would appear to be related to the mechanism of [the] body simply as a collateral product of its working, and to be as completely without any power of modifying that working as the steam whistle that accompanies the working of a locomotive engine is without influence upon its machinery."[3]

In more recent times, philosophers have taken a materialistic stance, holding that the mind and consciousness are identical to the operations of the brain or, at least, to certain of these operations. Some materialistic positions go so far as to deny any ontological or epistemic validity to conscious-

ness; they insist that there is literally nothing else beyond the functioning of brain circuits or, at least, that there is nothing else that needs to be explained. Several philosophers have suggested that once we understand the workings of the brain sufficiently well, the concept of consciousness will evaporate just as the concept of phlogiston (a hypothetical volatile constituent of all combustible substances that was thought to be released as a flame in combustion) evaporated when oxidation was understood. The mind-body problem is thus made to disappear by denying or explaining away the consciousness side of it. Other materialistic positions insist that although consciousness is generated by physical events in the brain, it is not reduced to them but, rather, emerges from them, just as the properties of water emerge from the chemical combination of two hydrogens and one oxygen but are not directly reducible to the properties of hydrogen or oxygen alone. Such positions come in various flavors, but, in general, they grant consciousness some residual status, at least from the point of view of explanation. Nevertheless, they insist that there is no "consciousness" substance separate from a "brain" substance.

The philosophical debate on the mind-body problem is by now extremely sophisticated and, in their variety, some current disputes rival those that flourished among post-Cartesian philosophers. As we had

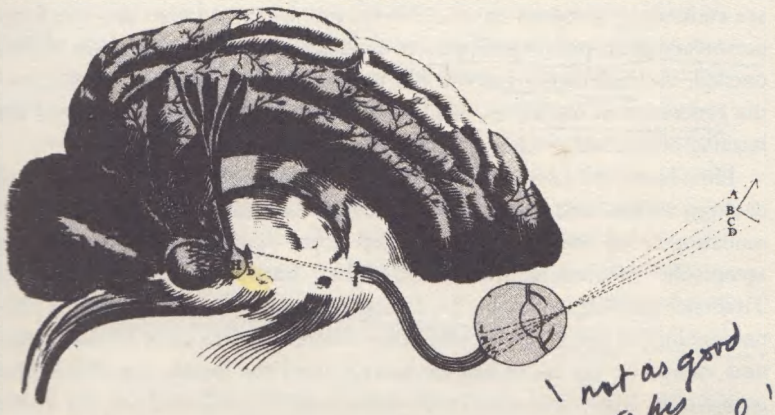

FIGURE 1.1 A diagram by Descartes illustrating his ideas about how the brain forms mental images of an object. The transaction between mental substance and physical substance was supposed to take place in the pineal gland (H).

Spinoza's dual-aspect theory, Malebranche's occasionalism, Leibniz's parallelism and his doctrine of preestablished harmony, we now have the identity theory, the central state theory, neutral monism, logical behaviorism, token physicalism and type physicalism, token epiphenomenalism and type epiphenomenalism, anomalous monism, emergent materialism, eliminative materialism, various brands of functionalism, and many others.[4]

Despite the profusion of philosophical positions, it appears unlikely that philosophical arguments alone will lead to a satisfactory solution to the mind-body problem. In the words of Colin McGinn,[5] a philosopher who takes an extreme position: "We have been trying for a long time to solve the mind-body problem. It has stubbornly resisted our best efforts. The mystery persists. I think the time has come to admit candidly that we cannot solve the mystery. [We still have no idea of how] the water of the physical brain is turned into the wine of consciousness."

There is indeed a fundamental limitation on philosophical efforts to discern the origins of consciousness that arises, in part, from the presumption that the sources of conscious thought can be revealed by thinking alone. This presumption is as patently inadequate as efforts in previous times to understand cosmogony, the basis of life, and the fine structure of matter in the absence of scientific observations and experiments. In fact, philosophers have excelled not so much in proposing solutions to the problem but in pointing out just how intractable the problem is. What many philosophers are reiterating amounts to this: No matter what scientists do, the first-person and third-person perspectives of conscious individuals will not be reconciled, the explanatory gap will not be bridged, and the "hard" problem—the generation of sensations, of phenomenal or experiential states out of the buzzing of neurons—will not be solved.[6]

How have scientists fared in explaining the mystery? If we look at psychology, we find that the "science of the mind" always had trouble in accommodating what should be its central topic—consciousness—within an acceptable theoretical framework. The introspectionist tradition of Titchener and Külpe[7] was the psychological counterpart of idealistic or phenomenological positions in philosophy; it attempted to describe consciousness viewed by the individual exclusively from the inside, hence the term *introspection*. Many introspectionists were psychological atomists; not unlike some present-day neurophysiologists, they postulated that consciousness was made up of elementary parts that could be catalogued (never mind that the American school came up with more than 40,000 sensations and the German school with just 12,000). By contrast, behaviorists notoriously

attempted to eliminate consciousness completely from scientific discourse, a position not unlike that of some contemporary philosophers.

Present-day cognitive psychologists have reintroduced consciousness and mind as legitimate concepts. They conceive of consciousness as either a special module or a stage in the flowchart delineating an information-processing hierarchy. In fact, cognitive psychologists often consider consciousness in terms of a limited-capacity bottleneck in our mental functioning, possibly due to an unspecified limitation of our brains. Several such models of the functions associated with consciousness have been formulated, drawing their inspiration from cognitive psychology or artificial intelligence or using metaphors borrowed from computer science, such as that of a central executive system or an operating system. Psychologists have also used the metaphor of consciousness as a unified stage, scene, or theater in which information from multiple sources is integrated for the control of behavior.[8] Some of these intuitions may point in the right direction, while others may be as misleading as they are potentially appealing.

What is certain, however, is that such metaphors cannot substitute for a genuine scientific understanding of consciousness. Cognitive models usually have little to offer vis-à-vis the experiential, phenomenal side of conscious experience. Looked at from the perspective of these models, consciousness as a phenomenal experience (and often an emotional one) may as well not exist, as long as some of its presumed functions, such as control, coordination, and planning, can be carried out. Standard cognitive accounts offer no convincing explanation of why multiplication performed by a human is a slow and hesitant conscious process while the same multiplication quickly carried out by a pocket calculator is presumably not conscious at all. Nor do they explain why the complicated processes needed to balance your weight when you walk or to articulate words when you speak should remain unconscious, while the simple application of pressure to your finger produces a conscious experience. Finally, as many critics have pointed out, any information-processing, strictly functionalistic approach to consciousness has little to say about the fact that consciousness requires the activity of specific neural substrates. These substrates are actually the central concern of neuroscientists.

Except for fundamental observations about coma, anesthesia, and the like, neuroscientists used to be exceedingly careful in their approaches to consciousness. Most profess a convenient agnosticism about the subject and justify their caution by our present ignorance. Although many of them would probably subscribe to some kind of system-level explanation—if only

they knew which one—for the present, they deem it more fruitful painstakingly to collect new facts and observations and to leave theorizing to the future. Over the past decade or so, however, something has definitely changed in the relationship between studies of consciousness and the neurosciences. Scientists seem less afraid of addressing the subject unabashedly, several books by neuroscientists have appeared, new journals have been launched, and studies have been conducted in which consciousness was actually treated as an experimental parameter.[9]

Although certain recent "scientific" hypotheses do not cover as wide a spectrum as that offered by philosophers, they are in some ways even more exotic or extreme. For example, some neuroscientists have embraced dualistic positions according to which the conscious mind interfaces with the brain by virtue of "psychons" communicating with "dendrons" in certain areas of the left brain (Descartes suggested that the pineal gland was the site of the interaction because it is situated in the middle of the head).[10] Some scientists (who may or may not qualify as neuroscientists) have concluded that conventional physics is not enough of a basis for theorizing about consciousness—one has to invoke esoteric physical concepts, such as quantum gravity, to explain consciousness.[11]

Others have pursued what appears to be a more profitable strategy—focusing on the search for specific neural correlates of consciousness. Indeed, in this area definite progress has been made. For example, given the limited neurological knowledge of his times, James had to conclude that the neural basis for consciousness was nothing less than the whole brain.[12] Today, scientists are able to be more sophisticated and specific. Different authors believe that different brain structures support consciousness, structures with forbidding names, such as the intralaminar thalamic nuclei, reticular nucleus, mesencephalic reticular formation, tangential intracortical network of layers I-II, and thalamocortical loops. Controversies rage over issues that were unthinkable at the time of James's writing: Does the primary visual cortex contribute to conscious experience or not? Are areas of the brain that project directly to the prefrontal cortex more relevant than those that do not? Does only a particular subset of cortical neurons play a role? If so, are these neurons characterized by a special property or location? Do cortical neurons need to oscillate at 40 Hz or fire in bursts to contribute to conscious experience? Do different areas of the brain or groups of neurons generate different conscious fragments—a kind of microconsciousness?[13]

These questions are being debated more and more frequently, and new experimental data are fueling the debate. Yet, as this profusion of various

questions and hypotheses indicates, something is definitely missing in attempts to identify the neural basis of consciousness with this or that set of neurons. Again, we confront the world knot. By what mysterious transformation would the firing of neurons located in a particular place in the brain or endowed with a particular biochemical property become subjective experience, while the firing of other neurons would not? It is not surprising that some philosophers view such attempts as prime examples of a category error—the error of ascribing to things properties that they cannot have.[14]

It is also not surprising that such errors are made, given how special consciousness is as a scientific object. In the next chapter we consider how the fundamental problem posed by this specialness may be confronted. We take the position that consciousness is not an object but a process and that, looked at from this point of view, it is indeed a fitting scientific subject.