The Mind-Body Problem

Neurophilosophy. Toward a Unified Science of the Mind-Brain. PATRICIA SMITH CHURCHLAND. MIT Press, Cambridge, MA, 1986. xiv, 546 pp., illus. $27.50. Computational Models of Cognition and Perception. A Bradford Book.

Ever since Plato declared mind and body to be fundamentally different, philosophers have argued about whether they are. No doubt the (physicalist) statements we make about people's bodies are different in kind from the (mentalist) statements we make about their thoughts and feelings. But that difference does not necessarily imply that mentalist statements do not refer to some special kind of bodily function, especially since, as Galen had shown by the second century A.D., a bodily organ, the brain, is the seat of consciousness and sensation. Mental phenomena might be nothing but products of the brain (monism); they might also be more than, or fundamentally different from, brain products (dualism). Philosophers have produced a variety of monist and dualist solutions of the mind-body problem, depending on their general metaphysical outlooks, idealist or materialist, rationalist or empiricist.

To join this ancient debate, Patricia Smith Churchland, a hard-core monist-materialist who believes that "the mind is the brain," has produced a book whose "guiding aim . . . is to paint in broad strokes the outlines of a very general framework suited to the development of a unified theory of the mind-brain." She thinks this is a project whose time has come.

For one thing, neuroscience has progressed to the point where we can begin to theorize productively about basic principles of whole brain function and hence to address the questions concerning how the brain represents, learns, and produces behavior. Second, many philosophers have moved away from the view that philosophy is an a priori discipline in which philosophers can discover the a priori principles that neuroscientific theories had better honor on peril of being found wrong.

"Neurophilosophy" is the name of the new discipline that is to be guided by Churchland's unified theory of the mind-brain.

Part 1 of Churchland's book surveys contemporary knowledge of cellular neurophysiology, neuroanatomy, and brain function. Most of this material is unnecessary for the understanding of the philosophical and system-analytical discussions in parts 2 and 3. Of Churchland's potential neurophilosophical recruits, neuroscientists are familiar with the material, whereas philosophers, whom she hopes she will help "to approach [neuroscientific] text books and review papers without being intimidated," would do better to read one of the several introductory texts that evidently informed Churchland herself. In part 1 many technical terms appear without definition, or long before they are defined (for example, "growth cones," "macropotentials," "Bayesian probability"), many illustrations are inadequately explained in the figure captions, and many sentences are cast in a mixture of purple prose (results are "wrenching," neurons are "bedizened," Descartes's "ruminations" have an "echo") and slang ("corker," "critter," "sloshing around"). Above all, Churchland's studies of the literature of neuroscience did not provide her with a journeyperson's competence in the subject she surveys. This is especially true for the ionic basis of electrophysiological activity, about which she makes many incorrect statements, such as that K^+ ions are in higher intracellular concentration than Na^+ or Ca^{2+} ions because the cell membrane is much more permeable to the former than to the latter, or that the refractory period following each action potential arises because "Na^+ has to be pumped out."

Not until the last chapter of part 1 does Churchland present material that is more or less relevant to her subsequent discussions of the mind-body problem. It pertains to the lateralization, or preferential location in the right or left hemisphere of the human brain, of such cognitive functions as speech and the recognition of familiar faces. The observations of Roger Sperry and his co-workers on split-brain subjects are of special interest here, since they raise the possibility that we have two minds rather than one. Churchland calls attention to the ambiguities inherent in these studies and to the difficulties in making valid interpretations of neuropsychological findings, where "between the farm-gate and the shop window, as it were, a lot of messiness endemic to the actual research is cured out." So how does this messiness square with our now being able to begin to theorize productively about how the brain gives rise to mental functions? All Churchland can offer is the hope that though "none of the experimental procedures is perfect or free of flaws . . . data from distinct experimental procedures will slowly converge upon a common hypothesis."

Part 2 opens with a historical sketch of philosophical contributions to the mind-body problem: the development of dualism from the idealist Plato to the rationalist Descartes, the rise of empiricism at the turn of the 18th century, the philosophical contributions of Kant at the end of the 18th century, which opened the way to resolving the conflict between empiricism and rationalism, and the latter-day radical criticism, from Duhem through Quine to Feyerabend, of the claims on behalf of empirical science as a source of objective knowledge. According to these recent critics, the theoretical inferences drawn from empirical findings are not, and cannot be, independent of the personal beliefs and social context of the observer. Inspired by this radical criticism Churchland declares that those philosophers who persist in arguing that the mind is *not* the brain do so because they are unfortunately steeped in the traditions of folk myths. They cannot imagine that mental states *are* brain states, just as the detractors of Galileo found it "outrageous and inconceivable" that the Earth is one planet among others moving about the Sun. How then did Churchland manage to reach her Galilean insight that the mind is the brain? Thanks to her "cardinal hunch . . . that to discover our nature we must see ourselves as organisms in Nature, to be understood by scientific methods and means."

In the remainder of part 2 Churchland argues that mental states are reducible to brain states. She has observed that "many philosophers and cognitive scientists, most of the artificial intelligentsia, not a few neuroscientists and biologists, and theologians generally, reject the possibility [of such a reduction] as unlikely—and not merely unlikely, but as flatly preposterous." Indeed, as she notes, reductionism "has come in some quarters to be used as a general term of insult and abuse." So she shows by means of examples drawn from physics, chemistry, and genetics that the reductionist approach to science is not only respectable but the basis of its greatest triumphs. A successful reduction has occurred when a scientific theory, T_R, about one set of phenomena, P_R, has been explained (or even eliminated) by another theory, T_B, about another set of phenomena, P_B. Thus reduction leads to a desirable explanatory unification of science, as well as to an ontological simplification of reality, in that phenomena P_R and P_B, previously thought to be of different kinds, are now recognized as being of the same kind. Churchland points out that reduction is not always a straightforward process, because it often happens that the original version of theory T_R has to be amended before it can be reduced by theory T_B, in other words that reduction can correct theoretical error.

One special kind of theory that has been, or ought to be, eliminated by successful

reduction is given the epithet "folk" by Churchland, such as "folk physics," "folk thermodynamics," "folk chemistry," and "folk meteorology." So when she relegates to the realm of "folk psychology" those mental states whose reduction is rejected as "flatly preposterous" by the antireductionist crowd, it is easy to sense, in the parlance of folk meteorology, which way the wind is blowing.

Churchland identifies beliefs and desires as two "crucial and indispensable" mental states of folk psychology, which "we all standardly use in explaining and predicting human behavior." She dismisses the antireductionists' arguments that they are not explainable in terms of brain states as irrelevant to the mind-body problem: The concepts of folk psychological theory—not only beliefs and desires but also awareness and consciousness—cannot be reduced by neuroscientific theory because they are "fuzzy," mere "cracker-barrel" talk.

The alleged fundamental irrelevance of their arguments notwithstanding, Churchland presents a 32-page critical taxonomy of the diverse breeds of antireductionists. First, there are the "substance dualists," foremost among them Descartes, who deny that mental states are identical with brain states because they conceive of the mind as a nonphysical substance. I agree with Churchland that inasmuch as substance dualism is not theoretically connectible to contemporary scientific notions, it is not worth discussing, except in a historical context. Second, there are "property dualists," who admit that the mind has a physical basis in the brain but assert that mental states are "emergent" properties of, and hence not theoretically reducible to, brain states. After having effectively defended reductionism, Churchland now deflates equally effectively the much-vaunted central concept of antireductionism, namely "emergence." She shows that, except for "innocent" cases, where an emergent phenomenon is, by definition, a property of an ensemble that its elements are incapable of possessing (as the phenomenon of "shoe" emerges only upon some pieces of leather being sewed together), the general notion of emergence is of little explanatory value. To say that phenomenon P_R is an emergent property of phenomenon P_B is not an argument for, but merely a restatement of, the claim of the irreducibility of theory T_R by theory T_B.

Property dualists therefore need an independent argument for the alleged emergence-irreducibility of mental states. One such argument is that the introspective character of the perception of mental states renders them categorically different from, and hence refractory to, explanatory theories about extrospectively perceived brain states. Churchland shows, to my satisfaction at least, that this argument is as circular as the original emergence proposition that it is intended to support, since *au fond*, the proof of the categorical difference between introspectively and extrospectively perceived phenomena presupposes the alleged irreducibility of mental states to brain states.

Another argument advanced by property dualists on behalf of the emergent nature of mental states is that their semantic character renders them categorically different from, and hence irreducible to, brain states. This argument too is disposed of by Churchland, but not by simply relegating the philosophically troublesome semantic concepts of representation and intentionality to folk psychology. She takes them seriously and declares that although there remain puzzling problems regarding the semantic character of mental states, especially in the domain of language, representation and intentionality are to be thought of as functional properties of, or relations between, brain states. Although that view is also widely held by cognitive psychologists, she believes that many of them persist in claiming the irreducibility of psychological theories to, and hence their autonomy vis-à-vis, neurobiological theories. She presents a number of arguments advanced by psychologists and the "artificial intelligentsia" on behalf of these claims and refutes them all.

So, since there seem to be no a priori reasons for holding the project of reducing the theories of functional psychology to neuroscience to be impossible, how should we proceed with it? Churchland advocates a "coevolutionary development of psychological, behavioral, and neurobiological research," to which persons of good will are unlikely to object in principle. Unfortunately, she cannot sustain her claim that substantial progress has been achieved in this coevolutionary development, since the examples she cites, such as the successful clarification of the molecular basis of synaptic plasticity in snails and of some behavioral defects in flies, as well as the neuronal basis of imprinting and song-learning in birds, still seem far away from any neuroscientific account of representation and intentionality. Moreover, her examples of the diverse cognitive deficits of patients suffering from neurological disorders, which might offer evidence of progress of the coevolutionary development, were pre-deflated by her earlier critique of the inferences drawn from Sperry's very much better controlled observations on split-brain subjects. Having shown that there are no good reasons for claiming that theories about mental states are in principle irreducible to theories about brain states, she advances a counterclaim, equally devoid of good reasons and based mainly on hunches and dogmatic assertions, that such reduction is, in fact, possible, or even imminent, in view of recent advances in neuroscience. In her dismissal of folk psychology, she draws Whiggish (or, in the parlance of folk historians, Monday-morning-quarterback) parallels to superseded or abandoned scientific theories, such as Aristotelian physics, geocentric cosmology, phlogiston theory, or vitalism, but does not provide alternatives to such folk concepts as beliefs and desires that "we all standardly use."

In part 3, Churchland summarizes three recent neurobiological theories, of which she states that "regardless whether any [of them] has succeeded in making a Grand Theoretical Breakthrough, each illustrates some important aspect of the problem of theory in neuroscience." These theories are the "tensor network" theory of Andras Pellionisz and Rodolfo Llinás, intended to account for the governance of motor output by sensory input, the "connectionist" model, which views the brain as a flexible network carrying out computations by operations running in parallel, and the "searchlight" theory of attention first put forward in psychological terms by Anne Treisman to account for the "wholeness" of visual percepts and of which a neurological interpretation was later proposed by Francis Crick. In contrast to part 1, part 3 does contain some vanguard neuroscientific material of which accounts cannot be readily found in currently available introductory texts. But Churchland can use such material to support her utopian vision of the imminent elimination of cracker-barrel folk psychological concepts by neuroscientific theories only by invoking more hunches and handwaving about the evolutionary origins of the nervous system.

In two pages of "Closing remarks," after 480 pages of neurophilosophical exposition, Churchland finally touches on the metaphysical core question of the mind-body problem. That question, with which philosophers and theologians have struggled since the time of the Ancients, is: Is it possible to reconcile *any* scientific account of the mind-body relation—be it in the idiom of autonomous psychologism or in the idiom of reductive neurobiologism—with the deep-seated human view of what it actually means to be human?

Churchland takes no account, here or anywhere else in her long narrative, of the dualist position—from Plato, through St. Augustine and Descartes, to Kant—having had its spiritual roots in man's paradoxical view of himself as half-beast and half-divine. From Churchland's viewpoint, this traditional ontology, the Judeo-Christian version

of which is rendered in the Book of Genesis, belongs on the trash-heap of outdated folk theory. All the same, she concedes that there will be those who "may tend to see the revision of folk theory and the rise of neurobiological-psychological theory as the irreparable loss of our humanity." But not to worry, because

> it may be a loss, not of something necessary for our humanity, but of something . . . that, though second nature, blinkers our understanding and tethers our insight . . . . The loss, moreover, may include certain folk presumptions and myths, that, from the point of view of fairness and decency, we come to see as inhumane.

With the words "fairness," "decency," and "inhumane," Churchland makes her first and only reference to the ethical dimension of the mind-body problem, after having exclusively considered its scientific dimension. In her earlier discussion of Descartes's contributions she did not mention his motivation for holding the substance dualist view, namely the argument that the body, being a machine, could not be guided by moral principles; hence the mind, which obviously *is* guided by such principles, cannot be a physical part of the body-machine. More important, Churchland has provided an inadequate account of Kant's treatment of the mind-body problem, which is generally considered to have initiated the Copernican revolution in philosophy that Churchland thinks is about to be set off by neuroscientists. By pointing out that we live in two metaphysically distinct worlds, Kant had replaced Cartesian substance dualism with an "epistemic" dualism. One of these worlds is that constructed by the theoretical reason of science, whose natural objects (including the brain of *Homo sapiens*) are governed by laws of causal determination. The other world is that constructed by the practical reason of ethics, whose rational human subjects are governed by laws of freedom that individual free will imposes on each person's actions. Here practical reason justifies the concept of free will, not on the introspective basis, which, as Churchland justly points out, cannot claim evidential priority over all other empirical arguments advanced by theoretical reason, but as a logically necessary constituent of the intuitive theory of personhood that governs interpersonal human relations. As such, the practical concept of free will is not, in principle, subject to reduction by scientific theory, be it neurobiological or psychological.

Accordingly, from the perspective of epistemic dualism, the neurophilosophical brouhaha about the reducibility of psychology to neurobiology is, to use one of Churchland's phrases, "mere crinkum-crankum." It is, after all, immaterial for the resolution of the deep mind-body problem of praxis, posed by the paradoxical human condition of simultaneously facing the two incommensurate realities of science and of ethics, whether psychological theories are or are not reducible to neurobiological theories.

Neuroscientists and psychologists do not need much assistance from philosophers in their struggle with the mind-body problem, as it is posed within the context of theoretical reason. As Churchland herself points out, the controversy regarding neuroscientific reduction of psychological theories will be settled anyhow, in the wash of future experimental and theoretical developments. My own expectations are those of a member of the set styled "boggled skeptics" by Churchland. We boggled skeptics tend to view the human brain as belonging to a class of phenomena whose very complexity limits the extent to which theories designed to explain them can be successfully reduced by theories developed to explain less complex phenomena. As a neuroscientist, I believe that all mental phenomena are *in principle*, explainable by neurobiological theories, just as, as a physical chemist, I believe that all neurobiological theories are, *in principle*, explainable by physico-chemical theories. Moreover, I look forward to some progress still being made in the venerable enterprise of reductionist neuroscience. Yet, I doubt that a complete reduction is de facto possible. *My* cardinal hunch is that a significant residue of unreduced psychological, as well as neurobiological, theory will remain with us long into the future.

Where neuroscientists and psychologists do need philosophical help is in fathoming not the physical but the metaphysical infrastructure of folk presumptions and myths and the likely consequences for the human condition of their abandonment. Churchland is not one of the folks who can provide that help.

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A Connectionist View of Cognition

Parallel Distributed Processing. Explorations in the Microstructure of Cognition. DAVID E. RUMELHART, JAMES L. MCCLELLAND, and the PDP RESEARCH GROUP. MIT Press, Cambridge, MA, 1986. In two volumes. Vol. 1, Foundations. xx, 547 pp., illus. $27.50. Vol. 2, Psychological and Biological Models. xiv, 611 pp., illus. $27.50. Computational Models of Cognition and Perception. A Bradford Book.

Two types of devices are known that can support such functions as perception, memory, language, and problem solving. One is the modern digital computer, programmed to produce "artificial intelligence" (AI); the other is the human brain, which produces the natural variety. Given that the latter device seems more intimately connected to the human mind, it may seem surprising that the dominant metaphor for developing theories of mental processes has been based on the former. Modern cognitive psychology, which has come of age with the digital computer, has been more heavily influenced by computer science than by brain science. There are at least two reasons for this. First, we know vastly more about the functioning of computers than of brains. Second, the basic approach of cognitive psychology has been predicated on a philosophical position known as functionalism, which emphasizes that mental functions can be analyzed at an abstract level separate from their physical realization. Just as a computer program can be described without reference to the particular hardware on which it runs, a functional analysis of cognition need not directly refer to brain processes.

The avowed intent of the authors of *Parallel Distributed Processing* is "to replace the 'computer metaphor' as a model of mind with the 'brain metaphor' " (vol. 1, p. 75). The publication of this massive work is a landmark event in cognitive science for a mixture of scientific and sociological reasons. The principles of parallel distributed processing (PDP), a variety of "connectionism," challenge the functionalist attitudes of cognitive psychologists, offer a distinct alternative to conventional AI techniques, and suggest representations of linguistic knowledge very different from the rule systems typically used by linguists. The volumes appear against a backdrop of conferences, workshops, and seminars devoted to the PDP approach. Although connectionism in fact has a long heritage and current models have been actively developed over the past decade, the approach has recently acquired the vigor of a movement in the first bloom of youth. The movement has a proselytizing bent, and talk of a Kuhnian "paradigm shift" is in the air, accompanied by a spirited mix of hype and hope on the part of adherents and by expressions of skepticism from various critics. *Parallel Distributed Processing*