

sociology, religion

## Where the Wasteland Ends

Politics and Transcendence in Postindustrial Society

Theodore Roszak,

Author of *The Making of a Counter Culture*

"The religious renewal we see happening about us — especially among disaffiliated young people, but by no means only among them—seems to me neither trivial nor irresponsible, neither uncivil nor indecent. On the contrary, I accept it as a profoundly serious sign of the times, a necessary phase of our cultural evolution, and—potentially—a life-enhancing influence of incalculable value. I believe it means we have arrived, after long journeying, at an historical vantage point from which we can at last see where the wasteland ends and where a culture of human wholeness and fulfillment begins. We can now recognize that the fate of the soul is the fate of the social order; that if the spirit within us withers so too will all the world we build about us. Literally so. What, after all, is the ecological crisis that now captures so much belated attention but the inevitable extroversion of a blighted psyche? Like inside, like outside. In the eleventh hour, the very physical environment suddenly looms up before us as the outward mirror of our inner condition, for many the first discernible symptom of advanced disease within."

From the Introduction

"What Theodore Roszak offers us in *Where the Wasteland Ends* is nothing less than a State of the Union Message on the condition of the human soul."

—Anatole Broyard, *The New York Times*

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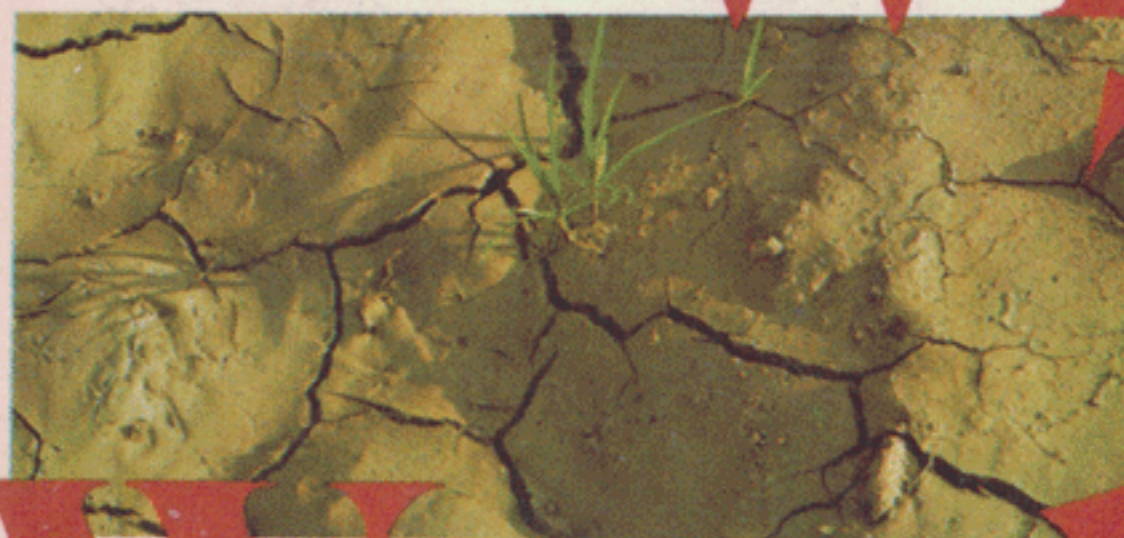
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*THE MAKING OF A COUNTER CULTURE*

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in Postindustrial  
Society



THEODORE ROSZAK teaches history and interdisciplinary studies at California State University, Hayward. During 1971-72, while completing this study, he was the recipient of a Guggenheim Foundation Fellowship. He is also the author of *THE MAKING OF A COUNTER CULTURE*.

*Other books by Theodore Roszak*

THE MAKING OF A COUNTER CULTURE

THE DISSENTING ACADEMY (*Editor*)

MASCULINE/FEMININE (*Co-Editor with Betty Roszak*)

SOURCES (*Editor*)

# WHERE THE WASTELAND ENDS

*Politics and Transcendence  
in Postindustrial Society*

THEODORE ROSZAK

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*To Betty  
For the conversations where all  
the best ideas happened.*

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*For our contention is not with the flesh and blood,  
but with dominion and authority, with the world-  
ruling powers of this dark age, with the spirit  
of evil in things heavenly.*

Ephesians 6:12, quoted by

William Blake on the title page of *Vala*.

*Crazy Horse dreamed and went into the world  
where there is nothing but the spirits of  
all things. That is the real world that is  
behind this one, and everything we see here is  
something like a shadow from that world.*

Black Elk

*I'd rather learn from one bird how to sing  
than teach ten thousand stars how not to dance.*

e. e. cummings

## CHAPTER 6

## FAIR BAIT . . . CRUEL TRAP

*A scientist should recognise in his philosophy—as he already recognises in his propaganda—that for the ultimate justification of his activity, it is necessary to look away from knowledge itself to a striving in man's nature [which is] not to be justified of science or reason, for it is in itself the justification of science, of reason, of art, of conduct.*

*Arthur Eddington*

## NATURE IN AN OBJECTIVE KEY

Francis Bacon might well be thought of as the Moses of the history of science, the inspired seer who discerns in Canaan the vivid promise of milk and honey, but who surveys the promised land only from far off and indistinctly. Bacon adumbrates the revolution in consciousness from which the world of urban-industrialism takes its course; it fell to others—to Galileo, Descartes, Newton—to perfect the single vision that would build that world. Compared to their sleek precision—especially in the application of mathematical technique—Bacon's attempts at methodology appear almost comically primitive. Bacon had little knowledge and less respect for mathematics, and given that bias, he failed to recognize that the secret of the de-personalizing *novum organum* he sought lay in the purely quantitative vision of nature which first appears in Galileo's new approach to terrestrial mechanics. For Galileo, measurement was all. In his science, the world was caught in a net of numbers. Whatever escaped must be regarded

as non-science, the leftover realm of mind, of spirit, of "secondary qualities," the ghostly country that has progressively come to be regarded as less and less habitable by people of a practical nature.

Still, something of Bacon's global conception of the New Philosophy has survived among the mathematizers. There are those who continue to hope that, in time, everything—politics, ethics, all—can be trapped in the quantitative net . . . if only its mesh might be made sufficiently fine. The ambition lingers on in the two little words that forever qualify the behavioral scientist's ritualistic confession of ignorance: *as yet*. "We do not know enough about man, society, aspiration, 'peak experience,' creativity, human fulfillment to treat these matters scientifically . . . *as yet*." But in time . . . when the net has been drawn tighter . . . with a bit more research . . . when some more refined system of measurement has been developed . . . when more data is in . . . *then* we shall know.

With the Newtonian synthesis, Bacon's objectivized nature was at last achieved; the world-picture was homogenized and qualitatively flattened. For the first time in the western tradition, the universe became in the most objective sense of the word a "universe": a cosmos uniform throughout its infinite extent, devoid of ethical nuance, of magic centers or charmed circles, of quintessential terrain. Henceforth, nature was seen to be spread out before the human observer like a value-neuter screen on which only the measurable behavior of things might be registered. And behind that screen, there was understood to be . . . nothing, no will, no animating purpose, no personality that might invite sensuous participation or answer the human desire to penetrate and commune.

Ordinarily, this Newtonian system is referred to as "mechanistic," with the machine metaphor understood to derive from the deterministic, clockwork precision of its astronomical movements. But the image cuts deeper, I think. The essence of a machine is that it acts to serve a function, never a purpose. Purpose is inherent and self-appointed; it is an indication of conscious willfulness, an



expression of spiritual autonomy. This was exactly the aspect of Aristotelian science which the New Philosophy, borrowing upon the idolatrous psychology of Christianity, was most determined to destroy. Yet nature is evidently active; it is filled with motion, growth, and orderly change. What to make of this activity? The problem is nicely solved if we imagine that nature's action is that of a machine. A machine, being dead, cannot choose a purpose; it can only serve a function. In contrast to purpose, function is externally imposed by the machine's maker or user. A mechanistic nature, therefore, lacks vital intention. It becomes a tool in need of a job, presumably to be supplied by God; or eventually, in God's stead, by his earthly steward, man—the only purposeful agent left in sight. Nature perceived as machine is nature adrift, waiting to be put to use as man sees fit to use it.

One more point. The machine image objectivizes at a stroke whatever it touches by emphasizing its inert otherness from man, its non-communicability. In the magical worldview of the Old Gnosis, all things—animal, plant, mineral—radiate meanings; they are intelligible beings—or the natural faces such beings put on for us in the physical world. But for Newton, the celestial spheres comprise a machine; for Descartes, animals become machines; for Hobbes, society is a machine; for La Mettrie, the human body is a machine; eventually for Pavlov and Watson, human behavior is machinelike. So steadily, the natural world dies as it hardens into mechanistic imagery.

If these are the deeper psychological implications of mechanistic thought, then a disturbing conclusion follows. Since the advent of the quantum and the relativity theories at the turn of the twentieth century, it has become a familiar notion that Newtonian mechanism has been replaced by more humanistically acceptable conceptions of time, space, matter, causation. Some have given this "revolution" in modern physics such prominence that they seem nearly to suggest the entire history of science prior to Planck, Einstein, and Bohr can be written off as a defunct tradition—as if the authority of classical physics over a wide

range of phenomena was not still respected by science; it does after all remain the physics of our local environment—of Euclidean space and common-sense time. Nevertheless, F. S. C. Northrup has insisted that "the old, rigid, cast-iron universe in which man seemed to be nothing but a mere cog in a vast cosmical machine, has evaporated. . . . No longer is nature to be conceived as a mere collision of individualistic, *laissez-faire* atoms, nor man merely as a collocation of such atoms, struggling for existence."

The statement typifies the hopes of many philosophers and scientists who have recognized the crushing inhumanity of western science and have grown desperate for an alternative worldview more hospitable to human aspiration. For such thinkers, the new physics has been greeted as, at last, their liberation from the death grip of the Newtonian world-machine, a rescue that arises, conveniently enough, from within science itself. Here is the line of thought which seeks to defend the freedom of the will by reference to Heisenberg's indeterminacy principle, and the philosophical virtues of paradox and ambiguity by reference to Bohr's principle of complementarity. Bohr himself once felt that the indeterminacy principle could be elaborated into a bulwark to protect the special status—the "irrationality"—of living organisms. During the nineteenth century, there were, in fact, a number of physicists (most notably Max Delbrück and Erwin Schrödinger) who were sufficiently inspired by the breakdown of mechanism in their field to migrate into biology with the hope of proving that living things were governed by "other laws" than physical systems—a mysterious project indeed which has received less and less interest from the biologists as biochemistry has gone from strength to strength. Similarly, the humanist social scientist Floyd Matson has turned the new physics against behaviorist psychology and sociology, seeking to demonstrate that the behaviorist approach is invalidated by its antiquated devotion to the "broken image" of Newtonian mechanism.

All this is commendable for its humanistic intentions—and yet pathetic. For it vastly exaggerates the scale and

wholly mistakes the character of this so-called revolution in modern science. It overlooks the psychological continuities that bind the old and new physics together; it fails to see the underlying sensibility to which mechanism only gave a surface expression. Mechanism was merely the first image on which single vision fastened in its effort to gain a purchase upon human consciousness. Once having served this function, the mechanistic model became quite dispensable. It could be retired without displacing the objective psychology it served to foster.

To be sure, over a certain range of phenomena in atomic physics and astronomy, the old machine metaphor has lost its serviceability. This has forced scientists working in those areas to revise some of their observational methods, to invent more ambiguous models and tentative paradigms, and to develop more sophisticated mathematical procedures for construing their experimental data. All of which has finished by making physics more inaccessible to the lay public than ever before—surely a dubious contribution to humanistic values. But the *psychology* of the enterprise has not changed; this is the string that holds all the scientific beads together from Galileo and Newton to the present day. In no sense does relativity (much less the quantum of action) imply a compromise of objective consciousness. One does not treat anti-sigma-minus-hyperons with any different sensibility than Newton treated the planets. The alienative dichotomy holds. And how sad it is to see so many intellectuals grasping at such straws, insisting that the advent of the linear accelerator and probability mathematics is, somehow, the salvation of the soul—as if it is only natural science that could legitimize a traditional human wisdom. Charles Gillispie has correctly observed that, in so far as there is any sort of “subjectivism” in modern physics, it is hardly a matter of “Einstein lapsing back into some Greek posture of humanism.”

It is all very well to say that there is no physics without a physicist. . . . But it would, after all, be more accurate to say “without an instrument”, because for such

purposes a physicist is an instrument. We are concerned, that is to say, not with a personal subjectivism, but with an instrumental subjectivism, the kind of which a computer is capable.

In short, when all the wishful thinking about the philosophical spin-off of the new physics has cleared away, the result is no gain for humanism. Worse still, when we turn to the life sciences, we find them pursuing a more crudely mechanistic mode of thought than ever. In biology, they persist in thinking of the cell as a “chemical factory,” and of the action of enzymes as “cyberated feedback,” and of DNA as “information transfer.” If the interior of the atom has ceased to look like a steam engine, the chemistry of life has nonetheless been assimilated with gusto to the imagery of automated industrialism. “In science,” as Joseph Needham, hardly the most boorish of our biologists, once said, “a man is a machine, or if he is not, then he is nothing at all.”

The basic effect of Newtonian mechanism was to produce a nature that was felt to be dead, alien, and purely functional. This estranged relationship of scientist to nature has remained unchanged; it is still what our science most irreducibly is. Indeterminacy, complementarity, quantum mechanics, relativity . . . the tunes have been altered, but the mode of the music is the same always. We are still performing in the key of objective consciousness. It would remain so if we found angels at the end of our telescopes and then subjected them to spectrum analysis. It is single vision—the act of objectification—that defines science, not the imagery or technique by which, during any period of history, scientists may choose to express their objectivity. Our very assumption that physics is the most *basic* science and that its transformations effect all else is revealing. Why should physics be regarded as the field which provides the surest and purest foundation for our understanding of nature? Obviously, because its subject matter is most easily regarded as dead and alien stuff, that from which we feel

the most remote, and therefore the reality single vision knows most reliably.

The point cannot be too strongly stated. It makes no automatic psychological difference that we exchange one theoretical model for another, or refine our methods of scientific measurement; the *quality* of our experience is the heart of the matter. And where evaluation and psychic participation are concerned, the scientific worldview remains as undimensioned today as in the age of Bacon and Newton. Single vision reigns supreme. Ours is still the universe Alexandre Koyré speaks of in his description of the Newtonian synthesis:

. . . the world of science, the real world, is no more seen . . . as a finite and hierarchically ordered, therefore qualitatively and ontologically differentiated whole, but as an open, indefinite, and even infinite universe, united not by its immanent structure but only by the identity of its fundamental contents and laws. . . .

This, in turn, implies the disappearance—or violent expulsion—from scientific thought of all considerations based on value, perfection, harmony, meaning, and aim, because these concepts, from now on *merely subjective*, cannot have a place in the new ontology. . . .

Modern science broke down the barriers that separated the heavens and the earth, and . . . united and unified the universe. . . . But . . . it did this by substituting for our world of quality and sense perception, the world in which we live and love and die, another world—the world of quantity, of reified geometry, a world in which, though there is a place for everything, there is no place for man.

#### GOD EXPERTLY EMBALMED

Such is the sense of nature our culture has come to take for granted and to which even the religious life of our society has adapted. It is a universe that has proved hospitable to only that fossilized form of Christianity which the Enlightenment called “natural religion” and which Blake

shrewdly recognized as a euphemism for the total surrender of visionary experience. Newton, like so many of the early scientists, was an outspokenly pious man; professions of faith punctuate his great treatises. But in his science Newton could retain only the chilliest, most bloodlessly cerebral notion of the divine. In the famous “General Scholium” which he attached to his *Principia* to defend its religious intentions, God is allowed into nature only as a deduction from the order of things . . . or else “how to keep the systems of the fixed stars by their gravity from collapsing?” He is the remote potentate who “governs all things, not as the soul of the world, but as Lord over all; and on account of his dominion he is wont to be called *Lord God pantocrator* or Universal Ruler.” “We know him,” concludes Newton, “only by his most wise and excellent contrivance of things . . . we reverence and adore him as his servants.” Here is a God no longer experienced, but inferred by a none too solid logic from the design of nature. Of all the poetry in which the divine has ever been clothed, Newton could retain only the austere image of celestial monarchy, the most detached relationship possible between the sacred and the natural. But of course the Judeo-Christian tradition was well freighted with this diminished conception of God and gave Newton much support. Mainstream Christian orthodoxy, with its minimal investment in visionary experience, was more than willing to see its God become a functional postulate in a desacralized universe.

True, Deism has never been a robust faith; it exhausted its philosophical viability within a few generations of its initial appearance. Before the eighteenth century was out, Hume had driven his skeptical rapier through its heart. But natural religion was so anemic to begin with that it scarcely suffered for the wound. It survives today as an easy and shapeless orthodoxy among routine churchgoers. They may never have heard the word “Deism,” but they continue to pay respects to that aloof “Somebody (or is it Something?) Up There,” the managerial deity who stands well off behind the scientist’s universe, careful never to

intrude . . . a shy and shriveled divinity . . . an afterthought . . . a cliché. If God has at last died in our culture, he has not been buried. For the casually religious, he lingers on like a fond old relative who has been so expertly embalmed that we may prop him up in the far corner of the living room and pretend the old fellow is still with us. We have even taken pains to bend his fallen mouth into a benign and permissive smile . . . and that is a comfort. It makes him so much *easier* to live with. No more of the old hellfire and brimstone; no more of the terrible mystery and paradox that require the crucifixion of the intellect; no more dark nights of the soul. Is it any wonder that for many people, a dead and stuffed God seems preferable not only to no God at all, but to *any* God at all?

But there is a trouble about this religion of the minimal God. It is so tissue thin that even a fairly obtuse sensibility can hardly fail to discern the void beyond. And only to glimpse that nothingness wherein all things human become "nothing but" . . . "nothing but" . . . "nothing but" . . . is to taste the cosmic absurdity, the annihilating despair. The great question Nietzsche addressed to the scientists may not relate accurately to the still high-spirited age of Bacon or of Voltaire, but it applies emphatically to his own time and ours.

Has there not been since the time of Copernicus an unbroken progress in the self-belittling of man and his *will* for belittling himself? Alas, his belief in his dignity, his uniqueness, his irreplaceableness in the scheme of existence, is gone. . . . Since Copernicus man seems to have fallen on to a steep plane—he rolls faster and faster away from the center—whither? into nothingness? *into the thrilling sensation of his own nothingness?* . . . All science . . . nowadays sets out to talk man out of his present opinion of himself, as though that opinion had been nothing but a bizarre piece of conceit. You might go as far as to say that science finds its peculiar pride, its peculiar bitter form of stoical ataraxia, in preserving man's *contempt for himself*. . . .

By now, the tougher natures among us have grown so accustomed to the reductionist pressure of science that a lament like this sounds perhaps quaintly old-fashioned, a shrill cry of post-Christian nostalgia. Whereas, how much *braver* it is to face the eclipse of God alone, unafraid, absurd. "I myself, like many scientists," announces Nobel laureate Francis Crick, "believe that the soul is imaginary and that what we call our minds is simply a way of talking about the functions of our brains." And he goes on: "Once one has become adjusted to the idea that we are here because we have evolved from simple chemical compounds by a process of natural selection, it is remarkable how many of the problems of the modern world take on a completely new light." Indeed they do. It is the funereal gleam by which we travel the wasteland, the light of dying stars.

Yet what is the alternative to humanist resignation? To forbid the quest for knowledge? Return to old superstition? Foster illusion? Deny the truth? Of course we must not grow contemptuous of the truth. But neither must we grow so contemptuous of our fellow human beings as to believe that the truth has been nowhere known or honored among them except in European society since the scientific revolution. To cast aside all the prescientific and non-scientific realities by which men and women have lived for so long is to settle for a truth that is little more than an operational superficiality; worse, a license for the making of well-informed fools.

#### THE VERIDICAL EXPERIENCE

Is there a way to avoid these extremes? I believe there is. Suppose we ask how the truth *becomes true* to us. What is the decisive, veridical experience that persuades us to accept any framework of discourse as meaningful and knowledge-yielding? For persuasion is the heart of the matter. What is true to me is what I am *persuaded* is true. Mind that I say "persuaded"—not brainwashed, intimidated, tricked, or duped . . . but freely won over, while

in full possession of my own mind and critical faculties. Is there, then, a psychology of persuasion which would account for our society's collective decision to become a science-based culture?

If we would discover that psychology, we must be prepared to see the truth as a multidimensional experience, an experience which resonates through the whole personality. Obviously, what people have considered true—the items we can package up into a propositional inventory—has altered from age to age, from culture to culture. But what of that? Trace the experience deeper and the relativism of the matter is dispelled. We are, after all, more than the articulate intellect and its logical apparatus; that is perhaps the last part of us to go to work on the truth, applying it here and there, elaborating its implications once a context of meaning has already been endorsed. What we are persuaded to call the truth is that which engages us at many and more secret levels, until we feel that the whole of our being has been warmed to life and is now burningly *there*, alert, and animated. It is this *experience* of truth—this bright response to a reality we sense pressing in upon us along the many avenues of our awareness—which is universal. Perhaps, then, if we could do justice within ourselves to the reality others have been touched by, we might even find *their* truth larger and more liberating than our own, and so be persuaded to see things anew.

But once this transforming, veridical experience has entered the lives of men and women, it is ironic what often follows. The personality which received the truth whole now reshapes itself, even delimits itself, striving for an identity that will best and most specially manifest its witness. Such a taking on of roles is, it would seem, our innately human way of celebrating the realization of truth. We adorn ourselves with a new self, usually one that seeks to emphasize aspects of reality previously slighted. This may be the project of generations, each successive generation sharpening the identity pioneered by its forebears. So a culture works out its peculiar destiny, achieving style, if often at the expense of wholeness. Until, at last, it may

lose touch entirely with dimensions of reality which initially inspired its distinctive identity. Then what a people call true will no longer be true as it was once experienced to be true. It will be the mere surface of the primordial experience: a collection of propositions, data, credos, dogmas, customs . . . at last institutionalized and enforced by authority. This is a diminishment of the personality; but it is important to realize that, initially, the whole person acted to create this half person—even as the whole and healthy actor might undertake to make himself over on the stage into a monomaniac, and then lose himself in the role.

In our personal lives, neurosis is such a playacting, the whole psyche seeking satisfaction by forcing itself into a lesser identity. Pico della Mirandola once called human beings, by their very nature, chameleons who are forever taking up one disguise after another. Perhaps there is no alternative to this human masquerade. But once any of our cultural roles becomes tyrannical and heavy with despair—once it forces us toward self-betrimement—it is time to excavate our inherited identity to find there the buried lineaments of the whole personality.

Those who feel—as I do—that culture based on single vision is dehumanizing, must sooner or later confront the question: why, then, did people enter so narrow a trap, and do so with a determination that still encourages them to make themselves at home in their captivity? We have already seen what a dark, idolatrous motif permeates the Judeo-Christian heritage. Some might, like myself, see in this movement the unfolding of a destiny whose nature yields to no purely secular explanation. Nonetheless, that destiny has had to wear an historical costume; or perhaps we should say, it has had to be baited with ideals that people could recognize, cherish, and covet. *What was this bait?* In the answer we give to this question there may lie our best hope of salvaging all that is most valuable in the scientific tradition. Though what we save may not be science as we now know it (let us be clear about that from the outset) but rather those qualities of the whole person to

which single vision has had to appeal in order to gain its cultural supremacy.

If science had never been more than science, it would have had no significant future in our culture. Only those who attend to the varying relations any standard of knowledge assumes with the many dimensions of the personality—conscience, imagination, social self-interest—will be able to understand the spectacular course science has run over the past three hundred years—from a marginal curiosity, the hobby of a few amateur natural philosophers, to the prevailing Reality Principle of high industrial society, the legitimizing mystique of the technocracy. The achievement is the more remarkable when one recognizes that scientists, as a group, have been—at least until the Big Science of our own time—among the most unobtrusive members of society. Far from being pushy, they have been for the most part almost monkish in their desire for seclusion, peace, and anonymity. It has been propagandists like Bacon, Voltaire, Ernst Haeckel, Thomas Huxley, H. G. Wells—men not themselves primarily scientists—who have been most concerned to promote and popularize the worldview of science. The scientists themselves have frequently suffered the adulation of society like a curse; it has traditionally intruded itself upon their quiet search for knowledge.

But the modesty of individual scientists notwithstanding, the collective enterprise of science has been anything but humble and reclusive. From the age of Bacon forward, science has addressed itself to more than a professional audience. It has appealed to a broad spectrum of human aspirations, to the evaluative and aesthetic sensibilities, to man's taste for the dramatic, to the sense of daring, to the instinctive urge for freedom and dignity, and, yes, to our civilization's peculiarly demonic greed for power. Science has always had its cultural and social extensions; we turn it into a rarefied body of evolving intellectual constructs only by a ruthless simplification of the historical record. People have wanted more of science than a body of hypotheses and methods, data and theory; and consciously or not,

even in spite of themselves, the scientists have provided them with more. They have provided a picture of nature and of nature's God; they have provided mankind with a place and a purpose within that picture; they have projected an ethical ideal for our culture to pursue. They have done all this, not as a mere by-product of their scientific activity, but as an inseparable aspect of their professional commitment. They have done it by what they have said and left unsaid; by what they have affirmed and failed to affirm; by what they have assumed and implied and denied. Most basically, they have done it by asserting their conception of what a reliable conception of nature is and how it is to be gained. All this has been the lure which has drawn mankind toward the culture of science and has influenced it to bestow the accolade of "truth" on the scientist's style of experience.

Let us spend the remainder of this chapter recounting the several ways in which science has gratified these wide-ranging aspirations.

"TO INTERROGATE NATURE WITH POWER":  
THE UTILITARIAN PROMISE

To begin with the most obvious point, consider the Baconian dictum that "knowledge is power." How far would the New Philosophy have carried without the promise of prodigious material benefit? "We shall become the masters and possessors of nature," Descartes announced, echoing Bacon. And, fortunately for the scientists, there was an important audience prepared to believe the prospectus and to identify the new style of natural philosophy with all the practical pursuits around them. When, therefore, we reach the *philosophes* of the Enlightenment, it was the most natural thing in the world for them to associate the Newtonian worldview with their own consuming passion for crafts, trades, and manufactures. Theoretical science and pragmatic invention, despite their wide separation from one another during that period, were allied in the

minds of the *philosophes* as means of exploiting nature—and correctly so, for reasons we have mentioned in the previous chapter. In numerous gentleman's clubs and intellectual societies like the eighteenth-century Lunar Club of Birmingham, the scientists Joseph Priestley and Erasmus Darwin found no trouble in hobnobbing with industrialists like Josiah Wedgwood and Matthew Boulton. Here were men who shared a common Baconian worldview, and looked forward (in the master's words) to "a line and race of inventions that may in some degree subdue and overcome the necessities and miseries of humanity." Accordingly, when the bourgeois revolution which the *philosophes* had done so much to inspire came in France, one of the first projects of the Directory was to finance a new scientific and technical establishment in whose schools the first generation of academic research scientists appears. For precocious technocrats like Saint-Simon and his disciples, that establishment, in league with the industrial wealth of the society, looked like the only logical government of the new bourgeois nation.

This utilitarian aspect of science is such a salient feature of the history of science that its importance should really go without saying. If I emphasize the point here it is because there are still many scientists who pretend to a kind of purity which will excuse them from the responsibilities of power. They invoke a "neutrality" which severs all connections with technology, and in so doing they falsify their own history.

Now, it may well be possible for individual research scientists to maintain such an aristocratic aloofness in the privacy of their own heads. But they purchase their purity by resort to an unbecoming historical amnesia; and turning a blind eye to the truth never buys real innocence. One need not even refer them to the outspoken utilitarianism of Bacon and Descartes; let them only read Newton's preface to the *Principia* to see how aware the great theoretician himself was of the technological implications of his thought. The object of the *Principia*, he announces, is to close the age-old schism between "rational" and

"practical mechanics" by way of a new "universal mechanics." Presently, Newton observes, "artificers do not work with perfect accuracy." But "if any *could* work with perfect accuracy, he would be the most perfect mechanic of all, for the description of right lines and circles, upon which geometry is found, belongs to mechanics." And what is the secret of this "perfect accuracy" but to discover (as Newton did) the mathematical principles of natural philosophy?

From the earliest stages of the scientific revolution, the most consistent meaning assigned to truth in the sciences has been through and through operational. The purpose of observation, experiment, classification, and theory is, ultimately, to predict or anticipate; to connect an "if" with a "then"; to hold forth the promise that we may successfully manipulate natural forces, or, at least, adapt advantageously to events. Other worldviews have included the same intention; but never with such exclusiveness and centrality. It is of little consequence (and of no moral significance whatever) if the task of applying applicable knowledge is carried out by other hands. The power principle of scientific knowledge begins in the laboratory—indeed, in the cogitating brain of the scientist; it is baked into the conceptual framework of the purest research. Through the eighteenth century, this was no guilty secret, but the open pride of scientists. Science was—boastfully—no parasitic form of learning. For example, consider Sir Humphry Davy's contrast between primitive and civilized people, as he makes it in his *Discourse Introductory to a Course of Lectures on Chemistry* (1802). Primitive man, Davy concludes, is "unable to discover causes, and [is] quietly and passively submissive to the mercy of nature and the elements." But civilized man is "informed by science and the arts, and in control of powers which may be almost called creative; which have enabled him to modify and change the beings surrounding him, and by his experiments to interrogate nature with power, not simply as a scholar . . . but rather as a master, active with his own instruments." These are hardly the words of a man fastidiously seeking

to disown the social repercussions of research. Rather, he eagerly claims them—for the greater glory of science.

This natural alliance between theory and praxis only became obscure during the middle and later nineteenth century as the sciences (especially in Germany) began to enter the university curriculum and yield to the spell of the ivory tower. Nineteenth-century research was richly productive, but much of it—even in medicine—far outstripped the capabilities of the then primitive industrial plant and the limited understanding of technicians, who were still little removed from being artisans and tinkers. For a time much knowledge had to be “pure,” because who was there to make use of it? So it became knowledge “for its own sake” . . . idle curiosity. Faraday, commissioned to study metal alloys, produced a host of them that finished up being locked away and forgotten in the vaults of the Royal Institution; the industrial needs and know-how of the day were incapable of assimilating such advanced, applied research. Similarly, one can only regard a discovery like Daniel Bernoulli’s famous principle of the air foil—achieved a century before Faraday’s time—as “pure knowledge,” because for the next one hundred and fifty years there existed no aeronautical technology capable of exploiting the idea for purposes of heavier-than-air flight. A principle of similar importance discovered in our own time would take how long . . . ? three days . . . ? to be transformed into a better ballistic missile.

Today, when the theoretical literature of science is well monitored by sophisticated technicians whose whole training has been aimed at digging application out of basic research, one must strain to imagine a science distinct from technology, except perhaps as part of a convenient division of intellectual labor. There is actually only the single, ongoing, all-embracing process of Research and Development. And that process is politically structured from start to finish. Scientists who blink the fact are simply playing dumb, not only about their own history, but about the sociological pattern in which they work, like it or not.

Clearly, most are inclined to like it. More and more these days, the developmental application of knowledge is

carried out by scientists wearing another hat: that of industrial consultant. Moreover, when public moneys are being paid out, the voice of pure science will always be heard intoning the old song: “You never can tell how basic research will pay off someday.” There is nothing in the least misleading about the assertion; it is only what history has demonstrated to be so over and over again. Not because *all* knowledge is power; but because science, from the study of the atomic nucleus to that of the most distant quasar, is single-mindedly the pursuit of that knowledge which *is* uniquely power—if only the power to predict a pointer reading correctly. There are, of course, other kinds of knowledge, those born of sensuous penetration, loving participation, ecstasy, transcendent aspiration. But that way lies art, joy, wisdom, salvation—not power. Science promised power as the means to all else. The promise was believed and at last realized, and so swept all before it. But we are left with no tolerance for these other varieties of knowledge, and so with no knowledge that can delimit power.

#### THE BOURGEOIS LIFESTYLE

It is hardly difficult to see why a style of thought so permeated by practicality should have managed to gain a sizable following during that era of turbulent social change which extends from the English Civil War to the French Revolution. It was the good fortune of science, not only that its worldview should have been so readily identified with praxis, but that there should have existed in Western Europe during the seventeenth and eighteenth centuries a restive class of practical-minded people who had begun to sense their own social importance. For these dynamic middle-class entrepreneurs, the New Philosophy conveniently became part of a bold liberal ideology, a weapon with which they might intimidate the parasitic clergy and aristocracy who had for so long smugly thwarted the bourgeois desire for full citizenly dignity.

To be sure, there were any number of clerics and aristo-



crats of Europe's *anciens régimes* who subscribed to the Newtonian worldview, priding themselves on their fashionably risqué "enlightenment." Nevertheless, the scientific sensibility belonged peculiarly to the bourgeois element in society. It endorsed their lifestyle—their secular energy, their penchant for utility and commercial gain—as it did that of no other class. Those who adopted their outlook were, to that extent, making concessions to an ideology that challenged the traditional virtues of the aristocratic "closed society."

Charles Gillispie has observed that, regardless of how willing scientists have always been to adapt to any political regime that comes to power, they have always, of necessity, been future-oriented in their outlook. "Neuter though [the scientific community] has been in politics, nevertheless the increasing orientation of all our modern sensibility to progress and the future pertains to science, though in what measure as cause and what as effect I should not like to try to say." For those social elements, then, which have been on the rise in modern times, which have felt no commitment to preserving the past but every incentive for shaping the future to meet their interests, the scientist, with his instinctive concern for novelty, discovery, innovation, became a natural ally.

Consider for a moment the figure of Benjamin Franklin, surely the prototype of the eighteenth-century bourgeois citizen. For centuries, since the rise of the medieval towns, the western world had known such crafty, self-reliant, self-made, men. And for centuries they had been distinctly junior members of the political nation. But from the time of the English Civil War, that situation had begun to shift rapidly; a revolution that was as much a change of cultural consciousness as of political power was under way. So that by the time we reach Franklin, we find in the man's make-up something more than the traditional virtues of hard work, self-denial, and resourcefulness, something that now lent the man's presence on the historical stage a formidable dynamism. It was his mighty conviction that his lifestyle grounded him more authentically in the nature of

things than that of any other class or estate, that he and his kind were peculiarly lords and masters of this Newtonian universe.

Franklin's gift for invention and disciplined rationality was no longer simply wealth-producing; it was *knowledge*-producing. It was an expression of the newfound human ability "to interrogate nature with power" in ways that revealed intoxicating truths about the world at large and the ways of God. The history of science remembers Franklin still for his significant contribution to electrical theory. But—typically—it omits the contribution's social and personal context. Yet that context once bestowed upon science an inestimable dignity of purpose and historical force. The familiar picture we preserve of the dumpy, bespectacled Franklin flying his kite in a thunderstorm may seem comically quaint. But that unlikely figure—precisely involved in that quaint task—is the very epitome of a revolutionary class, rebelliously proud and invincibly self-possessed as it makes up its appropriate worldview.

Franklin carried out his dangerous experiment, formulated his results into an ingenious theory, pioneered the new frontier of electromagnetic research, (Priestley called his work perhaps the most important since Newton), was accordingly elected a Fellow of the Royal Society, and capped this phase of his studies by inventing the lightning conductor. It was on the shoulders of such men that science rode forward to take possession of the modern world; it provided the universe in which their struggle for liberation could claim the sanction of nature and of nature's God. Turgot's epitaph for Franklin nicely summarizes the revolutionary elan of the bourgeois heroic age: "He snatched lightning from the heavens and sceptres from kings."

#### THE EGALITARIAN ETHIC

We can trace this libertarian thrust of science even further—down to the very epistemological foundations of the

New Philosophy. Here, as in so many other respects, it is Bacon and Descartes who sound the leading theme.

We have noted how frequently Bacon compares his *novum organum* to a tool or piece of machinery. Pressing this analogy to its ultimate conclusion, Bacon was led to believe that his method, once fully developed, could be appropriated by anybody and everybody. "The strength and excellency of the wit has but little to do in the matter," he tells us—and this astonishing assertion only follows logically from his premises. If method is, like a tool, a thing apart from its user, purged of all personality, then it must necessarily function for anyone who lays hands upon it. A truly objective method can be plugged into any mind and do its job. It is not an extension of the person, but an impersonal appurtenance, taken up and added on. Thus: "The course I propose for the discovery of sciences is such as leaves but little to the acuteness and strength of wits, but places all wits and understandings nearly on a level."

The qualifications "but little" and "nearly" seem to betray reservations on Bacon's part; but in fact they lead to nothing. Bacon never explores what qualities of mind or perception might shape scientific work besides his method. In fact, he goes on to campaign strongly against the importance in human thought of any unspicifiable talents of imagination or fancy.

When we turn to Descartes, even these most meager reservations are gone. We are confronted with the categorical claim:

. . . anyone who has learned this whole method perfectly, however humble his abilities may be, will nevertheless perceive that none of these ways is less open to him than to anyone else, and that there is nothing further of which he is ignorant because of any failure of ability or method.

Such became Descartes' great project: to formulate "rules so clear and simple that anyone who uses them carefully will never mistake the false for the true." It is a

potent word, that "anyone"—perhaps more alarmingly democratic than Descartes ever intended. Yet it follows from his conviction that the talent for gaining truth is no more than the proper application of that "good sense" which he takes to be "mankind's most equitably divided endowment." As he states at the outset of the *Discourse on Method*, disputes over the truth are "due not to differences in intelligence, but merely to the fact that we use different approaches and consider different things."

What we have here in the words of Bacon and Descartes is surely the highest and most unwarranted tribute that genius has ever paid to mediocrity. Still there can be no doubt that they meant what they say, extraordinary as the implications are. For if method alone is not the guarantor of truth, if other indefinable attributes intrude—gifts of insight, of vision, of erratic imagination—their entire project collapses. What, after all, would be the point of a well-wrought methodology if one finished by saying of it: "Do thus and so and (*provided* you are gifted with genius) significant knowledge will be forthcoming?" It would be rather like the famous recipe for stone soup, would it not? Start with a stone in boiling water . . . add everything else you can find in the kitchen that strikes your fancy . . . and *voilà!* stone soup.

Now, in truth, the process of discovering knowledge—especially at the level of a Galileo, a Newton, a Darwin—requires indispensably the unpredictable flash of genius, the unaccountable spark of insight. As Thomas Kuhn has shown in his *The Structure of Scientific Revolutions*, it is precisely by such inspired leaps that the great "revolutions" occur in the several branches of science. And then, suddenly and amazingly, there is something—an idea, an image, a conjecture, a neat synthesis, a "paradigm" as Kuhn calls it—that captures the imagination and is accepted as knowledge. Often enough, it is a matter, as Yeats has put it, "of finding similarities among things thought different and differences among things thought similar." But how such perceptions occur is beyond routinization. Which means that methodology is the stone in stone soup,

the most dispensable of all the ingredients. This is no less true of the so-called behavioral sciences, despite the fact that the learned journals of these disciplines brim over with the lucubrations of methodological specialists. It is all nonsense pure and simple. Who, except as an afterthought or as a pinch of incense on the professional altar, ever used another person's methodology to produce a significant idea of his own? The methodologies of a Max Weber or a Sigmund Freud yield brilliant insights only in the hands of a Weber or a Freud; in the hands of lesser talents, they yield what may be less worth having than the blunders of a great mind.

One might almost suspect that methodology is the preoccupation of mediocrity, the dullard's great hope of equaling the achievements of the gifted. *Almost . . .* were it not for such examples as we have at hand: Bacon and Descartes. No small minds these, and yet convinced that the process of knowing *could* be routinized and that knowledge *could* in this fashion grow by modest increments piled up by antlike armies of studious drudges. It is no better an idea for all their advocacy—though in their own time, it enjoyed the status of an unexplored and exciting new possibility filled with the drama of bold departure.

Clearly, science has profited enormously from the political implications inherent in the notion of impersonal method. If we take the idea at its face value, it places all people on a common noetic level. Knowledge becomes not a matter of inspiration or revelation; rather, it derives from the careful application of the right method. And this method—so Bacon and Descartes were convinced—may be readily acquired by any rational human being. Learn these thirty-four "Rules for the Direction of the Mind," Descartes tells us in an essay bearing that remarkable title, and you are well on the way to knowing all that can be known. Unhappily, Descartes worked out only eighteen rules in the unfinished treatise; nothing at all of the projected part three exists beyond the intriguing title "Concerning Problems Which Are Not Perfectly Understood." But no matter. If the enterprise in this instance remains

incomplete, its spirit shines through clearly. It proclaims that the human race has not even begun to probe reality, that our predecessors have dallied away the generations engrossed by follies and errors, that the truth has yet to be discovered and now waits to be unveiled by anyone who trains himself in the use of a few simple rules.

Perhaps there is little science to be wrung from that assumption; but the seeds of a democratic politics lie hidden therein, a subversive belief in human equality founded upon the prospect of knowledge available to all on a non-privileged, non-classified basis. In such an unforeseen way, the Newtonian worldview became the stage on which the era of democratic revolution would be enacted. Whether that promised knowledge was forthcoming self-evidently in the "pure light of reason" or had to be pieced together out of empirical experiment, or whether perhaps it flowed from some combination of the two—on this point the Baconian and Cartesian traditions move off in rather different directions. But with respect to the root idea that the impersonal eye of method equalizes all people in their encounter with reality, the divergent traditions of rationalism and empiricism are united at their source and work in tandem to make the scientific revolution the forerunner of all the liberal and democratic revolutions that have followed.

In the long run, however, this facile association of scientific knowledge and egalitarian politics has run into serious contradictions. The proper ground on which to defend human equality is that of innate moral worth, not equivalence of intellect. That is, of course, the ground on which religious tradition since Amos and the Buddha has rested its plea for human fellowship; the ideal relates to a quality of soul, not an intelligence quotient—which is a statistical nonsense in any case. Intellect, especially the sort of intellect a technocratic society favors, is, like all human abilities, far from uniformly distributed. Where there is a social competition which selects such serviceable intellect for reward, we quickly arrive at a meritocracy which winnows out the disadvantaged, the rebellious, the slow start-

ers, the possessors of eccentric or unmarketable talents. At which point there appear self-styled experts in "mental measurements" to report that there is no human equality after all, that the brains of the poor and the non-white are inherently deficient, and that we must adjust our educational and social ideals accordingly. It is a sad example of science (or at least an academic numbers game that is widely respected as science) undoing the very egalitarianism which was once a proud part of the scientific ethic.

#### A PASSION CALLED REASON

In dealing with these aspects of science—the practicality of its orientation, the assumed democracy of its method—we have stayed close to questions raised by the sociology of knowledge. Here we can see the claims of scientific single vision serving as an ideological weapon with which to beat back the entrenched privilege of aristocratic and clerical elites. Because, traditionally, the scientific worldview has been associated with the virtues of effort and invention, with the common man's aspiration for dignity, it has become as precious to socialist critics as to the bourgeois society they despise. Both the socialists and bourgeoisie have been allied in championing worldly enterprise, material progress, and the principle of equality. Thus the two most important social elements that urban-industrial society has inherited from the *ancien régime*—entrepreneur and worker—have found supportive values in science.

But the success of science does not derive solely from its compatibility with the self-interest of social classes on the rise. It would be an injustice to the scientific tradition if we did not acknowledge in it an authentically humanitarian appeal. I refer to the summons of the civilized dialogue.

It is scarcely a coincidence that Bacon's New Philosophy emerges from a period of unparalleled religious violence in western history. The war of the doctrines can still be heard in the background of Bacon's message; for

example, when he declares that "the state of learning as it now is" can but produce "contention and barking disputations which are the end of the matter and all the issue they can yield." So he raises his voice in the midst of fanatical warfare and persecution, as if to ask: Is there no way for mankind to pursue the truth except with sword in hand? Must the battleground inevitably replace the dialogue?

Confronted with this great question, Bacon's contemporary Montaigne retired despairingly to a position of charitable agnosticism: better ignorance and reticence than bloody murder. But Bacon was the braver spirit. He insisted on breaking free of the impasse by reconstituting the cultural dialogue on new grounds. Again, his project is paralleled in intention by Descartes. Both men invite their audience to cast off those inherited convictions which admit of no consensus, and to build knowledge on the bedrock of what can reasonably be *proved* to be so. Since neither authority nor revelation provides a basis for dialogue—indeed, they seem only to serve for hotting up parochial loyalties and making murder legitimate—let them be laid aside, and let people begin again from scratch with a new, more civilized way of knowing.

The epistemological conundrums involved in this fresh approach to knowledge were not to be easily resolved. But before the seventeenth century was out, the New Philosophy had achieved something better than a flawless theory of knowledge. It had, in Newton's work, a concrete example of what was possible along the lines of its program. It had achieved significant knowledge, as secure as numbers, demonstrable to all who would look to see, and derived not from arcane tradition or private revelation, but from observation and logical inference.

Here was the source of that intellectual clairvoyance and humane good sense which flows down through the best minds of the Enlightenment, the sweet reasonableness that stands out so magnificently against the violence-prone obscurantism of their times and of previous generations. Science was not just the study of nature; it was readily identified as the brightest manifestation of rational con-

duct. For could not the same dispassionate, Newtonian precision be extended to all of life; to personal ethics and social policy as well as to sun, and moon, and stars? The equation has by now become implicit in all discussions of science. Science equals Reason; and Reason equals all good things. So, when the eighteenth-century poet Mark Akenside set about writing a *Hymn to Science*, before all else he praised science as the defense of civilized good manners against all the vicious humbug of the world. "Science," the poet implores,

. . . first with thy resistless light,  
Dispense those phantoms from my sight,  
Those mimic shades of thee,  
The scholiast's learning, sophist's cant,  
The monk's philosophy.

Oh! let thy pow'rful charms impart  
The patient head, the candid heart,  
Devoted to thy sway,  
Which no weak passions e're mislead,  
Which still with dauntless steps proceed  
Where Reason points the way.  
Put tempers, passions, in the scale,  
Mark what degrees in each prevail,  
And fix the doubtful sway.

That last, best effort of thy skill,  
To form the life and rule the will,  
Propitious Pow'r! impart;  
Teach me to cool my passion's fires,  
Make me the judge of my desires,  
The master of my heart.

It is meager verse, as bloodless and stolid as much of the culture of the English Enlightenment; but it nicely condenses all those qualities we still commonly associate with "being rational": candor, patience, emotional coolness, a keen eye for windy nonsense . . . above all, unstinting self-control. (As Alex Comfort has put it, what rationality means to most people is "the systematic avoidance of

troublesome emotions.") Here are the virtues—the safe and modest virtues—which people of essential decency will always champion when they have witnessed the high destructive passions at their work. They are the virtues that promise the possibility of considerate human relations, of respectful conversation and simple courtesy. By the standards of such rationality, men and women will hear one another out, weigh and assess views, recognize one another's claim to a common humanity. Here again, science becomes more than "pure science"; it assumes a moral luster.

All that has ever challenged the worldview of science has had, at last, to confront this ethical bastion erected in the defense of fellowship. One need not probe far below the surface of even the most seemingly cold-blooded effort to scientize the intellectual life in order to discover the moral fervor that animates the project. Only consider the crusading zeal of the logical positivists of the early twentieth century. A work like A. J. Ayer's famous *Language, Truth and Logic* is, for all its chill precision, in reality an admirable manifesto in behalf of the civilized decencies. For some, indeed, science has offered nothing more important than its critical edge with which to hew down the obfuscators. So Ernest Renan concluded: "the main contribution of science will be to deliver us from superstitions rather than to reveal the ultimate truth."

It is along such lines, following the equation science=Reason=all good things, that Karl Popper, Joseph Needham, J. Bronowski, C. P. Snow, and Robert K. Merton have identified the scientific temperament as the secret of the democratic "open society." Karl Pearson, writing in 1892, put the argument as well and as vividly as it has ever been put since.

The classification of facts and the formation of absolute judgements upon the basis of this classification—judgements independent of the idiosyncrasies of the individual mind—essentially sum up the aim and method of modern science. *The scientific man has above all things to*

*strive at self-elimination in his judgements; to provide an argument which is as true for each individual mind as for his own.* The classification of facts, the recognition of their sequence and relative significance is the function of science, and the habit of forming a judgement upon these facts unbiased by personal feeling is characteristic of what may be termed the scientific frame of mind. The scientific method of examining facts is not peculiar to one class of phenomena and to one class of workers; *it is applicable to social as well as to physical problems,* and we must carefully guard ourselves against supposing that the scientific frame of mind is a peculiarity of the professional scientist.

Now this frame of mind seems to me an essential of good citizenship. . . . Minds trained to scientific methods are less likely to be led by mere appeal to the passions or by blind emotional excitement to sanction acts which in the end may lead to social disaster. . . . Modern science, as training the mind to an exact and impartial analysis of facts, is an education specially fitted to promote sound citizenship.

It is in passages like this that we begin to recognize how much of a passion (if a denatured passion) this thing called Reason is, and by how far it transcends a merely niggling concern for neat intellectual habits or the accumulation of knowledge for its own sake. *The appeal is ethical;* it addresses the person with all the emotion (if none of the rhapsodic power) of Hebrew prophecy. Paradoxically, it would have us believe that impersonal knowing is the strongest defense of personal right. After such fashion, love (which is what Pearson, Popper, and all the others are talking about) forswears its proper language, and fellowship becomes, strangely, a matter of test tubes and bevatrons.

#### MYTHIC STATURE

It is in defense of the civilized dialogue that science has produced its heroes—and its martyrs. Whether we think of

Voltaire's waspish debunking, or the high moral rhetoric of a John Stuart Mill and Bertrand Russell, we are in the presence of people who have risked much to champion a conception of Reason they have felt was most perfectly expressed by a steadfast commitment to science. But we can expand this heroism beyond the exploits of particular social critics who have appropriated the style and rhetoric of science, and, without exaggeration, give the pursuit of scientific knowledge an epic dimension. Humble, reticent, and unassuming as individual scientists may often be, narrowly as they may conceive of their professional duties, nevertheless there broods over them a mythological identity of cosmic proportions. What was it Mary Shelley named her Dr. Frankenstein? "The Modern Prometheus." And here, too, we find one of the secrets of the triumph of science in our culture.

Myths make history. The mythic symbol taps unconscious reservoirs of energy in all of us, winning our assent and motivating action by its imaginative power. Perhaps nothing has more to do with determining what we will decide to regard as truth than the force of an empowered symbol superbly projected upon the cultural stage. Certainly science has enjoyed the subliminal persuasion of such an image from the earliest days of its history. I refer to the image of Newton, the archetypal scientist. More than an outstanding physical theorist, Newton became, in his own time, the supreme example of godlike intellect, comparable in Edmund Halley's seventeenth-century *Ode* to the prophet on whom the Lord had bestowed the tables of the law. Here was the mind that had achieved "reckonings divine." With Newton, Halley tells us, we are "admitted to the banquet of the gods," there to

. . . contemplate the politics of heaven;  
and spelling out the secrets of the earth,  
Discern the changeless order of the world  
And all the aeons of its history.

The *Ode* concludes:

Then ye who now on heavenly nectar fare,  
Come celebrate with me in song the name  
Of Newton, to the Muses dear; for he  
Unlocked the hidden treasures of Truth:  
So richly through his mind had Phoebus cast  
The radiance of his own divinity.  
Nearer the gods no mortal may approach.

Or consider James Thomson's panegyric for the dead Newton, no less unrestrained in lavishing its praise:

All-piercing sage! who sat not down and dreamed  
Romantic schemes, defended by the din  
Of specious words, and tyranny of names;  
But bidding his amazing mind attend,  
And with heroic patience years on years  
Deep-searching, saw at last the system dawn  
And shine, of all his race, on him alone.  
. . . Nature herself  
Stood all subdued by him, and open laid  
Her every latent glory to his view . . .  
O unprofuse magnificence divine!  
O wisdom truly perfect! . . .  
Did ever poet image aught so fair,  
Dreaming in whispering groves by the hoarse brook?  
Or prophet, to whose rapture heaven descends?

The scientist who fails to see the significance of such resounding celebration scarcely understands the history of his discipline. In the figure of Newton, the traditional imagery of prophet, poet, sage, oracle, all merge to create a cultural identity of superhuman dimensions. The great man's feat is more than a contribution to knowledge; it is very nearly a divine revelation. True, when we examine the biography of Newton himself, it is a nondescript story, as colorless as the private lives of most scientists. But by an achievement of the intellect, Newton transcends his meager historical identity. He becomes the scientist as cosmic adventurer, more daring by far than any earthly explorer. Thus Thomson lauds Newton as one who

. . . with awful wing pursued  
The comet through the long elliptic curve,  
As round innumerable worlds he wound his way . . .  
The heavens are all his own, from the wide rule  
Of whirling vortices and circling spheres  
To their first great simplicity restored.

Perhaps Newton would have blushed for the praise. Modest men and women that they are, most scientists might cringe to have such extravagant sentiments heaped upon them. But no matter. Their supremacy within our culture borrows heavily upon a mythological perception which envisages them as the new Prometheus pitted against the hostile forces of nature. Blake, who hardly idolized Newton, has nevertheless given him that epic quality in his paintings: something of Apollo, something of Michelangelo's David . . . a gigantic protagonist who claims the universe for his theater. Surely more than a few of our scientists, even the most diffident of them, have felt the Faustian surge of this secret identity within them as they have yielded to the temptation of forbidden knowledge: life created in the test tube, the fury of the atom unchained, the mind of man duplicated and surpassed by the computer . . . J. Robert Oppenheimer, witnessing the first test of a nuclear weapon, confessed to tasting sin. But he and all his colleagues knew from the beginning what lay waiting at the end of the project. And which was the stronger flavor, the sin, or the satisfaction of having stolen fire from the gods? Our understanding of history becomes shallow when we lose sight of the spell that dramatic-mythic imagery can cast over the mind, even when it serves as demonic end.

#### IMAGINATIVE GRANDEUR

We have, in examining the psychology of idolatry, dealt with the contribution the Judeo-Christian tradition made to the growth of science. But there is another respect in which Christianity has served to midwife the scientific worldview.

If we think back to the cosmos to which Christian orthodoxy was bound until the time of Newton—the Aristotelian-Ptolemaic world-system—it is impossible to avoid feeling how cramped this traditional cosmology seems in comparison to the universe the scientists have given us. To be sure, along the mystic fringe of western society—especially among the Hermetic and Christian cabalist philosophers—the Aristotelian cosmos retained a symbolic resonance that provided unlimited room for imaginative elaboration. As we have mentioned, a transcendent symbol is inexhaustible; it can possess a *qualitative* infinity for those unburdened by single vision. But the idolatrous psychology of Christianity militated against just that symbolic openness; instead, it deadened and diminished everything it touched in the natural world. With the result that by the sixteenth century the Aristotelian world-system had degenerated into a stultifying arrangement of crystalline spheres, comfortable, well wrought, and secure, but scarcely a place where the mind could expand its imaginative energies. It had purchased its physical orderliness at the expense of grandeur, achieving, on the brink of the scientific revolution, an almost brittle refinement. Christian society found itself in possession of a neatly crafted little jewel case of heavenly bodies that threatened, by the very modesty of its scale, to compromise the magnificence of its creator.

This became one of the major liabilities of medieval Christian thought. By the sixteenth century, western culture was already beginning to feel the strain of this discrepancy between a theology of infinite divinity and a cosmology marked by claustrophobic smallness and cautiously finished order. It is hardly remarkable that a mind with the imaginative sweep of Giordano Bruno should begin to stifle within such a closeted cosmos. Bruno, the renegade Dominican who preached the infinity of the universe a century before Newton, described himself as one "who has swept the air, pierced the heavens, sped by the stars, and passed beyond the bounds of the world, who has annihilated the fantastic spheres with which foolish mathematicians and vulgar philosophers had closed us in."

Bruno's soaring intuition of an infinite universe was no more than a cosmological extrapolation of the infinite Christian God. Yet so committed was the orthodoxy of his time to the lesser worldview of tradition that the Inquisition burned the man at the stake. Still the future lay with Bruno's visionary grandeur.

One need only compare the Aristotelian-Ptolemaic universe with the stupendous world-systems projected by other religious traditions—most notably by Hinduism, but even by many primitive religions—to realize how lacking the old Christian cosmology had grown in dramatic scope. It could no longer offer the mind either physical or metaphysical infinities to ponder. As late as the nineteenth century, the most orthodox Christian thought could not allow itself to envision a universe that spanned more than a paltry six thousand years since the creation. It was left to the geologists and astronomers to conceive cosmic time scales that stretched the imagination—and to do so against the bitter opposition of religious authority. What inspired vision has achieved in other cultures, the microscope, telescope, spectroscopy, and carbon 14 dating have had to attempt in ours: the creation of a worldview that can evoke awe.

This is an incalculable advantage for science to have enjoyed in our culture. In the cosmological closet of traditional Christian thought, the scientists have been those who dared to cry out for room. They have won the attention of people because they have been prepared to think big; they have stood forth as giants among the theological pygmies. How much less dazzling their achievement would be had it been matched by a mainstream religion whose worldview was proportioned to the visionary magnitude of a Bruno or Blake, of the Hermetic philosophers, or of the Hindu and Jainist cosmologers. As it is, science and not the religious tradition has been the liberator of cosmological speculation in the west. Christianity has paid dearly for the small-mindedness of its inherited orthodoxies. It has had to stand by and watch an increasingly secularized science expand to fill the vacuum Christian theology left in the imaginative capacities of its society. Yet, ironically,



during the age of Newton and for a century thereafter, the natural philosophers saw themselves as the true and devout celebrants of a nature now at last commensurate with the omnipotence of the Christian God. Here, for example, is the deeply pious conviction which sounds through Roger Cotes's eloquent preface to the second edition of the *Principia Mathematica*. How difficult it is to believe that a science which accumulates "knowledge for its own sake" and which lacks any theistic dimension has sprung from such sources.

The gates are now set open, and by the passage Newton has revealed we may freely enter into the knowledge of the hidden secrets and wonders of natural things. . . . Therefore, we may now more nearly behold the beauties of nature, and entertain ourselves with the delightful contemplation; and, which is the best and most valuable fruit of philosophy, be thence incited the more profoundly to reverence and adore the great Maker and Lord of all. He must be blind who from the most wise and excellent contrivances of things cannot see the infinite Wisdom and Goodness of their Almighty Creator, and he must be mad and senseless who refuses to acknowledge them.

The human imagination possesses a wealth of energy and will expand itself magnificently. In the west, the idolatrous psychology of the Judeo-Christian tradition has thwarted that energy where it has sought to delve into the symbolic dimension of experience; nature, desacralized, can only rebuff such an adventure of the spirit like a wall of stone, forcing it into other channels. Lacking respect for the sacramental dimension of nature, our experience has become poor in quality. The alternative has been to seek a surrogate expression of the transcendent powers wholly in the extrapolation of objective quantity: size, variety, complexity of mechanism, vastness of space and time. Science has worked with the grain of this passionate need for physical infinities and has thereby profited enormously. Still, the depth dimension of nature, the sacramental consciousness which single vision forbids, remains to be explored.

A science that turns from that exploration, insisting that it is more important to know much than to know deep, cannot help but to harden into a new prison of the imagination.

#### NEVER TWO CULTURES . . . ONLY ONE

Whenever scientists pretend that their calling is the pursuit of knowledge for its own sake, all that we discuss here—the rich background of moral strength and mythopoeic splendor—falls into shadow. And to that extent, the history of science loses touch with the whole human personality. The idea of "pure research" may have a comfortable aura of priestly detachment about it, as well as an air of un sullied innocence; but it has even less historical legitimacy than sociological validity. It was only because science engaged so broad a range of aspirations that it won our civilization body and soul to its conception of truth. Indeed, what we discuss here *is* the truth of science, for these are the factors that made ready our consciousness to perceive the world as the scientist perceives it and to say, "Yes, *this is the real world.*" It would, then, be pointless to suggest that there is a *knowledge* left over after the ethical and cultural "excrescences" of science have been subtracted—and that it is this knowledge that scientists must pursue. Knowledge presupposes a standard of truth which will be its touchstone. And truth, as I have argued, depends upon a psychology of persuasion comprised of precisely those ethical and cultural "excrescences." The action of this psychology may sink to a subliminal level; but it is nevertheless there and makes all the difference.

Scientists who long for academic isolation and the license this grants them to pursue their careers without once looking beyond the narrowest professional assessment of their work, begin to live parasitically off the surface of their heritage. Worse still, they themselves cease to be whole persons; they become disembodied amnesiac intelligences, disclaiming responsibility to any other aspect of their nature than the intellect and its fascinations. Only

then, when the full passion and heroism of the scientific enterprise has been rudely purged away, can one join with Charles Gillispie in his weary, elitist lament.

[People] are not content to take science for what it is intellectually, a great creation, a description of how the physical world works, beautiful and admirable in itself, but empty of morals and lessons. They want more. They want reassurance about the existence of God from the design of nature and about His loving care from His continuing to repair its imperfections. . . . In short, they want science to give us a world we can fit, as Greek science did, and not just a world like any external object that we can first measure, and then destroy. . . . [The other elements of culture] are about man or God, personality or affairs. Science is about nature. It is about things.

And are we to pretend, then, that science did *not* make its way historically by addressing itself to man and God, personality and affairs? That it did not from its origin promise us "a world we can fit"?

More impossible still, are we to believe that science, being "about nature," has nothing to do with the "morals and lessons" of our civilization? That is an absurdity which permeates the entire discussion of the "two cultures." There has never been a culture whose vision of life and society was not deduced from its vision of nature. Voltaire follows from Newton; Spencer follows from Darwin; Sartre and Beckett follow from the whole scientific tradition as it finally enters its post-Christian phase. *And properly so.* Cosmology implicates value. That is the way culture works. It cannot be otherwise. There are never two cultures; only one—though that one culture may be schizoid. Scientists who ask that we go about our moral and spiritual business in a vacuum, leaving nature in their purely objective charge, ask the impossible. Even the effort to partition culture—science to one side, value to the other—produces in spite of itself a whole culture . . . though a psychically sick one. It is the culture of the wasteland.

Late in his life, the physicist Max Born complained that it was becoming "impossible to maintain the old ideal of the pursuit of knowledge for its own sake which my generation believed in." He was surely wrong in thinking that most scientists, still today, have any trouble shielding behind that professionally advantageous ideal. But he was even more in error to believe that the ideal was an "old" one. In fact, it was a latter-day trivialization of the full-blooded tradition of science, one which appeared in the universities of the late nineteenth century and which rendered science a thin and inhuman academic specialty.

And what a poor finish science so conceived makes for our modern Prometheus. Here is the culture hero to whom our society has, over three centuries looked for moral progress, a just abundance, freedom, and spiritual well-being. For such was the promise all along. But now that we have delivered so much of our trust, our hope, and our resources into his hands, making ourselves as beholden to him as ever people were to the high priests of the temple . . . *now* he turns to us and announces:

"Sorry—you had me all wrong. As far as I am concerned, it has all been knowledge for its own sake, an absorbing game of the mind, you see. Nothing more. So please not to bother me with your non-intellectual needs. You must take your soul elsewhere for doctoring; you are getting in the way of my research."

One must insist, those who take this position are *not* defending the intellectual integrity of science. Rather, they are betraying the moral and mythic beauties which are properly an inseparable part of the scientific heritage.

But, so rebuffed, a despairing humanity will undoubtedly begin to consider taking its soul elsewhere, perhaps at the cost of sacrificing intellect wholly. Only it may then discover that, having fallen for the bait, it has sprung the trap and cannot easily free itself of its artificial environment and scientized culture.

And needless to say, trapped animals, should they grow desperate, will be quick to lose their nobility.