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THE MYSTERIES OF NATURE

HOW DEEPLY HIDDEN?

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The title for these remarks is drawn from Hume's observations about the man he called "the greatest and rarest genius that ever arose for the ornament and instruction of the species": Isaac Newton. In Hume's judgment, Newton's greatest achievement was that while he "seemed to draw the veil from some of the mysteries of nature, he shewed at the same time the imperfections of the mechanical philosophy; and thereby restored [Nature's] ultimate secrets to that obscurity, in which they ever did and ever will remain." On different grounds, others reached similar conclusions. Locke, for example, had observed that motion has effects "which we can in no way conceive motion able to produce"—as Newton had in fact demonstrated shortly before. Since we remain in "incurable ignorance of what we desire to know" about matter and its effects, Locke concluded, no "science of bodies [is] within our reach," and we can only appeal to "the arbitrary determination of that All-wise Agent who has made them to be, and to operate as they do, in a way wholly above our weak understandings to conceive."[1]

I think it is worth attending to such conclusions, the reasons for them, their aftermath, and what that history suggests about current concerns and inquiries in philosophy of mind.

The mechanical philosophy that Newton undermined is based on our common-sense understanding of the nature and interactions of objects, in large part genetically determined and, it appears, reflexively yielding such perceived properties as persistence of objects through time and space (and as a corollary their cohesion and continuity)[2] and causality through contact, a fundamental feature of intuitive physics: "body, as far as we can conceive, being able only to strike and affect body, and motion, according to the utmost reach of our ideas, being able to produce nothing but motion," as Locke plausibly characterized the common-sense understanding of the world—the limits of our "ideas," in his sense. The theoretical counterpart was the materialist conception of the world that animated the seventeenth-century scientific revolution, the conception of the world as a machine, which was simply a far grander version of the automata that stimulated the imagination of thinkers of the time (much in the way programmed computers do today): the remarkable clocks, the artifacts constructed by master artisans like Jacques de Vaucanson that imitated animal behavior and internal functions like digestion, the hydraulically activated machines that played instruments and pronounced words when triggered by visitors walking through the royal gardens. The mechanical philosophy aimed to dispense with forms flitting through the air, sympathies and antipathies, and other occult ideas and to keep to what is firmly grounded in common-sense understanding and intelligible to it. As is well known, Descartes claimed to have explained the phenomena of the material world in mechanistic terms while also demonstrating that the mechanical philosophy is not all encompassing, not reaching to the domain of mind—again pretty much in accord with the common-sense dualistic interpretation of oneself and the world around us.

I. B. Cohen observes that "there is testimony aplenty in Newton's *Principia* and *Opticks* to his general adherence to the Cartesian mechanical philosophy."[3] The word "general" is important. Newton was much influenced by the neo-Platonic and alchemical traditions and also by the disturbing consequences of his own inquiries. For such reasons, he sometimes modified the more strict Cartesian dichotomy of matter and spirit, including in the latter category "the natural agencies responsible for the 'violent' motions of chemical and electrical action and even, perhaps, for accelerated motion in general," as Ernan McMullin shows in a careful analysis of the evolution of Newton's struggle with the paradoxes and conundrums he sought to resolve. In Newton's own words, "spirit" may be the cause of all movement in nature, including the "power of moving our body by our thoughts" and "the same power in other living creatures, [though] how this is done and by what laws we do not know. We cannot say that all nature is not alive."[4]

Going a step beyond, Locke added that we cannot say that nature does not think. In the formulation that has come down through history as "Locke's suggestion," he writes that "Whether Matter may not be made by God to think is more than man can know. For I see no contradiction in it, that the first Eternal thinking Being, or Omnipotent Spirit, should, if he pleased, give to certain systems of created senseless matter, put together as he thinks fit, some degrees of sense, perception, and thought." Furthermore, just as God had added inconceivable effects to motion, it is "not much more remote from our comprehension to conceive that GOD can, if he pleases, superadd to matter a faculty of thinking, than that he should superadd to it another substance with a faculty of thinking." There is no warrant, then, for postulating a second substance whose essence is thought. And elsewhere, it "involves no contradiction [that God should] give to some parcels of matter, disposed as he thinks fit, a power of thinking and moving [which] might properly be called spirits, in contradistinction to unthinking matter," a view that he finds "repugnant to the *idea* of senseless matter" but that we cannot reject, given our incurable ignorance and the limits of our ideas (cognitive capacities). Having no intelligible concept of "matter" (body, etc.), we cannot dismiss the possibility of living or thinking matter, particularly after Newton undermined common-sense understanding.[5]

Locke's suggestion was taken up through the eighteenth century, culminating in the important work of Joseph Priestley, to which we return. Hume, in the *Treatise*, reached the conclusion that "motion may be, and actually is, the cause of thought and perception," rejecting familiar arguments about absolute difference in kind and divisibility on the general grounds that "we are never sensible of any connexion betwixt causes and effects, and that 'tis only by our experience of their constant conjunction, we can arrive at any knowledge of this relation." In one or another form, it came to be recognized that since "thought, which is produced in the brain, cannot exist if this organ is wanting," and since there is no longer a reason to question the thesis of thinking matter, "it is necessary to consider the brain as a special organ designed especially to produce [thought], as the stomach and the intestines are designed to operate the digestion, the liver to filter bile," and so on through the bodily organs. Just as foods enter the stomach and leave it with

> new qualities, [so] impressions arrive at the brain, through the nerves; they are then isolated and without coherence. The organ enters into action; it acts on them, and soon it sends them back changed into ideas, which the language of physiognomy and gesture, or the signs of speech and writing, manifest outwardly. We conclude then, with the same certainty, that the brain digests, as it were, the impressions, i.e., that organically it makes the secretion of thought.

As Darwin put the matter succinctly, "Why is thought, being a secretion of the brain, more wonderful than gravity, a property of matter?"[6]

Qualifications aside, Newton did generally adhere to the mechanical philosophy, but he also showed its "imperfections"—in fact, he demolished it—though to the end of his life he sought to find some way to account for the mystical principle of action at a distance that he was compelled to invoke to account for the most elementary phenomena of nature. Perhaps, he thought, there might be "a most subtle spirit which pervades and lies hid in all gross bodies," which will somehow yield a physical account of attraction and cohesion and offer some hope of rescuing an intelligible picture of the world.[7]

We should not lightly ignore the concerns of "the greatest and rarest genius that ever arose for the ornament and instruction of the species," or those of Galileo and Descartes or Locke and Hume. Or of Newton's most respected scientific contemporaries, who "unequivocally blamed [Newton] for leading science back into erroneous ways which it seemed to have definitely abandoned," as E. J. Dijksterhuis writes in his classic study of the mechanistic world picture and its collapse as a substantive doctrine. Christiaan Huygens described Newton's principle of attraction as an "absurdity." Leibniz argued that Newton was reintroducing occult ideas similar to the sympathies and antipathies of the much-ridiculed Scholastic science and was offering no *physical* explanations for phenomena of the material world.[8]

Newton largely agreed with his scientific contemporaries. He wrote that the notion of action at a distance is "inconceivable." It is "so great an Absurdity, that I believe no Man who has in philosophical matters a competent Faculty of thinking, can ever fall into it." By invoking it, we concede that we do not understand the phenomena of the material world. As McMullin observes, "By 'understand' Newton still meant what his critics meant: understand in mechanical terms of contact action."[9]

To take a contemporary analogue, the absurd notion of action at a distance is as inconceivable as the idea that "mental states are states of the brain," a proposal "we do not really understand [because] we are still unable to form a conception of *how* consciousness arises in matter, even if we are certain that it does."[10] Similarly, Newton was unable to form a conception of how the simplest phenomena of nature could arise in matter—and they didn't, given his conception of matter, the natural-theoretical version of common-sense understanding. Locke and others agreed, and Hume carried that failure of conceivability a long step beyond by concluding that Newton had restored these ultimate secrets of nature "to that obscurity, in which they ever did and ever will remain"—a stand that we may interpret, naturalistically, as a speculation about the limits of human cognitive capacities. In the light of history, there seems to be little reason to be concerned about the inconceivability of relating mind to brain, or about conceivability altogether, at least in inquiry into the nature of the world. Nor is there any reason for qualms about an "explanatory gap" between *the physical* and consciousness, beyond the unification concerns that arise throughout efforts to understand the world. And unless *the physical* is given some new post-Newtonian sense, there is even less reason for qualms about an "explanatory gap" than in cases where there is some clear sense to the assumed reduction base. The most extreme of such concerns, and perhaps the most significant for the subsequent development of the sciences, is the explanatory gap that Newton unearthed and left unresolved, possibly a permanent mystery for humans, as Hume conjectured.[11]

Science, of course, did not end with the collapse of the notion of body (material, physical, etc.). Rather, it was reconstituted in a radically new way, with questions of conceivability and intelligibility dismissed as demonstrating nothing except about human cognitive capacities, though that conclusion has taken a long time to become firmly established. Later stages of science introduced more "absurdities." The legitimacy of the steps is determined by criteria of depth of explanation and empirical support, not conceivability and intelligibility of the world that is depicted.

Thomas Kuhn suggests that "It does not, I think, misrepresent Newton's intentions as a scientist to maintain that he wished to write a *Principles of Philosophy* like Descartes [that is, true science] but that his inability to explain gravity forced him to restrict his subject to the *Mathematical Principles of Natural Philosophy*, [which] did not even pretend to explain why the universe runs as it does," leaving the question in obscurity. For such reasons, "It was forty years before Newtonian physics firmly supplanted Cartesian physics, even in British universities," and some of the ablest physicists of the eighteenth century continued to seek a mechanical-corpuscular explanation of gravity—that is, what they took to be a *physical* explanation—as Newton did himself. In later years, positivists reproached all sides of the debates "for their foolishness in clothing the mathematical formalism [of physical theory] with the 'gay garment' of a physical interpretation," a concept that had lost substantive meaning.[12]

Newton's famous phrase "I frame no hypotheses" appears in this context: recognizing that he had been unable to discover the *physical* cause of gravity, he left the question open. He adds that "to us it is enough that gravity does really exist, and act according to the laws which we have explained, and abundantly serves to account for all the motions of the celestial bodies, and of our sea." But while agreeing that his proposals were so absurd that no serious scientist could accept them, he defended himself from the charge that he was reverting to the mysticism of the Aristotelians. His principles, he argued, were not occult: "their causes only are occult"; or, he hoped, were yet to be discovered in physical terms, meaning mechanical terms. To derive general principles inductively from phenomena, he continued, "and afterwards to tell us how the properties of actions of all corporeal things follow from those manifest principles, would be a very great step in philosophy, though the causes of these principles were not yet discovered."[13]

To paraphrase with regard to the contemporary analogue I mentioned, it "would be a very great step in science to account for mental aspects of the world in terms of manifest principles even if the causes of these principles were not yet discovered"—or to put the matter more appropriately, even if unification with other aspects of science had not been achieved. To learn more about mental aspects of the world—or chemical or electrical or other aspects—we should try to discover "manifest principles" that partially explain them, though their causes remain disconnected from what we take to be more fundamental aspects of science. The gap might have many reasons, among them, as has repeatedly been discovered, that the presumed reduction base was misconceived, including core physics.

Historians of science have recognized that Newton's reluctant intellectual moves set forth a new view of science in which the goal is not to seek ultimate explanations but to find the best theoretical account we can of the phenomena of experience and experiment. Newton's more limited goals were not entirely new. They have roots in an earlier scientific tradition that had abandoned the search for the "first springs of natural motions" and other natural phenomena, keeping to the more modest effort to develop the best theoretical account we can: what Richard Popkin calls the "constructive skepticism . . . formulated . . . in detail by Mersenne and Gassendi" and later in Hume's "mitigated skepticism." In this conception, Popkin continues, science proceeds by "doubting our abilities to find grounds for our knowledge, while accepting and increasing the knowledge itself" and recognizing that "the secrets of nature, of things-in-themselves, are forever hidden from us"—the "science without metaphysics . . . which was to have a great history in more recent times."[14]

As the impact of Newton's discoveries was slowly absorbed, such lowering of the goals of scientific inquiry became routine. Scientists abandoned the animating idea of the early scientific revolution: that the world will be intelligible to us. It is enough to construct intelligible explanatory theories, a radical difference. By the time we reach Russell's *Analysis of Matter*, he dismisses the very idea of an intelligible world as "absurd" and repeatedly places the word "intelligible" in quotes to highlight the absurdity of the quest. Qualms about action at a distance were "little more than a prejudice," he writes. "If all the world consisted of billiard balls, it would be what is called 'intelligible'—i.e., it would never surprise us sufficiently to make us realize that we do not understand it." But even without external surprise, we should recognize how little we understand the world, and we should also realize that it doesn't matter whether we can conceive of how the world works. In his classic introduction to quantum mechanics a few years later, Paul Dirac wrote that physical science no longer seeks to provide pictures of how the world works, that is, "a model functioning on essentially classical lines," but only seeks to provide a "way of looking at the fundamental laws which makes their self-consistency obvious." He was referring to the inconceivable conclusions of quantum physics but could just as readily have said that even the classical Newtonian models had abandoned the hope of rendering natural phenomena intelligible, the primary goal of the early modern scientific revolution, with its roots in common-sense understanding.[15]

It is useful to recognize how radical a shift it was to abandon the mechanical philosophy and with it any scientific relevance of our commonsense beliefs and conceptions, except as a starting point and spur for inquiry. The Galileo scholar Peter Machamer observes that by adopting the mechanical philosophy and initiating the modern scientific revolution, Galileo had "forged a new model of intelligibility for human understanding, [with] new criteria for coherent explanations of natural phenomena" based on the conception of the world as an elaborate machine. For Galileo, and leading figures in the early modern scientific revolution generally, true understanding requires a mechanical model, a device that an artisan could construct, hence intelligible to us. Thus Galileo rejected traditional theories of tides because we cannot "duplicate [them] by means of appropriate artificial devices."[16]

The model of intelligibility that reigned from Galileo through Newton and beyond has a corollary: when mechanism fails, understanding fails. The apparent inadequacies of mechanical explanation for cohesion, attraction, and other phenomena led Galileo finally to reject "the vain presumption of understanding everything." Worse yet, "there is not a single effect in nature . . . such that the most ingenious theorist can arrive at a complete understanding of it." Galileo was formulating a very strong version of what Daniel Stoljar calls "the ignorance hypothesis" in his careful inquiry into the contemporary study of philosophical problems relating to consciousness, concluding that their origins are epistemic and that they are effectively overcome by invoking the ignorance hypothesis—which for Galileo, Newton, Locke, Hume, and others was more than a hypothesis and extended far beyond the problem of consciousness, encompassing the truths of nature quite generally.[17]

Though much more optimistic than Galileo about the prospects for mechanical explanation, Descartes too recognized the limits of our cognitive reach. Rule 8 of the *Regulae* reads: "If in the series of subjects to be examined we come to a subject of which our intellect cannot gain a good enough intuition, we must stop there; and we must not examine the other matters that follow, but must refrain from futile toil." Specifically, Descartes speculated that the workings of *res cogitans* may lie beyond human understanding. He thought that we may not "have intelligence enough" to understand the workings of mind, in particular, the normal use of language, with its creative aspects his core example: the capacity of every human, but no beast-machine, to use language in ways appropriate to situations but not caused by them, and to formulate and express coherent thoughts without bound, perhaps "incited or inclined" to speak in certain ways by internal and external circumstances but not "compelled" to do so, as his followers put the matter.[18]

However, Descartes continued, even if the explanation of normal use of language and other forms of free and coherent choice of action lies beyond our cognitive grasp, that is no reason to question the authenticity of our experience. Quite generally, "free will" is "the noblest thing" we have, Descartes held: "there is nothing we comprehend more evidently and more perfectly," and "it would be absurd" to doubt something that "we comprehend intimately, and experience within ourselves" (that "the free actions of men [are] undetermined") merely because it conflicts with something else "which we know must be by its nature incomprehensible to us" ("divine preordination").[19]

Such thoughts about cognitive limits do not comport well with Descartes' occasional observation that human reason "is a universal instrument which can serve for all contingencies," whereas the organs of an animal or machine "have need of some special adaptation for any particular action." But let's put that aside and keep to the more reasonable conclusions about cognitive limits.

The creative use of language was a basis for what has been called the "epistemological argument" for mind-body dualism and also for the scientific inquiries of the Cartesians into the problem of "other minds"—much more sensible, I believe, than contemporary analogues, often based on misinterpretation of a famous paper of Turing's, a topic that I will put aside.[20]

Desmond Clarke is accurate, I think, in concluding that "Descartes identified the use of language as the critical property that distinguishes human beings from other members of the animal kingdom and [that] he developed this argument in support of the real distinction of mind and matter." I think he is also persuasive in interpreting the general Cartesian project as primarily "natural philosophy" (science), an attempt to press mechanical explanation to its limits, and in regarding the *Meditations* "not as the authoritative expression of Descartes' philosophy, but as an unsuccessful attempt to reconcile his theologically suspect natural philosophy with an orthodox expression of scholastic metaphysics."[21] In pursuing his natural science, Descartes tried to show that mechanical explanation reached very far but came to an impassable barrier in the face of such mental phenomena as the creative use of language. He therefore, quite properly, adopted the standard scientific procedure of seeking some new principles to account for such mental phenomena—a quest that lost one primary motivation when mechanical explanation was demonstrated to fail for everything.

Clarke argues that "Descartes' dualism was an expression of the extent of the theoretical gap between [Cartesian physics] and the descriptions of mental life that we formulate from the first-person perspective of our own thinking." The gap therefore results from Descartes' "impoverished concept of matter" and can be overcome by "including new theoretical entities in one's concept of matter."[22] Whether the latter speculation is correct or not, it does not quite capture the deficiencies of classical science from Galileo through Newton and beyond. The underlying concept of matter and motion—based on conceivability, intelligibility, and common-sense understanding—had to be abandoned, and science had to proceed on an entirely new course in investigating the simplest phenomena of motion, and all other aspects of the world, including mental life.

Despite the centrality of the creative use of language to Cartesian science, it was only one illustration of the general problems of will and of choice of appropriate action, which remain as mysterious to us as they were to seventeenth-century scientists, so it seems to me, despite sophisticated arguments to the contrary. The problems are hardly even on the scientific agenda. There has been very valuable work about how an organism executes a plan for integrated motor action—say, how a person reaches for a cup on the table. But no one even raises the question of why this plan is executed rather than some other one, apart from the very simplest organisms and special circumstances of motivation. Much the same is true even for visual perception. The cognitive neuroscientists Nancy Kanwisher and Paul Downing reviewed research on a problem posed in 1850 by Helmholtz: "even without moving our eyes, we can focus our attention on different objects at will, resulting in very different perceptual experiences of the same visual field." The phrase "at will" points to an area beyond serious empirical inquiry, still the mystery it was for Newton at the end of his life when he continued to seek some "subtle spirit" that lies hidden in all bodies and that might, without "absurdity," account for their properties of attraction and repulsion, along with the nature and effects of light, sensation, and the way "members of animal bodies move at the command of the will"—all comparable mysteries for Newton, perhaps even beyond our understanding.[23]

It has become standard practice in recent years to describe the problem of consciousness as "the hard problem," others being within our grasp, now or down the road. I think there are reasons for some skepticism, particularly when we recognize how sharply understanding declines beyond the simplest systems of nature. To illustrate with a few examples, a review article by Eric Kandel and Larry Squire on the current state of efforts aimed at "breaking down scientific barriers to the study of brain and mind" concludes that "the neuroscience of higher cognitive processes is only beginning." C. R. Gallistel points out that "we clearly do not understand how the nervous system computes" or even "the foundations of its ability to compute," even for "the small set of arithmetic and logical operations that are fundamental to any computation." Reviewing the remarkable computational capacities of insects, he concludes that it is a mistake to suppose that the nervous system does not carry out complex symbolic computations on grounds of "our inability, as yet to understand how the nervous system computes at the cellular and molecular level. . . . We do not know what processes belong to the basic instruction set of the nervous system—the modest number of elementary operations built into the hardware of any computing device." Semir Zeki, who is optimistic about the prospects for bringing the brain sciences to bear even on creativity in the visual arts, nevertheless reminds us that "how the brain combines the responses of specialized cells to indicate a continuous vertical line is a mystery that neurology has not yet solved," or even how one line is differentiated from others or from the visual surround. Basic traditional questions are not even on the research agenda, and even simple ones that might be within reach remain baffling.[24]

It is common to assert that "the mental is the neurophysiological at a higher level." To entertain the idea makes sense but, for the present, only as a guide to inquiry and without much confidence about what "the neurophysiological" will prove to be. Similarly, it is premature to hold that "it is empirically evident that states of consciousness are the necessary consequence of neuronal activity." Too little is understood about the functioning of the brain.[25]

History also suggests caution. In early modern science, the nature of motion was the "hard problem." "Springing or Elastic Motions" is the "hard rock in Philosophy," Sir William Petty observed, proposing ideas resembling those soon developed much more richly by Newton. The "hard problem" was that bodies that seem to our senses to be at rest are in a "violent" state, with "a strong endeavor to fly off or recede from one another," in Robert Boyle's words. The problem, he felt, is as obscure as "the Cause and Nature" of gravity, thus supporting his belief in "an intelligent Author or Disposer of Things." Even the skeptical Newtonian Voltaire argued that the ability of humans to "produce a movement" where there was none shows that "there is a God who gave movement" to matter, and "so far are we from conceiving what matter is" that we do not even know if there is any "solid matter in the universe." Locke relinquished to divine hands "the gravitation of matter towards matter, by ways, inconceivable to me." Kant rephrased the "hard problem," arguing that to reach his conclusions, Newton was compelled to tacitly "assume that all matter exercises this motive force [of universal attraction] simply as matter and by its essential nature"; by rejecting the assumption, he was "at variance with himself," caught in a contradiction. Newton therefore did not, as he claimed, really leave "the physicists full freedom to explain the possibility of such attraction as they might find good, without mixing up his propositions with their play of hypotheses." Rather, "The concept of matter is reduced to nothing but moving forces. . . . The attraction essential to all matter is an immediate action of one matter on another across empty space," a notion that would have been anathema to the great figures of seventeenth-century science, "such Masters, as the Great Huygenius, and the incomparable Mr. Newton," in Locke's words.[26]

The "hard problems" of the day were not solved; rather, they were abandoned as over time science turned to its more modest post-Newtonian course. Friedrich Lange, in his classic nineteenth-century history of materialism, observed that we have

> so accustomed ourselves to the abstract notion of forces, or rather to a notion hovering in a mystic obscurity between abstraction and con-

> crete comprehension, that we no longer find any difficulty in making one particle of matter act upon another without immediate contact . . . through void space without any material link. From such ideas the great mathematicians and physicists of the seventeenth century were far removed. They were all in so far genuine Materialists in the sense of ancient Materialism that they made immediate contact a condition of influence.

This transition over time is "one of the most important turning-points in the whole history of Materialism," depriving the doctrine of much significance, if any at all. Newton not only joined the great scientists of his day in regarding "the now prevailing theory of *actio in distans* . . . simply as absurd, [but] also felt himself obliged, in the year 1717, in the preface to the second edition of his 'Optics,' to protest expressly against [the] view" of his followers who "went so far as to declare gravity to be a fundamental force of matter," requiring no "further mechanical explanation from the collision of imponderable particles." Lange concludes that "the course of history has eliminated this unknown material cause [that so troubled Newton], and has placed the mathematical law itself in the rank of physical causes." Hence, "what Newton held to be so great an absurdity that no philosophic thinker could light upon it, is prized by posterity as Newton's great discovery of the harmony of the universe!" The conclusions are commonplace in the history of science. Fifty years ago, Alexander Koyrė observed that despite his unwillingness to accept the conclusion, Newton had demonstrated that "a purely materialistic pattern of nature is utterly impossible (and a purely materialistic or mechanistic physics, such as that of Lucretius or of Descartes, is utterly impossible, too)"; his mathematical physics required the "admission into the body of science of incomprehensible and inexplicable 'facts' imposed up on us by empiricism," by what is observed and our conclusions from these observations.[27]

George Coyne describes it as "paradoxical that the rise of materialism as a philosophy in the 17th and 18th centuries is attributed to the birth of modern science, when in reality matter as a workable concept had been eliminated from scientific discourse" with the collapse of the mechanical philosophy.[28] Also paradoxical is the influence of Gilbert Ryle's ridicule of the "ghost in the machine," quite apart from the accuracy of his rendition of the Cartesian concepts. It was the machine that Newton exorcised, leaving the ghost intact. The "hard problem" of the materialists disappeared, and there has been little noticeable progress in addressing other "hard problems" that seemed no less mysterious to Descartes, Newton, Locke, and other leading figures.

The third English edition of Lange's much expanded history of materialism appeared in 1925 with an introduction by Bertrand Russell, who shortly after published his *Analysis of Matter*. Developing his neutral monism, Russell carried further seventeenth- and eighteenth-century skepticism about matter and recognition of the plausibility (or, for some, necessity) of thinking matter. Russell held that there are "three grades of certainty. The highest grade belongs to my own percepts; the second grade to the percepts of other people; the third to events which are not percepts of anybody," constructions of the mind established in the course of efforts to make sense of what we perceive. "A piece of matter is a logical structure composed of [such] events," he therefore concluded. We know nothing of the "intrinsic character" of such mentally constructed entities, so there is "no ground for the view that percepts cannot be physical events." For science to be informative, it cannot be restricted to structural knowledge of such logical properties. Rather, "the world of physics [that we construct] must be, in some sense, continuous with the world of our perceptions, since it is the latter which supplies the evidence for the laws of physics." The percepts that are required for this task—perhaps just meter readings, Eddington had argued shortly before—"are not known to have any intrinsic character which physical events cannot have, since we do not know of any intrinsic character which could be incompatible with the logical properties that physics assigns to physical events." Accordingly, "what are called 'mental' events . . . are part of the material of the physical world." Physics itself seeks only to discover "the causal skeleton of the world, [while studying] percepts only in their cognitive aspect; their other aspects lie outside its purview"—though we recognize their existence, at the highest grade of certainty in fact.[29]

The basic conundrum recalls a classical dialogue between the intellect and the senses, in which the intellect says that color, sweetness, and the like are only convention while in reality there are only atoms and the void, and the senses reply: "Wretched mind, from us you are taking the evidence by which you would overthrow us? Your victory is your own fall."[30]

To illustrate his conclusion, Russell asks us to consider a blind physicist who knows the whole of physics but does not have "the knowledge which [sighted] men have" about, say, the quality of the color blue. In their review of related issues, Daniel Stoljar and Yujin Nagasawa call this the "knowledge intuition," as distinct from the "knowledge argument," presented in the resurrection of Russell's example by Frank Jackson: in this case the physicist (Mary) "learns everything there is to know about the physical nature of the world" while confined to a black-and-white room, but when released, she "will learn what it is like to see something red."[31]

There is a substantial literature seeking to evade the argument. One popular though contested proposal is that what Mary lacks is not the knowledge of the world that we have but rather a range of abilities, a species of "knowing how." That seems unhelpful, in part because there is an irreducible cognitive element in "knowing how," which goes beyond abilities, but also for the kinds of reasons that Hume discussed in connection with moral judgments. Since these, he observed, are unbounded in scope and applicable to new situations, they must be based on a finite array of general principles (which are, furthermore, part of our nature though they are beyond the "original instincts" shared with animals). The knowledge that *we* have but Mary lacks is a body of knowledge that does not fall within the knowing-how/knowing-that dichotomy: it is knowledge *of*—knowledge of rules and principles that yield unbounded capacities to act appropriately. All of this is for the most part unconscious and inaccessible to consciousness, as in the case of knowledge of the rules of language, vision, etc. Such conclusions have been rejected as a matter of principle by Quine, Searle, and many others, but not convincingly or even coherently, I think.[32]

Russell's knowledge intuition led him to conclude that physics has limits: experience in general lies "outside its purview" apart from cognitive aspects that provide empirical evidence, though along with other mental events, experience is "part of the material of the physical world," a phrase that seems to mean no more than "part of the world." We must have "an interpretation of physics which gives a due place to perceptions," Russell held, or it has no empirical basis. Jackson's knowledge argument leads him to the conclusion that "physicalism is false." Or in a later version, that to be valid "materialism [as] a metaphysical doctrine" must incorporate "the psychological story about our world"; the "story about our world told purely in physical terms [must] enable one to deduce the phenomenal nature of psychological states."[33] But that is uninformative until some clear concept of physicalism/materialism is offered. Classical interpretations having vanished, the notions of body, material, and physical are hardly more than honorific designations for what is more or less understood at some particular moment in time, with flexible boundaries and no guarantee that there will not be radical revision ahead, even at its core. If so, the knowledge argument only shows (with Russell) that humanly constructed physics has limits, or that Mary did not know all of physics (she had not drawn the right conclusions from Eddington's meter readings).

To resurrect something that resembles a "mind-body problem," it would be necessary to characterize *physicalism* (matter, etc.) in some post-Newtonian fashion or to argue that the problem arises even if the concepts are abandoned. Both approaches have been pursued. I will return to current examples. An alternative approach is to dismiss the mind-body problem and to approach the knowledge/intuition argument as a problem of the natural sciences. Rephrasing Russell's thought experiment, we might say that like all animals, we have internal capacities that reflexively provide us with what ethologists called an *Umwelt*, a world of experience, different for us and for bees—in fact, differing among humans, depending on what they understand. That's why radiology is a medical specialty. Galileo saw the moons of Jupiter through his primitive telescope, but those he sought to convince could only see the magnification of terrestrial objects and took his telescope to be a conjuring trick (at least if Paul Feyerabend's reconstruction of the history is correct). What I hear as noise is perceived as music by my teenage grandchildren, at a fairly primitive level of perceptual experience. And so on quite generally.

Being reflective creatures, unlike others, we go on to seek to gain a deeper understanding of the phenomena of experience. These exercises are called myth, or magic, or philosophy, or science. They reveal not only that the world of experience is itself highly intricate and variable, resulting from the interaction of many factors, but also that the modes of interpretation that intuitive common sense provides do not withstand analysis, so that the goals of science must be lowered in the manner recognized in post-Newtonian science. From this point of view, there is no objective science from a third-person perspective, just various first-person perspectives, matching closely enough among humans so that a large range of agreement can be reached, with diligence and cooperative inquiry. Being inquisitive and reflective creatures, if we can construct a degree of theoretical understanding in some domain, we try to unify it with other branches of inquiry, reduction being one possibility but not the only one.

We can anticipate that our quest might fail, for one reason, because our basically shared capacities of understanding and explanation have limits—a truism that is sometimes thoughtlessly derided as "mysterianism," though not by Descartes and Hume, among others. It could be that these innate cognitive capacities do not lead us beyond some understanding of Russell's causal skeleton of the world (and enough about perception to incorporate evidence within this mental construction), and it is an open question how much of that can be attained. In principle, the limits could become topics of empirical inquiry into the nature of what we might call "the science-forming faculty," another "mental organ." These are interesting topics, but the issues are distinct from the traditional mind-body problem, which evaporated after Newton, or from the question of how mental aspects of the world, including direct experience, relate to the brain, one of the many problems of unification that arise in the sciences.

In brief, if we are biological organisms, not angels, much of what we seek to understand might lie beyond our cognitive limits—maybe a true understanding of anything, as Galileo concluded and Newton in a certain sense demonstrated. That cognitive reach has limits is not only a truism but also a fortunate one. If there were no limits to human intelligence, it would lack internal structure and would therefore have no scope: we could achieve nothing by inquiry. The basic points were expressed clearly by Charles Sanders Peirce in his discussion of the need for innate endowment that "puts a limit upon admissible hypotheses" if knowledge is to be acquired.[34] Similarly, if a zygote had no further genetic instructions constraining its developmental path, it would at best grow into a creature formed solely by physical law, like a snowflake, nothing viable.

We might think of the natural sciences as a kind of chance convergence between our cognitive capacities and what is more or less true of the natural world. There is no reason to believe that humans can solve every problem they pose or even that they can formulate the right questions; they may simply lack the conceptual tools, just as rats cannot deal with a prime-number maze.

Russell's general conclusions seem to me on the right track. The formulation can be improved, I think, by simply dropping the words "matter" and "physical." Since the Newtonian revolution, we speak of the "physical" world much as we speak of the "real" truth: for emphasis, but adding nothing. We can distinguish various aspects of the world—say chemical, electrical, experiential, and the rest—and we can then inquire into their underlying principles and their relations with other systems, problems of unification.

Suppose we adopt the "mitigated skepticism" that was warranted after Newton, if not before. For the theory of mind, that means following Gassendi's advice in his *Objections*. He argued that Descartes had at most shown "the perception of the existence of mind, [but] fail[ed] to reveal its nature." It is necessary to proceed as we would in seeking to discover "a conception of Wine superior to the vulgar," by investigating how it is constituted and the laws that determine its functioning. Similarly, he urged Descartes, "it is incumbent on you, to examine yourself by a certain chemical-like labor, so that you can determine and demonstrate to us your internal substance"[35]—and that of others.

The theory of mind can be pursued in many ways, like other branches of science, with an eye to eventual unification, whatever form it may take, if any. That is the task that Hume undertook when he investigated what he called "the science of human nature," seeking "the secret springs and principles, by which the human mind is actuated in its operations," including those "parts of [our] knowledge" that are derived from "the original hand of nature," an enterprise he compared to Newton's: essentially what in contemporary literature is termed "naturalization of philosophy" or "epistemology naturalized." Gassendi's recommended course was in fact being pursued in the "cognitive revolution" of the seventeenth century by British neo-Platonists and continental philosophers of language and mind and has been taken up with renewed vigor in recent years, but I'll put that matter aside.[36]

Chemistry itself quite explicitly pursued this course. The eighteenth-century chemist Joseph Black recommended that "chemical affinity be received as a first principle, which we cannot explain any more than Newton could explain gravitation, and let us defer accounting for the laws of affinity, till we have established such a body of doctrine as he has established concerning the laws of gravitation." Being yet "very far from the knowledge of first principles," chemical science should be "analytical, like Newton's *Optics*, in the form of a general law, at the very end of our induction, as the reward of our labour." The course he outlined is the one that was actually followed, as chemistry established a rich body of doctrine, its "triumphs . . . built on no reductionist foundation but rather achieved in isolation from the newly emerging science of physics," as the historian of chemistry Arnold Thackray observes. Newton and his followers did attempt to "pursue the thoroughly Newtonian and reductionist task of uncovering the general mathematical laws which govern all chemical behavior" and to develop a principled science of chemical mechanisms based on physics and its concepts of interactions among "the ultimate permanent particles of matter." But the Newtonian program was undercut by Dalton's "astonishingly successful weight-quantification of chemical units," Thackray continues, shifting "the whole area of philosophical debate among chemists from that of chemical *mechanisms* (the *why*? of reaction) to that of chemical *units* (the *what*? and *how much*?)," a theory that "was profoundly antiphysicalist and anti-Newtonian in its rejection of the unity of matter, and its dismissal of short-range forces." "Dalton's ideas were chemically successful. Hence they have enjoyed the homage of history, unlike the philosophically more coherent, if less successful, reductionist schemes of the Newtonians."[37]

Adopting contemporary terminology, we might say that Dalton disregarded the explanatory gap between chemistry and physics by ignoring the underlying physics, much as post-Newtonian physicists disregarded the explanatory gap between Newtonian dynamics and the mechanical philosophy by ignoring (and in this case rejecting) the latter, even though it was self-evident to common-sense understanding. That has often been the course of science since, though not without controversy and sharp criticism often later recognized to have been seriously misguided.

Well into the twentieth century, the failure of the reduction of chemistry to physics was interpreted by prominent scientists as a critically important explanatory gap, showing that chemistry provides "merely classificatory symbols that summarized the observed course of a reaction," to quote Brock's standard history. Kekulé, whose structural chemistry was an important step toward the eventual unification of chemistry and physics, doubted that "absolute constitutions of organic molecules could ever be given"; his models and analysis of valency were to have an instrumental interpretation only, as calculating devices. Lavoisier before him believed that "the number and nature of elements [is] an unsolvable problem, capable of an infinity of solutions none of which probably accord with Nature." "It seems extremely probable that we know nothing at all about . . . [the] . . . indivisible atoms of which matter is composed"—and never will, he believed. Kekulé seems to be saying that there isn't a problem to be solved: the structural formulas are either useful or not, but there is no truth of the matter. Large parts of physics were understood the same way. Poincaré went so far as to say that we adopt the molecular theory of gases only because we are familiar with the game of billiards.

Boltzmann's scientific biographer speculates that he committed suicide because of his failure to convince the scientific community to regard his theoretical account of these matters as more than a calculating system—ironically, shortly after Einstein's work on Brownian motion and broader issues had convinced physicists of the reality of the entities he postulated. Bohr's model of the atom was also regarded as lacking "physical reality" by eminent scientists. In the 1920s, America's first Nobel Prize–winning chemist dismissed talk about the real nature of chemical bonds as metaphysical "twaddle": they are nothing more than "a very crude method of representing certain known facts about chemical reactions, a mode of representation" only, because the concept could not be reduced to physics. The rejection of that skepticism by a few leading scientists, whose views were condemned at the time as a conceptual absurdity, paved the way for the eventual unification of chemistry and physics, with Linus Pauling's quantum-theoretic account of the chemical bond seventy years ago.[38]

In 1927, Russell observed that chemical laws "cannot at present be reduced to physical laws,"[39] an observation that was found to be misleading: the words "at present" turned out to understate the matter. Chemical laws could not ever be reduced to physical laws, because the conception of physical laws was erroneous. The perceived explanatory gap was never filled. It was necessary, once again, to dismiss as irrelevant the notions of "conceivability" and "intelligibility of the world" in favor of the mitigated skepticism of methodological naturalism: seeking to increase our knowledge while keeping an open mind about the possibility of reduction.

There are fairly clear parallels to contemporary discussion of language and mind and some lessons that can be drawn. The study of insect symbolic representation, organization of motor behavior, mammalian vision, human language, moral judgment, and other topics is in each case well advised to follow Joseph Black's prescription. If these inquiries succeed in developing a "body of doctrine" that accounts for elements of insect navigation, or the rule that image motions are interpreted (if other rules permit) as rigid motions in three dimensions, or that displacement operations in language observe locality principles, and so on, that should be regarded as normal science, even if unification with neurophysiology has not been achieved—and might not be for a variety of possible reasons, among them that the expected "reduction base" is misconceived and has to be modified. Needless to say, the brain sciences are not as firmly established as basic physics was a century ago or as the mechanical philosophy was in Newton's day. It is also pointless to insist on doctrines about accessibility to consciousness: even if they could be given a coherent formulation, they would have no bearing on the "physical reality" of the rigidity principle or locality conditions. We should understand enough by now to dismiss the interpretation of theoretical accounts as no more than a way of "representing certain known facts about [behavior], a mode of representation" only—a critique commonly leveled against theories of higher mental faculties, though not insect computation, another illustration of the methodological dualism that is so prevalent in the critical discussion of inquiry into language and mind.[40]

It is also instructive to observe the reemergence of much earlier insights, though divorced from their grounding in the collapse of traditional physicalism. Thus we read today of the thesis of the new biology that "Things mental, indeed minds, are emergent properties of brains, [though] these emergences are . . . produced by principles that . . . we do not yet understand"—so writes the neuroscientist Vernon Mountcastle, formulating the guiding theme of a collection of essays reviewing the results of the Decade of the Brain that ended the twentieth century. The phrase "we do not *yet* understand" might well suffer the same fate as Russell's similar comment about chemistry seventy years earlier. Many other prominent scientists and philosophers have presented essentially the same thesis as an "astonishing hypothesis" of the new biology, a "radical" new idea in the philosophy of mind, "the bold assertion that mental phenomena are entirely natural and caused by the neurophysiological activities of the brain," opening the door to novel and promising inquiries, a rejection of Cartesian mind-body dualism, and so on.[41] In fact, all reiterate, in virtually the same words, formulations of centuries ago, after the traditional mind-body problem became unformulable with the disappearance of the only coherent notion of body (physical, material, etc.): for example, Joseph Priestley's conclusion that properties "termed mental" reduce somehow to "the organical structure of the brain,"[42] stated in different words by Hume, Darwin, and many others and almost inescapable, it would seem, after the collapse of the mechanical philosophy.

Priestley's important work was the culmination of a century of reflections on Locke's speculation and is their most elaborate development.[43] He made it clear that his conclusions about thinking matter followed directly from the collapse of any serious notion of *body*, or *matter*, or *physical*. He wrote that

> the principles of the Newtonian philosophy were no sooner known, than it was seen how few in comparison, of the phenomena of Nature were owing to solid matter, and how much to powers which were only supposed to accompany and surround the solid parts of matter. . . . Now when solidity had apparently so very little to do in the system, it is really a wonder that it did not occur to philosophers sooner . . . that there might be no such thing in Nature.

There is, then, no longer any reason to suppose that "the principle of thought or sensation [is] incompatible with matter," Priestley concluded. Accordingly, "the whole argument for an immaterial thinking principle in man, on this supposition, falls to the ground; matter, destitute of what has hitherto been called solidity, being no more incompatible with sensation and thought than that substance which without knowing anything farther about it, we have been used to call immaterial." The powers of sensation, perception, and thought reside in "a certain organized system of matter, [and] necessarily exist in, and depend upon, such a system." It is true that "we have a very imperfect idea of what the power of perception is" and that we may never attain a "clear idea," but "this very ignorance ought to make us cautious in asserting with what other properties it may, or may not, exist." Only a "precise and definite knowledge of the nature of perception and thought can authorize any person to affirm whether they may not belong to an extended substance which also has the properties of attraction and repulsion." Our ignorance provides no warrant for supposing that sensation and thought are incompatible with post-Newtonian matter. "In fact, there is the same reason to conclude, that the powers of sensation and thought are the necessary result of a particular organization, as that sound is the necessary result of a particular concussion of the air." And in a later discussion, "In my opinion there is just the same reason to conclude that the brain *thinks*, as that it is *white*, and *soft*."[44]

Priestley criticizes Locke for being hesitant in putting forth his speculation about thinking matter, since the conclusion follows so directly from "the universally accepted rules of philosophizing such as are laid down by Sir Isaac Newton." He urges that we abandon the methodological dualism that deters us from applying to thought and sensation the rules that we follow "in our inquiries into the causes of particular appearances in nature," and he expresses his hope "that when this is plainly pointed out the inconsistency of our conduct cannot fail to strike us and be the means of inducing" philosophers to apply the same maxim to investigation of mental aspects of the world that they do in other domains—a hope that has yet to be realized, I think.[45]

Priestley clearly "wished the disappearance of solid matter to signal an end to matter-spirit dualism," Thackray writes. And with it an end to any reason to question the thesis of thinking matter. In John Yolton's words, Priestley's conclusion was "not that all reduces to matter, but rather that the kind of matter on which the two-substance view is based does not exist," and "with the altered concept of matter, the more traditional ways of posing the question of the nature of thought and of its relations to the brain do not fit. We have to think of a complex organized biological system with properties the traditional doctrine would have called mental *and* physical."[46] Priestley's conclusions are essentially those reached by Eddington and Russell and developed in recent years particularly by Galen Strawson and Daniel Stoljar, in ways to which we will return.

Reviewing the development of Locke's suggestion in England through the eighteenth century, Yolton observes that "Priestley's fascinating suggestions were not taken up and extended; they were hardly even perceived as different from earlier versions of materialism. The issues raised by Locke's suggestion of thinking matter . . . played themselves out through the century, but no one gave the emerging view of man as one substance—foreshadowed by Priestley—a systematic articulation."[47] This conclusion remains largely true, even for simple organisms, if we interpret it as referring to the unification problem.

Having argued that the mind-body problem disappears when we follow the "principles of the Newtonian philosophy," Priestley turns to confronting efforts to reconstitute something that resembles the problem, even after one of its terms—body (matter, etc.)—no longer has a clear sense. The first is "the difficulty of conceiving how thought can arise from matter . . . an argument that derives all its force from our ignorance," he writes, and has no force unless there is a demonstration that they are "absolutely incompatible with one another." Priestley was not troubled by qualms arising from ignorance, rightly I think, any more than scientists should have been concerned about the irreducibility of the mysterious properties of matter and motion to the mechanical philosophy, or, in more modern times, about the inability to reduce chemistry to an inadequate physics until the 1930s, to take two significant moments from the history of science.

A common objection today is that such ideas invoke an unacceptable form of "radical emergence" unlike, for example, the emergence of liquids from molecules, where the properties of the liquid can in some reasonable sense be regarded as inhering in the molecules. In Nagel's phrase, "we can *see* how liquidity is the logical result of the molecules 'rolling around on each other' at the microscopic level," though "nothing comparable is to be expected in the case of neurons" and consciousness. Also taking liquidity as a paradigm, Galen Strawson argues extensively that the notion of emergence is intelligible only if we interpret it as "total dependence": if "some part or aspect of Y [hails] from somewhere else," then we cannot say that Y is "emergent from X." We can speak intelligibly about emergence of Y-phenomena from non-Y phenomena only if the non-Y phenomena at the very least are "somehow *intrinsically suited* to constituting" the X-phenomena; there must be "something about X's nature in virtue of which" they are "so suited." "It is built into the notion of emergence that emergence cannot be brute in the sense of there being no reason in the nature of things why the emerging thing is as it is." This is Strawson's *No-Radical Emergence Thesis*, from which he draws the panpsychic conclusion that "experiential reality cannot possibly emerge from wholly and utterly nonexperiential reality." The basic claim, which he highlights, is that "If it really is true that Y is emergent from X then it must be the case that Y is in some sense wholly dependent on X and X alone, so that all features of Y trace intelligibly back to X." Here "intelligible" is a metaphysical rather than an epistemic notion, meaning "intelligible to God": there must be an explanation in the nature of things, though we may not be able to attain it.[48]

Priestley, it seems, would reject Nagel's qualms while accepting Strawson's formulation, but without drawing the panpsychic conclusion. It should be noted that the molecule-liquid example, commonly used, is not a very telling one. We also cannot conceive of a liquid turning into two gases by electrolysis, and there is no intuitive sense in which the properties of water, bases, and acids inhere in hydrogen or oxygen or other atoms. Furthermore, the whole matter of conceivability seems to be irrelevant whether it is brought up in connection with the effects of motion that Newton and Locke found inconceivable, the irreducible principles of chemistry, or mind-brain relations. There is something about the nature of hydrogen and oxygen "in virtue of which they are intrinsically suited to constituting water," so the sciences discovered after long labors, providing reasons "in the nature of things why the emerging thing is as it is." What seemed "brute emergence" was assimilated into science as ordinary emergence—not, to be sure, of the liquidity variety, relying on conceivability. I see no strong reason why matters should necessarily be different in the case of experiential and nonexperiential reality, particularly given our ignorance of the latter, stressed from Newton and Locke to Priestley, developed by Russell, and arising again in recent discussion.

Priestley then considers the claim that mind "cannot be material because it is influenced by reasons." To this he responds that since "reasons, whatever they may be, do ultimately move matter, there is certainly much less difficulty in conceiving that they may do this in consequence of their being the affection of some material substance, than upon the hypothesis of their belonging to a substance that has no common property with matter"—not the way it would be put today but capturing essentially the point of the contemporary discussion leading some to revive panpsychism. But contrary to the contemporary revival,[49] Priestley rejects the conclusion that consciousness "cannot be annexed to the whole brain as a system, while the individual particles of which it consists are separately unconscious." That "a certain quantity of nervous system is necessary to such complex ideas and affections as belong to the human mind; and the idea of self, or the feeling that corresponds to the pronoun I," he argues, "is not essentially different from other complex ideas, that of our country for example." Similarly, it should not perplex us more than the fact that "life should be the property of an entirely animal system, and not the separate parts of it" or that sound cannot "result from the motion of a single particle" of air. We should recognize "that the term self denotes that substance which is the seat of that particular set of sensations and ideas of which those that are then recollected make a part, as distinct from other substances which are the seat of similar sets of sensations and ideas" and that "It is high time to abandon these random hypotheses, and to form our conclusions with respect to the faculties of the mind, as well as the properties and powers of matter, by an attentive observation of facts and cautious inferences from them," adopting the Newtonian style of inquiry while dismissing considerations of common-sense plausibility. That seems to be a reasonable stance.

Priestley urges that we also dismiss arguments based on "vulgar phraseology" and "vulgar apprehensions," as in the quest for an entity of the world picked out by the term *me* when I speak of "my body," with its hint of dualism. "According to this merely verbal argument," Priestley observes, "there ought to be something in man besides all the parts of which he consists," something beyond both soul and body, as when "a man says I devote my soul and body," the pronoun allegedly denoting something beyond body and spirit that "makes the devotion." In Rylean terms, phrases of common usage may be "systematically misleading expressions," a lively concern at the time, based on a centuries-old tradition of inquiry into the ways surface grammatical forms disguise actual meaning. Like Priestley, Thomas Reid argued that failure to attend "to the distinction between the operations of the mind and the objects of these operations" is a source of philosophical error, as in interpreting the phrase "I have an idea" on the model of "I have a diamond," when we should understand it to mean something like "I am thinking." In an earlier discussion, the encyclopedist César Chesneau du Marsais, using the same and many other examples, warned against the error of taking nouns to be "names of real objects that exist independently of our thought." The language, then, gives no license for supposing that such words as "idea," "concept," and "image" stand for "real objects," let alone "perceptible objects."[50] For similar reasons, Priestley argues that "Nothing surely can be inferred from such phraseology as ['my body'], which, after all, is only derived from vulgar apprehensions."

The need to resist arguments from "vulgar apprehensions" holds more broadly: for such phrases as "my thoughts," "my dreams," "my spirit," even "my self," which is different from myself (= me, even though in another sense, I may not be myself these days). When John thinks about himself, he is thinking about John, but not when he is thinking about his self; he can hurt himself but not his self (whatever role these curious entities play in our mental world). There's a difference between saying that his actions are betraying his true (authentic, former) self and that he's betraying himself, and "thine own self" indicates a more essential characteristic than "thyself." Inquiry into manifold questions like these, while entirely legitimate and perhaps enlightening, is concerned with the "operations of the mind," our modes of cognition and thought, and should not be misinterpreted as holding of the "real objects that exist independently of our thought." The latter is the concern of the natural sciences, and I take it also to be the prime concern of the tradition reviewed here.

The operations of the mind doubtless accommodate the thesis that "I am not identical to my body," a core assumption of substance dualism, Stephen Yablo proposes.[51] He suggests further that "substance dualism . . . has fallen strangely out of view," perhaps "because one no longer recognizes 'minds' as entities in their own right, or 'substances,'" though "*selves*—the things we refer to by use of 'I'—are surely substances, and it does little violence to the intention behind mind/body dualism to interpret it as a dualism of bodies and selves." In the tradition I am following here, it is *matter* that has lost its presumed status, and not "strangely." It is also by no means clear, as just noted, that by use of the first-person pronoun (as in "I pledge to devote my body and my soul"), or the name "John," we refer to *selves*. But truth or falsity aside, an argument would be needed to show that in using such words we refer (or even take ourselves to be referring) to real constituents of the world that exist independently of our modes of thought. An alternative, which seems to me more plausible, is that these topics belong not to natural science but rather to a branch of ethnoscience, a study of how people think about the world, a very different domain. For natural science, it seems hard to improve on Priestley's conclusion that Locke's suggestion was fundamentally accurate and that properties "termed mental" reduce to "the organical structure of the brain"—though in ways that are not understood, no great surprise when we consider the history of even the core hard sciences, like chemistry.

As noted above, with the collapse of the traditional notion of body (etc.), there are basically two ways to reconstitute some problem that resembles the traditional mind-body problem: either define *physical* or set the problem up in other terms, such as those that Priestley anticipated.

The first option is developed by Galen Strawson in an important series of publications.[52] Unlike many others, he does give a definition of "physical" so that it is possible to formulate a physical-nonphysical problem. The physical is "any sort of existent [that is] spatio-temporally (or at least temporally) located." The physical includes "experiential events" (more generally mental events) and permits formulation of the question of how experiential phenomena can be physical phenomena—a "mind-body problem" in a post-Newtonian version. Following Eddington and Russell and earlier antecedents, notably Priestley, Strawson concludes that "physical stuff has, in itself, 'a nature capable of manifesting itself as mental activity,' i.e., as experience or consciousness."

That much seems uncontroversial, given the definitions along with some straightforward facts. But Strawson intends to establish the much stronger thesis of *micropsychism* (which he identifies here with *panpsychism*): "at least some ultimates are intrinsically experience-involving." The crucial premise for that further conclusion, as Strawson makes explicit, is the No-Radical Emergence Thesis, already discussed, from which it follows that "experiential reality cannot possibly emerge from wholly and utterly non-experiential reality," a metaphysical issue, not an epistemic one. Strawson interprets Eddington's position to be *micropsychism*, citing his observation that it would be "rather silly to prefer to attach [thought] to something of a so-called 'concrete' nature inconsistent with thought, and then to wonder where the thought comes from," and that we have no knowledge "of the nature of atoms that renders it all incongruous that they should constitute a thinking object." This however appears to fall short of Strawson's micropsychism/panpsychism. Rather, Eddington seems to go no farther than Priestley's conception, writing that nothing in physics leads us to reject the conclusion that an "assemblage of atoms constituting a brain" can be "a thinking (conscious, experiencing) object." He does not, it seems, adopt the No-Radical Emergence Thesis that is required to carry the argument beyond to Strawson's conclusion. Russell too stops short of this critical step, and Priestley explicitly rejects it, regarding radical emergence as normal science. Textual interpretation aside, the issues seem fairly clearly drawn.

The second option is pursued by Daniel Stoljar, who has done some of the most careful work on physicalism and variants of the "mind-body problem." He does offer some answers to the question of what it means to say that something is *physical*[53]—a question that, he notes, has not received a great deal of attention in the literature, though "Without any understanding of what the physical is, we can have no serious understanding of what physicalism is." The answers he offers are not too convincing, I think he would agree, but he argues that it does not matter much: "we have many concepts that we understand without knowing how to analyze," and "the concept of the physical is one of the central concepts of human thought." The latter comment is correct, but only with regard to the common-sense concept of the mechanical philosophy, long ago undermined. The former is correct too, but it is not clear that we want to found a serious philosophical position on a concept that we think we understand intuitively but cannot analyze, particularly when a long history reveals that such common-sense understanding can often not withstand serious inquiry. But Stoljar's more fundamental reason for not being too concerned with characterizing the "physical" is different: the issues, he argues, should be shifted to epistemological terms, not seeking reduction to *the physical* but taking physicalism to be only the "background metaphysical assumption against which the problems of philosophy of mind are posed and discussed." Thus "when properly understood, the problems that philosophers of mind are interested in are not with the framework [itself], and to that extent are not metaphysical."

Stoljar suggests that "the problem mainly at issue in contemporary philosophy is distinct *both* from the mind-body problem as that problem is traditionally understood *and* from the problem as it is, or might be, pursued in the sciences"; a qualification, I think, is that the traditional problem, at least from Descartes through Priestley (taking his work to be the culmination of the post-Newtonian reaction to the traditional problem), can plausibly be construed as a problem within the sciences. The traditional questions "we may lump together under the heading 'metaphysics of mind,'" but contemporary philosophy Stoljar takes to be concerned with "epistemic principles" and, crucially, "*the logical problem of experience*." It might be true that "the notion of the physical fails to meet minimal standards of clarity," he writes, but such matters "play only an illustrative or inessential role in the logical problem," which can be posed "even in the absence of . . . a reasonably definite conception of the physical."[54]

The logical problem arises from the assumption that (1) there are experiential truths, while it seems plausible to believe both that (2) every such truth is entailed by (or supervenes on) some nonexperiential truth and (3) not every experiential truth is entailed by (or supervenes on) some nonexperiential truth. Adopting (1) and (2) (with a qualification, see below), the crucial question is (3). As already discussed, following a tradition tracing back to Newton and Locke, Priestley sees no reason to accept thesis (3): our "very ignorance" of the properties of post-Newtonian *matter* cautions us not to take this step. In Russell's words (which Stoljar cites), experiential truths "are not known to have any intrinsic character which physical events cannot have, since we do not know of any intrinsic character which could be incompatible with the logical properties that physics assigns to physical events." From these perspectives, then, the logical problem does not arise.[55]

Stoljar's solution to the logical problem, the new "mind-body problem," is similar to the stance of Priestley and Russell, even if put somewhat differently. It is based on his "ignorance hypothesis, according to which we are ignorant of a type of experience-relevant nonexperiential truth," so that the "logical problem of experience" unravels on epistemic grounds.[56] He suggests elsewhere that "the radical view . . . that we are ignorant of the nature of the physical or non-experiential has the potential to completely transform philosophy of mind."[57] In Strawson's formulation, the (sensible) line of thought that was well understood up to a half century ago "disappeared almost completely from the philosophical mainstream [as] analytical philosophy acquired hyperdualist intuitions even as it proclaimed its monism. With a few honorable exceptions it out-Descartesed Descartes (or 'Descartes' [that is, the constructed version]) in its certainty that we know enough about the physical to know that the experiential cannot be physical."[58]

The qualification with regard to (2) is that we cannot so easily assume that there are nonexperiential truths; in fact, the assumption may be "silly," as Eddington put it. Some physicists have reached such conclusions on quantum-theoretic grounds. The late John Wheeler argued that the "ultimates" may be just "bits of information," responses to queries posed by the investigator. "The actual events of quantum theory are experienced increments in knowledge" (H. P. Stapp).[59] Russell's three grades of certainty suggest other reasons for skepticism. At the very least, some caution is necessary about the legitimacy even of the formulation of the "logical problem."

Stoljar invokes the ignorance hypothesis in criticizing C. D. Broad's conclusions about the irreducibility of chemistry to physics, a close analogue to the Knowledge Argument, he observes. He concludes that Broad was unaware "that chemical facts follow from physical facts," namely the quantum-theoretic facts.[60] But putting the matter that way is somewhat misleading. What happened is that physics radically changed with the quantum-theoretic revolution, and with it the notion of "physical facts." A more appropriate formulation, I think, is to recognize that post Newton, the concept "physical facts" means nothing more than what the best current scientific theory postulates and hence should be seen as a rhetorical device of clarification adding no substantive content. The issue of physicalism cannot be so easily dispensed with. Like Marx's old mole, it keeps poking its nose out of the ground.

There are also lesser grades of mystery worth keeping in mind. One of particular interest to humans is the evolution of their cognitive capacities. On this topic, the evolutionary biologist Richard Lewontin has argued forcefully that we can learn very little, because evidence is inaccessible, at least in any terms understood by contemporary science.[61] For language, there are two fundamental questions in this regard: first, the evolution of the capacity to construct an infinite range of hierarchically structured expressions interpretable by our cognitive and sensorimotor systems; and second, the evolution of the atomic elements, roughly word-like, that enter into these computations. In both cases, the capacities appear to be specific to humans, perhaps even specific to language, apart from the natural laws they obey, which may have rather far-reaching consequences, recent work suggests. I think something can be said about the first of these questions, the evolution of the generative mechanisms. One conclusion that looks increasingly plausible is that externalization of language by means of the sensorimotor system is an ancillary process and also the locus of much of the variety and complexity of language. The evolution of atoms of computation, however, seems mired in mystery, whether we think of them as concepts or lexical items of language. In symbolic systems of other animals, symbols appear to be linked directly to mind-independent events. The symbols of human language are sharply different. Even in the simplest cases, there is no word-object relation, where objects are mind-independent entities. There is no reference relation, in the technical sense familiar from Frege and Peirce to contemporary externalists. Rather, it appears that we should adopt something like the approach of the seventeenth- and eighteenth-century cognitive revolution and the conclusions of Shaftesbury and Hume that the "peculiar nature belonging to" the linguistic elements used to refer is not something external and mind independent. Rather, their peculiar nature is a complex of perspectives involving Gestalt properties, cause and effect, "sympathy of parts" directed to a "common end," psychic continuity, and other such mental properties. In Hume's phrase, the "identity, which we ascribe" to vegetables, animal bodies, artifacts, or "the mind of man"—the array of individuating properties—is only a "fictitious one," established by our "cognoscitive powers," as they were termed by his seventeenth-century predecessors. That is no impediment to interaction, including the special case of communication, given largely shared cognoscitive powers. Rather, the semantic properties of words seem similar in this regard to their phonetic properties. No one is so deluded as to believe that there is a mind-independent object corresponding to the internal syllable [ba], some construction from the motion of molecules perhaps, which is selected when I say [ba] and when you hear it. But interaction proceeds nevertheless, always a more-or-less rather than a yes-or-no affair.[62]

There is a lot to say about these topics, but I will not pursue them here, merely commenting that in this case too there may be merit to Strawson's conclusion that "hyperdualist intuitions" should be abandoned along with the "certainty that we know enough about the physical to know that the experiential cannot be physical" and Stoljar's suggestion that "the radical view" might transform philosophy of mind and language, if taken seriously.

Returning finally to the core example of Cartesian science, human language, Gassendi's advice to seek a "chemical-like" understanding of its internal nature has been pursued with some success, but what concerned the Cartesians was something different: the creative use of language, what Humboldt later called "the infinite use of finite means," stressing *use*.[63]

There is interesting work on precepts for language use under particular conditions—notably the intent to be informative, as in neo-Gricean pragmatics—but it is not at all clear how far this extends to the normal use of language, and in any event, it does not approach the Cartesian question of creative use, which remains as much of a mystery now as it did centuries ago and may turn out to be one of those ultimate secrets that ever will remain in obscurity, impenetrable to human intelligence.

NOTES

1. David Hume, *The History of England*, VI, LXXI. John Locke, *An Essay Concerning Human Understanding*, book 4, chap. 3. Locke's reasons, of course, were not Hume's but relied on the boundaries of "the simple ideas we receive from sensation and reflection," which prevent us from comprehending the nature of body or mind (spirit).

2. R. Baillargeon, "Innate Ideas Revisited: For a Principle of Persistence in Infants' Physical Reasoning," *Perspectives on Psychological Science* 3 (2008): 2–13.

3. B. Cohen, *Revolution in Science* (Cambridge, Mass.: Harvard University Press, 1985), 155.

4. E. McMullin, *Newton on Matter and Activity* (Notre Dame, Ind.: University of Notre Dame Press, 1978), 52ff. He concludes that because of Newton's vacillation in use of the terms "mechanical," "spirit," and others, it is "misleading . . . to take Newton to be an exponent of the 'mechanical philosophy'" (73).

5. Locke, *An Essay Concerning Human Understanding*. Correspondence with Stillingfleet cited by Ben Lazare Mijuskovic, *The Achilles' Heel of Rationalist Arguments* (The Hague: Martinus Nijhoff, 1974), 73. On the development of "Locke's suggestion" through the eighteenth century, culminating in Joseph Priestley's important work (discussed below), see John Yolton, *Thinking Matter* (Minneapolis: University of Minnesota Press, 1983).

6. Pierre-Jean-George Cabanis, *On the Relations Between the Physical and Moral Aspects of Man*, vol. 1 (1802; repr. Baltimore, Md.: The Johns Hopkins University Press, 1981). Darwin cited

by V. S. Ramachandran and Sandra Blakeslee, *Phantoms in the Brain* (New York: William Morrow, 1998), 227.

7. *Principia*, General Scholium.

8. E. J. Dijksterhuis, *The Mechanization of the World Picture* (Oxford: Oxford University Press, 1961; Princeton, N.J.: Princeton University Press, 1986), 479–480.

9. Letter to Bentley, 1693. Cited in McMullin, *Newton on Matter and Activity*, 488. See chap. 3 of McMullin's volume for more detailed analysis.

10. Thomas Nagel, *Other Minds* (Oxford: Oxford University Press, 1995), 106.

11. For varying perspectives on the "explanatory gap," see essays in Galen Strawson et al., *Consciousness and Its Place in Nature* (Exeter: Imprint Academic, 2006).

12. T. Kuhn, *The Copernican Revolution* (New York: Random House, 1957), 259. Heinrich Hertz cited by McMullin, *Newton on Matter and Activity*, 124.

13. Dijksterhuis, *The Mechanization of the World Picture*, 489.

14. Joseph Glanvill; see John Henry, "Occult Qualities and the Experimental Philosophy," *History of Science* 24 (1986). R. Popkin, *The History of Skepticism from Erasmus to Spinoza* (Berkeley: University of California Press, 1979), 139–140, 213.

15. B. Russell, *Analysis of Matter* (London: Allen and Unwin, 1927; repr. New York: Dover, 1954), 18–19, 162. P. Dirac, *Principles of Quantum Mechanics* (Oxford: Oxford University Press, 1930), 10, brought to my attention by John Frampton.

16. P. Machamer, introduction and "Galileo's Machines, His Mathematics, and His Experiments," in P. Machamer, ed., *The Cambridge Companion to Galileo* (Cambridge: Cambridge University Press, 1998).

17. Ibid. Cited by Pietro Redondi, "From Galileo to Augustine." D. Stoljar, *Ignorance and Imagination* (Oxford: Oxford University Press, 2006). Recall that Newton hoped that there might be a scientific (that is, mechanical) solution to the problems of matter and motion.

18. On these topics, see my *Cartesian Linguistics* (New York: Harper & Row, 1966); third edition, edited by James McGilvray, with introduction, full translations, and quotes from updated scholarly editions (Cybereditions, forthcoming); and *Language and Mind* (New York: Harcourt Brace Jovanovich, 1968), chap. 1. Note that the concerns go far beyond indeterminacy of free action, as is particularly evident in the experimental programs by Cordemoy and others on "other minds"; see *Cartesian Linguistics*.

19. Letter to Queen Christina of Sweden, 1647; *Principles of Philosophy*. For discussion, see Tad Schmaltz, *Malebranche's Theory of the Soul* (Oxford: Oxford University Press, 1996), 204ff.

20. See my "Turing on the 'Imitation Game,'" in Stuart Schieber, ed., *The Turing Test* (Cambridge, Mass.: The MIT Press, 2004).

21. D. Clarke, *Descartes' Theory of Mind* (Oxford: Oxford University Press, 2003), 12. See also Descartes' 1641 letter to Mersenne on the goal of the *Meditations*, cited by Margaret Wilson, *Descartes* (1978), 2.

22. Clarke, *Descartes' Theory of Mind*, 258.

23. Kanwisher and Downing, "Separating the Wheat from the Chaff," *Science* 282 (October 2, 1998). Newton, *General Scholium*.

24. E. Kandel and L. Squire, "Neuroscience," *Science* 290 (2000): 1113–1120. C. R. Gallistel, "Neurons and Memory," in *Conversations in the Cognitive Neurosciences*, ed. M. Gazzaniga (Cambridge, Mass.: The MIT Press, 1997); "Symbolic Processes in the Insect Brain," in *Methods, Models, and Conceptual Issues: An Invitation to Cognitive Science*, ed. D. Scarborough and S. Sternberg, vol. 4 (Cambridge, Mass.: The MIT Press, 1998). S. Zeki, "Art and the Brain," *Daedalus* 127 (1998).

25. Nagel, *Other Minds*. For some cautionary notes on "sharp logical separation between the nervous system and the rest of the organism," see Charles Rockland, "The Nematode as a

Model Complex System," Working Paper (LIDS-WP-1865), Laboratory for Information and Decisions Systems, MIT (April 14, 1989): 30.

26. Henry, "Occult Qualities and the Experimental Philosophy." Alan Kors, "The Atheism of D'Holbach and Naigeon," in *Atheism from the Reformation to the Enlightenment*, ed. M. Hunger and D. Wootton (Oxford: Oxford University Press, 1992). Locke, *An Essay Concerning Human Understanding*; Yolton, *Thinking Matter*, 199. Voltaire, Kant, McMullin, *Newton on Matter and Activity*, 113, 122–123, from Kant's *Metaphysical Foundations of Natural Science*, 1786; Michael Friedman, "Kant and Newton: Why Gravity Is Essential to Matter," in *Philosophical Perspectives on Newtonian Science*, ed. P. Bricker and R. I. G. Hughes (Cambridge, Mass.: The MIT Press, 1990). Howard Stein, "On Locke, 'the Great Huygenius, and the incomparable Mr. Newton,'" in *Philosophical Perspectives on Newtonian Science*. Friedman argues that there is no contradiction between Newton and Kant because they do not mean the same thing by "essential," Kant having discarded Newton's metaphysics and making an epistemological point within his "Copernican revolution in metaphysics."

27. F. Lange, *Geschichte des Materialismus und Kritik seiner Bedeutung in der Gegenwart* (1865), translated as *The History of Materialism*, 3rd expanded ed. (London: Kegan Paul, 1925). A. Koyré, *From the Closed World to the Infinite Universe* (Baltimore, Md.: The Johns Hopkins University Press, 1958), 210.

28. G. Coyne, "The Scientific Venture and Materialism: False Premises," in *Space or Spaces as Paradigms of Mental Categories* (Fondazione Carlo Erba, 2000).

29. Russell, *Analysis of Matter*, chap. 37. Russell did not work out how percepts in their cognitive aspect were assimilated into the "causal skeleton of the world," leaving him open to a counterargument by mathematician Max Newman. See Russell's letter to Newman (April 24, 1928), in *The Autobiography of Bertrand Russell*, vol. 2: *1914–1944* (Boston: Little Brown, 1967).

30. Democritus, quoted by Erwin Schrödinger, *Nature and the Greeks* (Cambridge: Cambridge University Press, 1954), 89. Brought to my attention by Jean Bricmont.

31. D. Stoljar and Y. Nagasawa, introduction to Peter Ludlow, Yujin Nagasawa, and Daniel Stoljar, *There's Something About Mary* (Cambridge, Mass.: The MIT Press, 2004).

32. For Hume, see John Mikhail, *Rawls' Linguistic Analogy: A Study of the "Generative Grammar" Model of Moral Theory Described by John Rawls in* A Theory of Justice (Ph.D. diss., Ithaca, N.Y., Cornell University, 2000); *Moral Grammar: Rawls' Linguistic Analogy and the Cognitive Science of Moral Judgment* (Cambridge: Cambridge University Press, forthcoming); "Universal Moral Grammar: Theory, Evidence, and the Future," *Trends in Cognitive Sciences* (April 2007). On the irrelevance (and, as it is formulated, even incoherence) of the doctrine of "accessibility to consciousness, see my *Reflections on Language* (New York: Pantheon, 1975), *Rules and Representations* (New York: Columbia University Press, 1980), and *New Horizons in the Study of Language and Mind* (Cambridge: Cambridge University Press, 2000). On the rules of visual perception, inaccessible to consciousness in the interesting cases, see Donald Hoffman, *Visual Intelligence* (New York: Norton, 1998).

33. F. Jackson, "What Mary Didn't Know," "Postscript," in Ludlow et al., *There's Something About Mary*.

34. C. S. Peirce, "The Logic of Abduction," in *Peirce's Essays in the Philosophy of Science*, ed. V. Tomas (New York: Liberal Arts Press, 1957). See my *Language and Mind*, 90ff., for a discussion of his proposals and fallacies invoking natural selection that lead him to the ungrounded (and implausible) belief that our "guessing instinct" leads us to true theories.

35. Cited by Wilson, *Descartes*, 95.

36. Hume, *Inquiry*, 2.1. On dubious modern efforts to formulate what had been a reasonably clear project before the separation of philosophy from science, see my *New Horizons*, 79–80, 144–145, and generally chaps. 5–6 (reprinted from *Mind* [1995]: 104, 1–61).

37. Joseph Black and Robert Schofield, *Mechanism and Materialism* (Princeton, N.J.: Princeton University Press, 1970), 226; William Brock, *The Norton History of Chemistry* (New York: Norton, 1993), 271. A. Thackray, *Atoms and Powers* (Cambridge, Mass.: Harvard University Press, 1970), 37–38, 276–277.

38. Brock, *The Norton History of Chemistry*. For sources and further discussion, see my *New Horizons* and *Knowledge of Language* (New York: Praeger, 1986), 251–252. David Lindley, *Boltzmann's Atom* (New York: The Free Press, 2001). Some argue that even if quantum-theoretic unification succeeds, "in some sense the program of reduction of chemistry to [the new] physics fails," in part because of "practical issues of intractability." Maureen Christie and John Christie, "'Laws' and 'Theories' in Chemistry Do Not Obey the Rules," in *Of Minds and Molecules*, ed. Nalin Bhushan and Stuart Rosenfield (Oxford: Oxford University Press, 2000).

39. Russell, *Analysis of Matter*, 388.

40. See references in note 32, above. Sometimes misunderstanding and distortion reach the level of the surreal. For some startling examples, see my contribution to the Symposium on Margaret Boden, "Mind as Machine: A History of Cognitive Science, Oxford, 2006," *Artificial Intelligence* 171 (2007): 1094–1103 (Elsevier), http://www.sciencedirect.com. On "the rigidity rule and [Shimon] Ullman's theorem," see Hoffman, *Visual Intelligence*, 159. Needless to say, the rule is inaccessible to consciousness.

41. V. Mountcastle, in *Daedalus* (Spring 1988). For sources, see my *New Horizons*, chap. 5.

42. J. Priestley, "Materialism," from *Disquisitions Relating to Matter and Spirit* (1777). In John Passmore, ed., *Priestley's Writings on Philosophy, Science, and Politics* (New York: Collier-MacMillan, 1965).

43. Similar ideas appear pre-Newton, particularly in the *Objections to the Meditations*, where critics ask how Descartes can know, "without divine revelation . . . that God has not implanted in certain bodies a power or property enabling them to doubt, think, etc." Catherine Wilson, in Strawson et al., *Consciousness and Its Place in Nature*.

44. Priestley, "Materialism." Later discussion, Yolton, *Thinking Matter*, 113. Similar conclusions had been drawn by La Mettrie a generation earlier but in a different framework and without addressing the Cartesian arguments to which he is attempting to respond. The same is true of Gilbert Ryle and other modern attempts. For some discussion, see my *Cartesian Linguistics*.

45. For discussion and illustrations, see my *New Horizons*. Strawson, below, on "hyperdualism."

46. Thackray, *Atoms and Powers*, 190. Priestley's reasons for welcoming "this extreme development of the Newtonian position" were primarily theological, Thackray concludes. Yolton, *Thinking Matter*, 114.

47. Yolton, *Thinking Matter*, 125. See chaps. 5–6 for discussion. Yolton writes that "there was no British La Mettrie," but that exaggerates La Mettrie's contribution, I believe. See n. 44, above.

48. Nagel, *Other Minds*. Strawson, "Realistic Monism" and "Reply," in Strawson et al., *Consciousness and Its Place in Nature*. Printer's errors corrected. See essays in this volume for further discussion.

49. Priestley, "Materialism." Strawson and commentary.

50. See my *Aspects of the Theory of Syntax* (Cambridge, Mass.: The MIT Press, 1965), 199–200, and for much more extensive discussion, *Cartesian Linguistics*. On the accuracy of interpretations of the empiricist theory of ideas by Reid and others, see John Yolton, *Perceptual Acquaintance from Descartes to Reid* (Minneapolis: University of Minnesota Press, 1984), chap. 5.

51. S. Yablo, "The Real Distinction Between Mind and Body," *Canadian Journal of Philosophy*, suppl. vol. 16.

52. Quotes here from "Realistic Monism" and "Reply," in Strawson et al., *Consciousness and Its Place in Nature*.

53. Quotes in this paragraph from Stoljar, "Physicalism," in the *Stanford Encyclopedia of Philosophy* (2001).

54. Stoljar, *Ignorance and Imagination*.

55. Stoljar, *Ignorance and Imagination*, 17ff., chap. 2, 56–57, 104. Stoljar understands the "traditional problem" to be derived from the *Meditations* (45), hence not a problem of the sciences. But though a conventional reading, it is questionable, for reasons already discussed.

56. Stoljar, *Ignorance and Imagination*, chap. 4.

57. Stoljar, in Strawson et al., *Consciousness and Its Place in Nature*.

58. Strawson, "Realistic Monism," n. 21.

59. J. Wheeler, *At Home in the Universe* (American Institute of Physics, 1994), vol. 9 of *Masters of Modern Physics*. Stapp, in Strawson et al., *Consciousness and Its Place in Nature*.

60. Stoljar, *Ignorance and Imagination*, 139.

61. R. Lewontin, "The Evolution of Cognition: Questions We Will Never Answer," in *Methods, Models, and Conceptual Issues: An Invitation to Cognitive Science*.

62. Chomsky, *Cartesian Linguistics*, 94ff.; and McGilvray's introduction, on Cartesian and neo-Platonist conceptions of the role of "cognoscitive powers." For review and sources on referring, see *New Horizons*. For Shaftesbury, Hume, and forerunners, see Mijuskovic, *The Achilles' Heel of Rationalist Arguments*.

63. On misunderstandings about this matter, see my "A Note on the Creative Aspect of Language Use," *Philosophical Review* 41, no. 3 (July 1982).