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TOWARD A REVOLUTION IN THE MIND SCIENCES

DEFERRED DEVELOPMENT

For millennia before Galileo (1564–1642), people throughout the world gazed at the starry skies with unaided vision and sought to understand the correlations between celestial and terrestrial phenomena. Multiple systems of astrology were the fruits of their labors, but the modern science of astronomy remained beyond reach. For centuries, mathematicians sought to understand the movements of celestial bodies in accordance with the dominant worldviews of their times. But even the heliocentric system devised by Copernicus (1473–1543) was widely regarded as simply one more plausible mathematical model, for it was not experimentally better than Ptolemy's (c. 90–168 C.E.) geocentric model. It was Galileo who introduced advanced technology for observing celestial phenomena, and his empiricism soon triumphed over the rationalism of his predecessors. The modern science of astronomy had begun.

Galileo's astronomical use of the telescope was a pivotal point in the first revolution in the physical sciences, which began with the publication of Copernicus's work *On the Revolutions of the Heavenly Spheres* in 1543 and culminated with the publication of Newton's (1643–1727) masterpiece, *Mathematical Principles of Natural Philosophy,* in 1687. After decades of rigorous observations of biological phenomena, Charles Darwin (1809–82)

initiated a revolution in the life sciences in 1859 with the publication of his first classic, *On the Origin of Species*. This revolution took on momentum in the 1930s when Darwin's views were synthesized with Mendelian genetics, and it has culminated in the Human Genome Project and commercial applications of genetic engineering.

The start of scientific study of the mind is dated to 1875, the year that Wilhelm Wundt (1831–1920) and William James independently established the first experimental psychology laboratories in Germany and the United States. The natural sciences were at a crossroads. Over the preceding three centuries, scientists had made dramatic advances in quantitative observations of objective physical phenomena that are independent of the human mind. Now they were faced with the challenge of studying mental phenomena, which are subjective, immeasurable with technological instruments, and difficult for multiple researchers to verify. With no scientifically rigorous means of observing mental phenomena themselves, the safest approach was to focus on the physical correlates of mental phenomena, such as neural activity and behavioral expressions.

Wundt argued for the indispensability of extending the scientific method by "perfecting our inner observation" so that introspection could be rigorously applied to the scientific study of the mind.[1] James envisioned psychology as a science of mental phenomena, including thoughts, emotions, memories, desires, volitions, perceptions, and all other conscious and unconscious mental processes.[2] He proposed a threefold approach, including the *indirect* study of the mind by way of behavior and neural correlates, and the *direct* study of mental phenomena themselves. Within this strategy, he declared that one should rely "first and foremost and always" on introspection, which is the sole means by which mental phenomena—and not just their objective physical correlates—can be observed.[3] James was aware of the many formidable problems in adopting introspection as a viable means of scientific inquiry,[4] but he was convinced that this was necessary in order to expand the scientific worldview to fully incorporate both subjective and objective phenomena.

Shortly after James's death, however, American behaviorist John B. Watson (1878–1958) set the new science of mind on what he perceived as a more conservative course by equating psychology with the study of objective, physical, quantitatively measurable human behavior. Watson argued that psychology must "bury subjective subject matter [and] in-

trospective method."[5] Throughout the history of science, new methods of observation have been devised for investigating a wide variety of natural phenomena. But over the past century, the cognitive sciences have devised no rigorous means of examining mental phenomena. The revolution in the mind sciences proposed by Wundt and James never took place, and scientific methods for directly observing mental phenomena have barely surpassed folk psychology. Although behaviorism, cognitive psychology, and the neurosciences have made many advances in understanding the mind, there has been no revolution in the 130-year history of the mind sciences comparable to the revolutions in the physical and life sciences.

THE NEW SCHOLASTICISM

For centuries preceding Galileo, natural philosophy was dominated by the ideological constraints of medieval scholasticism. As a result of Aquinas's (1225–74) grand unification of biblical theology and Aristotelian philosophy, it was assumed that the general principles of nature were already well known. The ideology of scholasticism dictated which ways of thinking were "reasonable," and the authority of the Bible and Aristotle (384–322 B.C.E.) determined what kinds of experience qualified as reliable empirical evidence.

Galileo challenged the prevailing ideology by insisting that empirical evidence, based on meticulous observation and experiment, should be rationally analyzed and evaluated without the constraints of medieval dogma. Revolutionary ways of understanding the world are threatening and painful to those who are rigidly committed to the ways of the past, and Galileo's theories met with fierce resistance. Darwin faced similar opposition when he presented his empirically based theory of natural selection, which contradicted the biblical account of the creation of species. But physics and biology have prevailed over the dogmas of the past, radically shifting our understanding of the nature of matter and life in the universe.

In his insistence on the primacy of the direct observation of mental phenomena, James expressed the revolutionary spirit of empiricism in the tradition of Galileo and Darwin. But he challenged the methodologi-

cal constraints and materialistic assumptions of the prevailing mechanistic view of the universe. By 1820, classical mechanics had developed to such an extent that Pierre-Simon Laplace (1749–1827) cogently argued for a deterministic universe governed entirely by physical forces.[6] In 1847, Hermann von Helmholtz (1821–94) presented his seminal paper on the mathematical principles governing the conservation of energy,[7] whereby all nonphysical causation was excluded from the natural world. And in 1864, James Clerk Maxwell (1831–18) presented his famous equations describing the propagation of electromagnetic fields. This explanation was based on a physical medium, the "luminiferous ether," as well as an absolute frame of reference. By 1875, when experimental psychology formally began, the mechanistic view of the universe was held by many scientists to be the ultimate explanation of the nature of reality.

But such confidence proved to be short-lived. In 1887, the existence of a mechanical medium for the propagation of energy fields in empty space was disproved by the renowned Michelson-Morley experiment. Since then, electromagnetic fields have been explained in terms of mathematical abstractions alone; they can no longer be conceptualized as material stuff oscillating in empty space. In 1905, Albert Einstein (1879–1955) published his special theory of relativity, overthrowing long-standing beliefs in the absolute nature of time and space as well as the existence of the luminiferous ether. Twentieth-century advances in quantum physics have supplanted Laplace's physical determinism, and insights into nonlocality and quantum entanglement have refuted the assumption that causality is confined to local, mechanical interactions. The unresolved "measurement problem" in quantum physics challenges the very existence of elementary particles with mass and energy existing independently of a system of measurement. The Heisenberg uncertainty principle demonstrates that the conservation of energy is not nearly as airtight as was previously assumed. And current theories of quantum field theory, quantum cosmology, and string theory force us to question the notion of a universe constituted of absolutely objective matter.

As a result of advances in physics at the end of the nineteenth century, the incompatibility of theism and mechanistic materialism had become increasingly apparent not only to scientists but to other intellectuals as well. In 1882, Friedrich Nietzsche (1844–1900) proclaimed "God is dead," which was his provocative way of describing the popular rejection of ab-

solute values: people no longer believed in a cosmic order. Nietzsche felt this would lead to nihilism, a disaster that could be avoided only if human values were newly established on a natural basis that transcended a world of mindless matter. Similarly, as a result of advances in physics at the end of the twentieth century, the antiquated nature of nineteenth-century materialism is becoming increasingly apparent. Steven Weinberg, for example, has taken a position tantamount to declaring that matter is dead: "In the physicist's recipe for the world, the list of ingredients no longer include[s] particles."[8] He asserts that "matter thus loses its central role in physics."[9]

Although nineteenth-century physics appeared to corroborate the atomism of Democritus, the twentieth-century revolution in physics has reduced matter to mathematical abstractions, or ideas. Werner Heisenberg concluded, "With regard to this question, modern physics takes a definite stand against the materialism of Democritus and for Plato and the Pythagoreans."[10] Many of the beliefs of mechanistic materialism have now been rejected, and the absolute Cartesian separation of subject and object has been challenged scientifically and philosophically. The renowned experimental physicist Anton Zeilinger sums up this radical shift in his comment that "one may be tempted to assume that whenever we ask questions of nature, . . . there is reality existing independently of what can be said about it. We will now claim that such a position is void of any meaning."[11]

Remarkably, well into the eighteenth century—long after the groundbreaking discoveries of Kepler, Galileo, and Newton—Aristotelian physics was taught in the great universities of Europe as if the first revolution in physics had never occurred. Most of the innovators conducted research outside the universities, under the auspices of independent organizations such as the Royal Society.[12] Nowadays, it is equally odd that virtually all contemporary university undergraduate and graduate courses in psychology and neuroscience are based on the physics that was current in 1875, neglecting the second revolution in physics!

Some physicists argue that the startling discoveries of quantum physics have no relevance for the study of the mind and brain.[13] If this is true, it certainly makes the work of the cognitive sciences easier. But a growing number of distinguished physicists are beginning to challenge this view, proposing that consciousness may play a far more fundamental role in

the natural world than was previously assumed.[14] Research is ongoing and the debate continues, but little news of this controversy penetrates departments of psychology and neuroscience.

With the rise of behaviorism in the early twentieth century, the cognitive sciences entrenched themselves in the mechanistic worldview of the preceding century while distancing themselves from the revolutionary empiricism of William James. John Watson, for example, declared in 1913 that psychology must "never use the terms consciousness, mental states, mind, content, introspectively verifiable, imagery, and the like."[15] The most influential proponent of behaviorism, B. F. Skinner (1904–90), continued to argue forty years later that since mental phenomena lack physical qualities, they have no existence whatsoever.[16] Rarely in human history has allegiance to dogma so flagrantly violated experience.

Although few scientists and philosophers today are this brazen in their dismissal of mental phenomena, the specter of nineteenth-century materialism continues to haunt the classrooms and laboratories of the cognitive sciences. In various ways, subjective experiences have been granted provisional membership in nature, but only if it can be shown that—despite appearances—they are equivalent to objective physical phenomena that operate according to the laws of nineteenth-century physics. Philosopher John Searle, for example, proposes that conscious states are equivalent to "higher order physical processes in the brain."[17] But the neural correlates of consciousness have not yet been identified, so his declaration that states of consciousness are identical to hypothetical physical processes in the brain illuminates nothing except his materialistic assumptions. Owen Flanagan suggests that mental phenomena misleadingly *appear* to be nonphysical, but they are actually "realized" as neural events, which are their "essential nature."[18] There is overwhelming evidence that specific neural events *cause* specific mental events, but there is no compelling empirical evidence indicating that mental phenomena are themselves *identical* to their neural correlates, despite common claims to that effect.[19] Cristof Koch is one of many neuroscientists who have expressed skepticism about the equivalence of brain states and mental phenomena: "Are they really one and the same thing, viewed from different perspectives? The characters of brain states and of phenomenal states appear too different to be completely reducible to each other."[20] When we objectively observe brain states, they exhibit none of the characteristics of mental states, and when

we subjectively observe mental states, they display none of the characteristics of brain activity. It makes little sense to say that an effect is realized as its cause. So Flanagan's assertion reveals nothing apart from his belief that mental processes can't be admitted into the natural world unless they qualify as physical processes.

DOUBLE DOUBLETHINK

In his landmark science fiction novel *Nineteen Eighty-Four,* George Orwell introduced two terms that illuminate the parallels between medieval scholasticism and contemporary materialism. He explains "crimestop," the first of these terms, as follows:

> *Crimestop* means the faculty of stopping short, as though by instinct, at the threshold of any dangerous thought. It includes the power of not grasping analogies, of failing to perceive logical errors, of misunderstanding the simplest arguments if they are inimical to Ingsoc [English Socialism], and of being bored or repelled by any train of thought which is capable of leading in a heretical direction. *Crimestop*, in short, means protective stupidity.[21]

The second term, "doublethink," is defined in this passage:

> *Doublethink* means the power of holding two contradictory beliefs in one's mind simultaneously, and accepting both of them. The Party intellectual knows in which direction his memories must be altered; he therefore knows that he is playing tricks with reality; but by the exercise of *doublethink* he also satisfies himself that reality is not violated. The process has to be conscious, or it would not be carried out with sufficient precision, but it also has to be unconscious, or it would bring with it a feeling of falsity and hence of guilt.[22]

The notions of crimestop and doublethink are relevant to modern materialistic beliefs about the nature of human identity and volition. For example, in his book *The Illusion of Conscious Will,* psychologist Daniel M.

Wegner writes, "it seems to each of us that we have conscious will. It seems we have selves. It seems we have minds. It seems we are agents. It seems we cause what we do . . . it is sobering and ultimately accurate to call all this an illusion."[23] With all the authority of a highly respected Harvard professor, Wegner reduces human identity, the human mind, and all acts of volition to illusions with no basis in reality. This view is shared by radically materialistic philosophers of mind, such as Patricia Churchland, who comments, "there is an appearance of a mind, or of a self, but there is no such thing. There is an appearance of a flat earth, but it is no such thing."[24]

According to a common materialistic viewpoint, human beings are identical to our brains and all our activities are governed by the laws of physics, so the experience of choosing is an illusion. Given the limitations of the current scientific understanding of consciousness, these assertions are simply beliefs, determined in large part by inductive reasoning based on nineteenth-century materialism. Current empirical evidence and rational analysis do not compel anyone to accept these statements; those who have adopted them have *chosen* to do so, although they may feel they have no alternative.

In a meeting of a group of neuroscientists with the Dalai Lama in 1989, a group of distinguished cognitive scientists unanimously claimed that human beings are equivalent to human brains. The Dalai Lama then asked them collectively whether, as scientists conducting neuroscientific research in their laboratories, they ever experienced a spontaneous feeling of affection for the brain itself as they would for a loved one. The scientists immediately responded that they did love brains. But as the import of his question began to sink in, their ensuing responses were clear expressions of doublethink and crimestop, as the scientists sought to defend their materialist convictions while remaining true to their own personal experience.[25] This raises the underlying question: Are even the most committed materialists actually able to regard themselves and their loved ones as mindless biological robots who never make any decisions and whose every act is determined by impersonal biochemical processes operating according to the laws of physics?

Some contemporary philosophers of mind, such as Searle and Flanagan, have sought to reconcile a vestige of free will and human dignity with the depersonalizing and demoralizing implications of materialism.[26] Their deductive reasonings are displays of human ingenuity on a par with

medieval theologians' attempts to reconcile their beliefs in predestination with their unquestioning belief in a merciful and omnipotent God. If, as Antonio Damasio claims, human beings are nothing more than "brains that have a body on their backs,"[27] human volition can be scientifically understood in only one of two ways. Either the brain behaves deterministically in accordance with the laws of classical physics, or it functions with a mixture of strict causality and chaos in accordance with the laws of quantum mechanics and chaos theory. Neither alternative provides a viable basis for devising a materialistic justification for human volition, moral responsibility, or free will.

Physics evolved beyond the absolute determinism of Laplace not by deductive, philosophical reasoning, but by progress in the empirical study of physical phenomena. Likewise, if scientists wish to understand the nature of choice and volition, they must depend upon rigorous observation of the mental processes of choice and volition along with the study of their neural and behavioral correlates. Unless they refine the empirical examination of mental phenomena themselves, the scientific understanding of human volition and the possibility of freedom will remain as ideologically bound as medieval theology.

OBSTACLES TO A REVOLUTION IN THE MIND SCIENCES

In his remarkable book *The Discoverers: A History of Man's Search to Know His World and Himself*, Daniel J. Boorstin declares that "illusions of knowledge," not mere ignorance, have always acted as the greatest impediments to scientific discovery.[28] In the past, these illusions of knowledge were often traced to religious beliefs and philosophical speculations. But now the primary obstacles to discovering the origins, nature, and potentials of human consciousness lie in the illusions of knowledge of mechanistic materialism. If the mind is not physical, says the authority of nineteenth-century materialism, there is no way it can exert causal influences on the body or anything else in the natural world. But no instruments of technology, which are designed to measure physical phenomena, are capable of detecting consciousness. And when mental phenomena are directly

observed by means of introspection, they display no physical attributes, such as physical location, spatial dimension, or mass. Nevertheless, cognitive scientists are almost unanimous in their insistence that the mind must be "physical," even if they have only the fuzziest idea of what that term means in modern physics.[29]

Antonio Damasio expresses an ideal held by many of his peers when he declares that neuroscientists are absolutely committed to the goal of devising a comprehensive account of subjective experience purely in terms of neural activity as described by the current tools of neurobiology.[30] In the view of such scientists, mental phenomena are unexplained until they have been thoroughly understood in the language of biology on the basis of physical observations. Subjective experience must be stuffed into the box of objective reality before it can be considered to be real. The taboo of subjectivity continues to exert a powerful, ubiquitous influence on the natural sciences to this day.[31]

The notion of devising a comprehensive account of mental phenomena purely in terms of neurobiology ignores the fact that biology alone does not define, predict, or explain the emergence of mental phenomena in living organisms, nor are such phenomena detected with any of the current tools of biological science. In the objective language of biology, such subjective terms as "thought," "emotion," and "consciousness" have no meaning. They acquire meaning only from the first-person experience of mental phenomena. Ever since the rise of behaviorism in the early twentieth century, such first-person experience has been marginalized or denied altogether. Despite more than a century of domination of psychology by biology, cognitive scientists still have no scientific definition of consciousness and no objective means of detecting mental phenomena; even the neural correlates of consciousness have yet to be discovered. Many of the neural causes of mental processes have been discovered in humans and other animals, but no one knows whether such organic processes are universally necessary for the generation of mental states. Research in artificial intelligence, for example, has not yet determined whether consciousness can be produced in nonorganic, physical systems. So cognitive scientists have not yet identified the universally necessary causes of conscious mental states, much less their sufficient causes. Finally, the "hard problem" of how the brain generates or even influences

mental phenomena remains just as elusive as the problem of how mental events influence the brain.

Commitment to biological reductionism regarding the mind is almost universal among cognitive scientists, but the successes resulting from this ideological commitment have been limited. The underlying assumption that a comprehensive account of biological processes can be devised purely in terms of physics ignores the fact that physics alone does not define, predict, or explain the emergence of living organisms in the universe. In the language of physics, such terms as "alive," "dead," "healthy," and "sick" are meaningless. They acquire meaning only from third-person observations of living organisms and first-person experiences of being alive. The view that the first living organisms evolved spontaneously from nonliving chemical processes is almost universal among biologists. But scientists have been just as unsuccessful in creating living organisms from nonliving chemical compounds as they have been in generating consciousness in computers.

Galileo, a devout Roman Catholic, granted his church authority regarding theological issues, such as the nature of the Trinity, heaven, hell, and the human soul, but he denied its authority regarding the objective physical world. Neither Christian theology nor Aristotelian philosophy had devised sophisticated means for the experimental observation of physical phenomena, and a growing number of their assertions were being proved wrong by the empirical discoveries of Galileo and his contemporaries. Likewise, today's advocates of a new empiricism in the study of the mind may remain committed to science, granting biologists authority regarding the neurobiological and behavioral correlates of mental phenomena while denying biologists ultimate authority regarding the subjective world of the mind. Neither physicists nor biologists have devised sophisticated means for observing and experimenting with mental phenomena, and many of their materialistic assumptions regarding the mind—including its lack of existence—are either uncorroborated or simply wrong.

The principle of parsimony known as Ockham's razor was used to great effect in shaving off unwarranted assumptions from medieval scholasticism, opening the way for the scientific revolution. This principle states that it is futile to do with more assumptions that which can be done with

fewer. Imagine that we were to shave away the assumption that for mental phenomena to be real and causally effective, they must be physical. Without making this assumption, can we explain mental phenomena any less satisfactorily? Does the absence of this assumption impair or limit scientific research on the mind in any way? Consider the fact that this materialistic assumption has never been corroborated by empirical evidence, yet it continues to constrain scientific research on the mind. Has ideological bias prevented the cognitive sciences from devising sophisticated first-person methods for observing mental phenomena over the past 130 years? If so, the illusion of knowledge that the mind is physical has delayed the revolutionary development of the mind sciences and may have delayed progress in other branches of science as well.

Cartesian dualism, rooted in many of the assumptions of medieval scholasticism, has not been a viable basis for the scientific study of the mind. But materialistic monism, based on the assumptions of nineteenth-century physics, has also proven to be a dead end in the discovery of the nature, origins, and potentials of consciousness. At the time of Descartes, the Roman Catholic Church exerted the power of its Inquisition to punish those who deviated from ideological conformity, and now the scientific establishment exerts a similar (though not usually so violent) pressure on its members to reject all forms of mind-body dualism in favor of an antiquated monism. We need to begin thinking outside the box—outside the familiar dualities of dualism and monism, supernaturalism and naturalism—bringing instead an unprecedented spirit of empiricism to the scientific investigation of the mind.