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IN SPITE OF HIS DEFECTS

THE progress of the human race is commonly estimated by the events which take place within the luminous zone of history. What is the luminous zone? It is the region so well lighted by attention and concern that what happens there seems to decide the course of human development. Figures who have been prominent in the luminous zone of their age were Galileo, Newton, Marx, Freud, and Einstein, and various others of similar if lesser influence. When history is first written, it is constructed around the positive achievements of such men. Their work becomes the definer of the main stream of progress, to which all other accomplishments are related.

There is, however, another stage in the understanding of the past, which involves critical perspective. After long generations of celebrating these pioneers and enjoying the benefits of their discoveries or innovations, we are compelled by unanticipated troubles to ask: *What did they leave out?* What other facts and ideas were cast into deep shadow by the brilliance and dramatic claim to attention of what they did? Pursuing this inquiry, we set about redressing balances, correcting excesses, and trying, during this critical period, to determine what is actually symmetry and wholeness in both science and philosophy. We find this difficult to do, since the vicissitudes of human affairs pull our thinking first in one direction, then in another, and the more sagacious we become, the more we are led to suspect that there may be no escape from the conditionings of the time—that, almost certainly, our best and wisest conclusions will be found limited or flawed by the critics and analysts of future generations.

This is the problem of both educator and philosopher alike. The grace and wisdom with which a thinker faces and deals with it are doubtless the index of his maturity, and a simple measure of his worth to other human beings. There is no escape from deciding what we are able to say we "know," and what ought to be left open to future experience and learning. Only the writers and thinkers who make sound decisions in relation to this question are worthy of being entrusted with the shaping of culture, philosophy, and education. But obviously, since such persons will not seek or accept "authority," to speak of "entrusting" them with such responsibilities is partly a rhetorical expression.

Yet it remains important to find such individuals. This means identifying those who have been wise in their own times, not just in the perspective of later events, after the course of history has given us unavoidable instruction in what men of the past, however admirable, failed to see.

There are two ways to go at this project. One is well known—the listing and study of the great founders of the high religions. Wisdom is always found in the essential documents of the philosophical religions. We obtain inspiration from them, but are also struck by awe and wonder. The question arises, How can we, so fallible, so confused by the pressure of circumstances, rise to such passionless heights of understanding? There is also the difficulty of relating timeless insight to our local uncertainties and dilemmas. People often say, "Yes, but things are different, now," and they most certainly are, in a way. But in what way are they not different at all? How, in other words, do we bring wisdom up to date? Asking this question more modestly: How can we render the knowledge of past philosophers into our own limited idiom, so that we have opportunity to recognize its application?

There are also, of course, those questions which challenge the validity of past knowledge,

but with these another sort of enquiry must ensue, since this argument seems to demand decisions about knowledge before anyone is sure what knowledge is and where it can be found. The belief that rare men of the past have had high knowledge is a fundamental intuition of the human race. Without this idea, we would have no reason to preserve the classics of religion and philosophy, and no reason for inquiring into the literature of the past except antiquarian curiosity.

Second in importance to recognition of old wisdom is studying the work of men who seemed to be on the right track, but who made various, now obvious, mistakes. It seems clear that there are some mistakes which don't matter much, and others which are practically fatal. How does a man protect himself from making the fatal mistakes—in life, in thought? For answer to this question, one must study the past, but not so much to know about the past, or about some particular past individual, as to find out what that individual knew or practiced that is just as true today as it was in his time. That, surely, will be his *wisdom*—the knowledge he obtained in spite of his confinement by a particular age and cultural environment. Surely, this is the sort of understanding that needs to be increased, since it is not just a redressing of balances—a swing of the pendulum of thought—but authentic understanding.

Seeking an example of such individuals, we turn, then, to Giambattista Vico (1668-1744), a Florentine thinker who is recognized as the first European philosopher of history. In contemporary thought, Vico gained attention through his extraordinary influence on Michelet, the French historian who wrote about the French revolution. Edmund Wilson describes Vico's impact on Michelet in *To the Finland Station:*

> From the collision of Michelet's mind with Vico's, it is hardly too much to say that a whole new philosophical-artistic world was born: the world of re-created social history. Of this moment in Michelet's life he was afterwards to note: . . . "From 1824 on," he wrote, "I was seized by a frenzy caught from Vico, an incredible intoxication with his great historical principle." . . .
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> Human history had hitherto always been written as a series of biographies of great men or as a chronicle of remarkable happenings or as a pageant directed by God. But now we can see that the developments of societies have been affected by their sources, their environments; and that like individual human beings they have passed through regular phases of growth. "The facts of known history, "Vico writes, "are to be referred to their primitive origins, divorced from which they have seemed hitherto to possess neither a common basis, nor continuity nor coherence." . . . And: "In that dark night which shrouds from our eyes the most remote antiquity, a light appears which cannot lead us astray, I speak of this incontestable truth: *the social world is certainly the work of men;* and it follows that one can and should find its principles in the modifications of the human intelligence itself." . . .
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> How was it . . . that the *Scienza Nuova* (1725) could come to a man of 1820 as an intoxicating revelation? Because Vico, by force of an imaginative genius of remarkable power and scope, had enabled him to grasp fully for the first time the *organic* character of human society and the importance of reintegrating through history the various forces and factors which actually compose human life.

How did Vico view and interpret history? According to one account, he sees the history of humanity "as a process of development from 'poetic wisdom,' the impersonal, religious, instinctive ideas of primitive society, to 'occult wisdom,' which turns divinely implanted ideas into conscious philosophical wisdom." He sought to understand all history in this "threefold succession of phases, divine, heroic, and human," which he found exemplified in "government, language, literature, jurisprudence and civilization."

Those who wish to follow up how Vico used the data of history to support this view may go to works by H. P. Adams (*Life*), by Bergin and Fisch (*Autobiography*), and by Robert Caponigri (*Time and Idea*). Here we are interested in developing his "organic" conception of society, to which Wilson refers.

Vico was born only a few years after the death of Descartes, the man who, probably more than any other European thinker, had turned the mind of his times away from all such modes of thinking. For Descartes, the physical world was to be understood as a great machine, and the model for comprehending organisms was also a machine. Mind might exist, but this was a subject dealt with by theology and in any case irrelevant to knowledge of the natural world. To isolate the natural world for scientific study, Descartes separated absolutely mind and matter. As Whitehead observed in *Nature and Life* (University of Chicago Press, 1934):

> The mental substances are external to the material substances. Neither type requires the other type for the completion of its essence. Their unexplained interrelations are unnecessary for their respective existences. . . .
>
> The effect of this sharp division between Nature and life has poisoned all subsequent philosophy. Even when the co-ordinate existence of the two types of actualities is abandoned, there is no proper fusion of the two in most modern schools of thought.

Whitehead cannot have been the first to notice the effect of Cartesian dualism; indeed, the Cambridge Platonists, contemporaries of Newton, did their best to oppose the mechanistic, materializing influence of Descartes; but Whitehead was an effective critic of Descartes in a later age and his analysis led the way to the strong condemnation of the machine philosophy now heard from many quarters. Lewis Mumford, for example, devotes a long section of *The Pentagon of Power* to criticism of Descartes, noting especially his declaration that his objective was to show men how to become *"lords and possessors of nature."* In one place Mumford says:

> I have gone into this matter in detail, though it seemingly lies outside the scope of technology, because Descartes' analysis of the machine, and his admiration for its automatism had, and still has, a potent effect in causing Western man to misinterpret and underestimate the unique subjective quality of organisms, and above all of man's own symbolic performances in crowning mere existence with meaning and purpose. No machine, however complex its nature or however ingenious its human inventor, can even theoretically be made to replicate a man, for in order to do so it would have to draw upon two or three billion years of diversified experience. This failure to recognize the importance of cosmic and organic history largely accounts for the imperious demands of our age, with its promise of instant solutions and instant transformations—which turn out too often to be instant destructions and exterminations.

Here Mumford is considering what Descartes left out of his thinking, and measuring, in view of his decisive shaping of the interest and direction of the Western mind, the disastrous results of the omission. He continues:

> The missing elements in Descartes' grossly over-simplified mechanical model, and in the scientific outlook that, consciously or unconsciously, has taken that model over, are history, symbolic culture, mind—in other words, the totality of human experience *not simply as known but as lived;* for every living creature knows something about life that even the most brilliant biologist cannot discover except by living. To heed only the abstractions of intelligence or the operations of machines, and to ignore feelings, emotions, intuitions, fantasies, ideas, is to substitute bleached skeletons, manipulated by wires, for the living organism. The cult of anti-life secretly begins at this point, with its readiness to extirpate organisms and contract human wants and desires in order to conform to the machine.

Well, we see the point of this criticism now, when everything Mumford says is brought home to us in dozens of daily experiences, as well as by the massive policies of nation-states for which "conquering" has become a law of survival. But in Descartes' own time, the clarity and simplicity of his "mathematical" method converted very nearly all Europe to his outlook.

But not Vico. This lonely, uncelebrated, and always poor son of a Florentine bookseller saw the shortcomings in Descartes' doctrines, and in his critical comment Vico went to the core of the matter in the mathematician's theory of knowledge. In his exhaustive study of Vico (*The Philosophy of Giambattista Vico*, Macmillan, 1913), Benedetto Croce shows that Vico began by

attacking Descartes' supreme confidence in his formula, *Cogito ergo sum.* Croce says:

> Vico, unlike the other opponents of Descartes, did not confine himself to or waste time in scandalised outcries at the danger to religion entailed by the subjective method. He did not inquire, like the schoolmen, whether the *Cogito* was or was not a syllogism, and if so whether it was or was not defective. He did not join in the protest of outraged common-sense against the Cartesian contempt of history rhetoric, and poetry. He went straight to the heart of the question, to Descartes' criterion of scientific truth itself, the principle of self-evidence.
>
> Fine knowledge, says Vico, this of the clear and distinct idea! That I think what I think is certainly an indubitable fact; but it has by no means the appearance of a scientific statement. Any idea, however false, may seem self-evident: that I think it so does not give it the force of knowledge.

Vico's further point is that the similar clarity of mathematical abstractions, even though in physics they may lead to a grasp of causes of physical motion, is only a surface knowledge; we do not learn, as a result, the reality of things in the round. He did not call Cartesian demonstrations false, but limited. He held, moreover, that the constructions of mathematics, while having sharp conclusiveness and validity, make a created system of "truth" which is often remote from the realities of human life, with all its sublety, its mysteries and dilemmas. There is much more, of course, to this fundamental criticism of Vico's, in which interesting theological argument plays a part, since Vico thought of himself as an earnest and faithful Catholic, but for this development readers may go to Croce: the gist of Vico's point is that man's knowledge of causes is only in the mechanistic dimension, while the Deity has perfect knowledge, which leads to Vico's central proposition that we can know completely only what we ourselves have created, or are able to create—a rather profound conclusion. Croce summarizes:

> If the mathematical sciences construct their concepts as they please, if they produce not truth but definitions, they are as a matter of fact not sciences at all, nor any form of knowledge, and cannot be compared with the divine knowledge, the knowledge of actual reality. In mathematics, says Vico 'man, holding within himself an imaginary world of lines and numbers, operates in this world by abstraction just as God operates in the universe by reality." It is a luminous comparison; but perhaps its light is that of metaphor rather than logic.

Vico is especially interesting in his discussion of education, in which he stresses the need to both awaken and discipline the imagination. Geometry serves discipline:

> . . . for geometry is to some extent pictorial in character while it strengthens the memory by the great number of its elements, ennobles the imagination by the delicacy of its figures and stimulates the inventive faculty by forcing it to review all these figures in order to choose those suitable to the demonstration of the quantity required. But the whole value of geometry also was annulled by the method then in favour with the schools, the algebraic method; which like the scholastic logic numbs all the vigour of youthful faculties, obscures the imagination, enfeebles the memory, and renders the inventive power and the understanding sluggish; thus damaging the liberal arts in four distinct ways, in the knowledge of languages and history, in invention and in prudence. More particularly algebra is fatal to the inventive faculty, because in using the algebraic method one is conscious only of the immediate field of vision; it weakens the memory because once the second sign is found the first need no longer be remembered; it blinds the imagination, because that faculty is not used at all; it destroys the understanding, because it lays claim to the power of divination.

This could be read as a defense of the Humanities, as distinguished from the sciences employing mathematics, and we know that the contempt of practitioners of the hard sciences for the inexact methods and conclusions of scholars and lovers of literature still exists, giving evidence of the strong survival of the Cartesian idea.

What can we say, simply, about the Humanities? One thing is clear: the Humanities all involve an element of subjective judgment. Accuracy in observation wins intuitive agreement; wisdom is not quantitatively measured, but *felt.* So one could say that Vico is making a brief for

this side of life, and in his severe judgment of living and learning purely by abstractions, he anticipates a great deal of the present-day criticism of the scientific method, not so much in itself as in its role of claiming a monopoly on all knowledge. The tendency of science, so conceived, is mechanistic and deterministic; what is wanted is balance between the quantitative and the qualitative, but so far we don't really know how to even begin to relate the two.

Another thing is clear: that knowledge which is subjective in origin is concerned with meaning, value, and human purpose, and for this reason must be acknowledged as entitled to control of all other departments of understanding. In short, present-day priorities in relation to the kinds of knowledge need to be reversed.

We have one more passage by Croce on Vico, an evaluation which follows a critical review of his work as a historian and historiographer. Croce says:

> Vico classifies, rather than narrates and represents, but there is classification and classification, it may be pressed into the service of a superficial thought or of a profound one. And the historical side of the New Science [the title of Vico's major work] is one great substitution of profound for superficial classifications.
>
> In this process which constitutes the strength of Vico's treatment of history, the deficiencies and errors come not from outside the limits of the process but from causes at work within these limits themselves. It has been alleged in defence of Vico that a great part of his errors is due to the scantiness and inadequacy of the materials at his disposal. But the materials for any study are always scanty and inadequate compared to our thirst for knowledge; and in judging a historian the question is not this, but the method, cautious or incautious, in which he employs the materials that are at his disposal.

Then, after some further criticisms, with examples of what seem fanciful inventions inappropriate in a historian Croce continues:

> Vico's was not an acute mind, so now in speaking of his historical work we must say that it was not critical. But as while we denied him acuteness on a small scale, so here we ought to add that if Vico lacked the critical sense in small matters, in great matters he had abundance of it. Careless headstrong, and confused in detail; cautious, logical and penetrative in essentials; he exposes his flank or rather his whole body to the attacks of the most miserable and mechanical pedant, and over-awes and inspires respect in every critic and historian however great. . . . absorbed by his own discoveries, often he does not give his power of investigation and observation time and room to develop, and instead of history he invents myths and investigates romances; but when he allows the power free play, it does wonders in the field of history. . . .

Here Croce seems to touch the very nerve of what we tried to say earlier, concerning what imperfect, unfinished men are able to do, when they are at their best.

What, finally, is the point of recalling this work of Giambattista Vico, of so many years ago? The point is simply that if in those days there had been more thinkers of his caliber and determination, Cartesian mechanism would have had additional and successful opponents, and we would not now be confronted by the social and ecological shambles of a world mismanaged and betrayed by "conquerors," exploiters, and manipulators, fully confident that they have been following the dictates of scientific knowledge, in full conformity with the laws of nature.

REVIEW
DISTORTIONS OF ANCIENT TRADITION

WE asked for a review copy of Peter Worsley's *The Trumpet Shall Sound* (Schocken paperback, $3.45) for the reason that its subject-matter—the "Cargo cults" of Melanesia—seemed to be something we should know more about. What are "Cargo cults"?

They are, in the author's words, "strange religious movements in the South Pacific" which have emerged during the past few decades.

> In these movements, a prophet announces the imminence of the end of the world in a cataclysm which will destroy everything. Then the ancestors will return, or God, or some other liberating power, will appear, bringing all the goods the people desire, and ushering in a reign of eternal bliss.
>
> The people therefore prepare themselves for the Day by setting up cult organizations, and by building storehouses, jetties, and so on to receive the goods, known as "cargo" in the local pidgin English. Often, also, they abandon their gardens, kill off their livestock, eat all their food, and throw away their money.

Readers will easily recognize certain characteristics which also appear in religious traditions of the Western world, in the form of millenarianism, such as the belief of the Adventists in the thousand years of harmony and bliss on earth, to be begun by the return of Christ. The Hopi Indians also believe in the coming of a Great Reform, which, it is said, will be not far off when there are "roadways in the sky" (now evident in the flight of aircraft), during which the evil people of the world will be destroyed and the Hopis will become instructors of all that remain, who will need to be taught the harmonious Hopi way of life. It seems evident that the extraordinary tenacity of Hopi culture, and its wide influence on those who have come to admire the qualities of the American Indians, are due to the profound sense of social and even cosmic responsibility which the Hopis acquire through their ancestral religion. The Jehovah's Witnesses, with their curious sort of pacifism which forbids them to fight in any war excepting the coming Armageddon, are another group with a family resemblance to the Cargo cult followers.

If the attributes of the "Cargo cult" can be discerned all over the world, in various religious groups, why discuss their presence in Melanesia? The answer to this question, Mr. Worsley says, is that in this region—the vast islanded area north and east of Australia—"the millenarian cult has become not merely a matter of theoretical importance to anthropologists, but also a matter of practical concern to governments."

> In Melanesia . . . Cargo cults have been central, not marginal. Indeed, I undertook the study of them, not out of some interest in the bizarre, the marginal or the archaic—as from the point of view of their contemporary social importance, millenarian, fundamentalist, salvationist, and other cognate micro-sects in developed countries such as Britain are—but because the opposite was true of Melanesian millenarian movements, which were precisely the most important widespread, and pervasive manifestations of the self-expression of the peoples of Melanesia at that time.

A general statement Worsley makes about Cargo cults is that when they are historically important—which seems to mean, numerous enough to have impact on the rest of society—they "are movements of the disinherited." They are peoples who have suffered at the hands of others. The Cargo cult, in short, in present-day sociological definition, is always the result of extreme tensions. The ideas which it rests upon and exploits are a part of many religious traditions, but its defining characteristics do not emerge unless great pressures are felt by the people involved. Worsley says:

> Without the situation, activist millenarian ideas are unlikely to arise, or if they do arise will be confined to a clique. There are many examples of eminently suitable mythical material in indigenous mythologies which was never used as the basis of millenarian movements until the coming of the White man. Thus the North American Indians had culture-myths of the renewal of the world and the return of the culture-hero.

This is a reference to the Ghost Dance religion which sprang up among the Plains Indians of the 1870s and 1890s in America, so well described in *Bury My Heart at Wounded Knee.* One might recall, also, the Aztec anticipation of the return of Quetzalcoatl, and the illusion that Cortes was their White God come again, as promised.

The psychology of the Cargo cult was first noticed during troubled times on the island of Fiji late in the nineteenth century. "Cargo" did not enter the picture until what has been named the "German Wislin" (possibly a corruption of "Wesleyan") movement of 1913-14 on an island close to the Papuan mainland.

> The doctrines of the German Wislin were first put about in 1913, but it was not until early 1914 that it became an organized movement. It contained some novel features. The earlier Milne Bay movement . . . had included the notion of the coming of a vessel with the ancestors aboard. This would be the beginning of millennial conditions in which there would be bountiful crops, numerous pigs and so on. Except in so far as Tokeriu was to have a steamer, it was not envisaged that the ancestors would bring European goods for the people. In the German Wislin, however, we find for the first time outside of Fiji the notion that was to become so important and widespread in decades to come—the notion of the Cargo.
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> The cult devotees did not anticipate millennial conditions in which yams and pigs would abound, but that the ancestors would bring them money, flour, calico, tomahawks, knives and so on.

The organizers and followers of the Wislin cult met at a graveyard, and one of them made an oration in which it was promised that ancestral spirits would appear, and that in two weeks the millennium would begin.

> When that period expired, the Day was promised for another three weeks' time, and when that period ended without the ancestors having arrived, the event was postponed once more. It was expected that a steamer, the *Silubloan,* would arrive with the spirits of the dead, and would tie up at a jetty which was to rise up out of the sea. . . .
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> Then would the Cargo be dispensed. Then, some said, the era of equality of White and Black would begin, but since others prophesied that the Whites at Thursday Island would be slaughtered, the theme of peaceful coexistence is a variable element in the prophecy. In native eyes, the basic point was the occurrence of a radical change in Black-White relations. Originally both had been equal; the White man had only established his control over key resources by theft self-help, then, was a logical and parallel action on the part of the islanders.

Another typical outbreak occurred on the island, Espiritu Santo in New Hebrides, where the population has been decimated by the enforced transport of thousands as laborers to the plantations of Queensland and Fiji. Disease and violence became common, and "the flow and pattern of native life" was destroyed. In 1923, when the wife of a native prophet failed to recover from an ill, a British planter was held responsible, and murdered. The prophet, Runovoro, declared that after all Europeans had been killed, the lost people, who had been taken away, would return in white "resurrection bodies," and the island life would be restored.

> Runovoro prophesied that the ancestors would arrive after a Deluge in a great white ship loaded with Cargo. . . . The prophet was credited with having raised from the dead not only human beings, including one of his followers who "died" in the excitement of a dance, but also a dead cow.
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> The awakening of the dead was constantly postponed, but this only strengthened the more radical wing of the movement. The demand "Santo for the Santoese" was put forward and the death of the Whites called for, since they were preventing the resurrection of the dead.

In New Guinea, similar anti-white feeling was mixed with longing for the things the whites could produce. In the Highlands the people believed that eventually black skins would be exchanged for white. Air drops by planes in the 1930s convinced them of miraculous possibilities. An observer reported:

> Each time the machine tore down the clearing . . rice, flour, axes and goods of all descriptions came hurtling to the ground. . . . The local people sat in

> awe and wonderment, their eyes wide open at the sight. To them the aeroplane was a messenger from the heavens bringing food to spirits who had become stranded.

Often the material riches of the whites caused the islanders to adopt Christianity, in the hope of similar benefits. But magic and ritual, not hard work, were regarded as the means to the new order, since the Europeans did not engage in any hard labor at all!

In a summarizing passage, Worsley notes the close resemblance of these millenarian cults to similar movements through history and around the world.

> . . . the future millennium is often envisaged in terms of a past Golden Age which may represent a folk-memory of an actual earlier epoch. . . . Or the messiah may be some historical figure expected to return once more—a secular folk-hero usually invested with a religious aura. Stenka Razin, Marko of Serbia, King Olaf of Norway, Charlemagne, Barbarossa, Alexander, Nero, Cromwell, Napoleon, King Arthur Bruce, Owen Glendower, Drake, and countless other heroes have been expected to return one day. Both millenarianism and the folk-memories of stateless societies are often merged in more advanced movements with secular utopias and with visions of a classless society in the future. In isolating the limited field of millenarianism we do not imply any rigid separation in reality. But some delimitation must be made otherwise a very large part of world history could be subsumed under the rubric of religious heresies, enthusiastic creeds and utopias.

While, as a scientific sociologist, the author does not interest himself in the possible "truth content" behind these dreams, he does point out that *all* values cherished by human beings "lie in realms of faith beyond scientific scrutiny," and it is useful to recall, here, Northrop Frye's judgment that scientific conceptions never enter the lives of people except in the form of myths. Meanwhile, it seems clear that the Cargo cult religions are practically all desperate remedies for intolerable conditions, and that they draw on ancient traditions which are common to all peoples everywhere, such as the cyclic coming of avatars, teachers, saviors, and heroes. This belief seems graven in the human heart, and it may have more truth in it than the "value-free" judgments of modern social science, even though preserved mainly in the materialized simplifications of unsophisticated races and tribes. In consideration of such possibilities, the reading of Mr. Worsley's scholarly and thoughtful book may prove an uncomfortable experience for some. How shall we explain the Krishnas, Buddhas, and Christs of history, if such longings are regarded as no more than cultural delusions? Human beings do have lives to live, philosophies to shape, and convictions to test. One wonders what sort of social science would result from the study of world peoples and their beliefs on the basis of a conviction that living a human life *requires* the search for truth, instead of the unengaged outlook of scientific "objectivity"?

COMMENTARY
A HIGHER MATHEMATICS?

IN justice to Vico, it should be noted that his criticism of mathematics applied mainly to the assumption that it comprehended all knowledge. Its abstract certainty nonetheless became for him a symbol of the *kind* of knowledge to be sought—knowledge gained through the power of creation. In a valuable appendix (III) to his book Croce surveys the philosophical valuations of mathematics throughout Western thought. He notes that Vico compares God to the geometrician, and that he said, "if I knew God I should be God." There seems a sense in which Vico, following Ficino and other Platonists, admitted the splendor of mathematics in a higher sense, but criticized its arbitrariness as a human creation. Leibniz, for example, remarked that "the ideas of justice and temperance are no more our own invention than those of the circle and the square." That there is a mathematics of this order, unarbitrary, even divine, was the Pythagorean conviction, and in the *Republic* (VII) Plato said that the study of reckoning is useful to the philosopher, but only for the sake of knowledge and "not for huckstering." He added that the *by-products* of geometry "are not slight," since the value of its discipline reaches beyond mundane considerations:

> . . . there is in every soul an organ or instrument of knowledge that is purified and kindled afresh by such studies when it has been destroyed and blinded by our ordinary pursuits, a faculty whose preservation outweighs ten thousand eyes, for by it only is reality beheld.

Interestingly, a vaguely parallel statement may be found in a paper by a modern philosopher of science, Pierre Duhem, who remarked of physics, pre-eminently a mathematical science, "that it would be unreasonable to work for the progress of physical theory if this theory were not the increasingly better defined and more precise reflection of a metaphysics; the belief in an order transcending physics is the sole justification of physical theory." (*Science*, April 23, 1954)

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Crowded out of this week's "Children" is the observation, especially worth noting, of David Kriebel that the recycling programs in which so many schoolchildren participate have greater fruit than their immediate accomplishments:

> A large percentage of active young environmentalists got their start in small recycling programs. Apparently these projects serve well as motivation, because they represent a combination of fairly straight-forward work requiring time and muscles, plus involvement in a complex political and economic issue more typical of larger environmental problems.

CHILDREN
. . . and Ourselves
ENVIRONMENTAL STUDIES

IN "Children" for last Oct. 17, we quoted from Christoph Hohenemser's account (in *Environment* for July/August) of a course he had been giving on "Technology and Man" at Clark University. In his discussion, Prof. Hohenemser spoke of the anti-science mood of many undergraduates, and of the value of technology-impact studies as means of restoring interest in the value of science as a tool for directing social action. Two *Environment* readers add further contributions along these lines in the January/February issue.

Under the heading of "Urban Affairs," Tee L. Guidotti tells about the Watts Science Project of 1970-71, in which he was involved. Collaborating were the Los Angeles Unified School District and the Biology department of the University of Southern California.

> Undergraduate science students from USC were placed in inner-city elementary schools where they were responsible for preparing and teaching lessons in science, receiving course credit for this work. The goal was enrichment of the child's store of experience, especially for the specific purpose of reading improvement.
>
> The program was a real challenge to the university students. They had to be secure in their subject and capable of answering the disarmingly simple but often devastating questions of little children. They had to convey their material in such a way as to hold the sustained interest of their pupils, few of whom had any previous instruction in science and engineering from their community and families. The barriers were many between student-teacher and student-pupil (both were students, just cast in different roles), as white college-educated students bound for professional careers tried to communicate with black inner-city school children for whom the sciences and technology belonged to a different world.

Some of the projects devised by the undergraduate teachers were wild and wonderful. A third-grade class was involved in a scheme to build a rocket that would go to the moon, leading to study of "jet propulsion, combustion, life-support systems, and the solar system with simple experiments and class demonstrations, finally landing their cardboard rocket on a poster-paper moon." Purists may disagree with the inspiration for this course, but it at least won the interest of the third-graders. The approach of Tee Guidotti, who is a medical student at the University of California, San Diego, is likely to be more appealing:

> I taught a unit in basic ecology. To maximize the impact and value of the lesson within a tightly restricted time period I emphasized basic concepts which could be transferred to urban systems and applied to the pupils' daily experience and which tied in with their other studies in science under the program. My vehicles included a pet rabbit and a great deal of lettuce to introduce food chains and energy transfer (where do your groceries go?) and an aquarium to introduce mutualism and interdependence. The children quickly made logical connections with their urban setting and before long were discussing playground fights in terms of competition and the conversion of "food energy" to "muscle energy." One pupil pointed out that unlike our rabbit, which might be eaten by a wolf (or by her for dinner), all the energy she didn't use up working or playing would be trapped in her body, unavailable to others. The concept of a top carnivore is an impressive one for a nine-year-old to figure out by herself.

In a general comment on the importance of such projects in education, Guidotti and a colleague say:

> . . . the only highly sophisticated technology the ghetto resident is likely to be exposed to is medicine when he is hurt and law enforcement when he is in trouble. . . . Ours is a highly technical society, for better or worse, and we demand of our citizens a certain minimal competence in the matters of technology for them to interpret the society in which they live and make intelligent decisions. Those who cannot appreciate the basic scientific principles underlying our way of life are, in short, disenfranchised.

Edwin Marston, who teaches physics at Ramapo College in New Jersey, was moved by

Prof. Hohenemser's report to tell about a course he calls "Urban Physics." He says:

> Since we are describing the students' everyday world, the course emphasizes the making of rough estimates of magnitude and quantity followed up by back-of-the-envelope calculations. They calculate how many acres of trees the Sunday edition of the *New York Times* consumes, how large their town's watershed and sewage treatment plant should be, how many highway lanes are equivalent to a railroad track or to a certain number of telephone cables, and how much power a highrise office building needs.

The idea is to fill various gaps in the knowledge of the ordinary person—fill it with facts he will not even realize he doesn't know, until he gets some experience in acquiring them. The goal is far students to learn "how their urban support system operates." Some of the gaps:

> On a qualitative level, they do not understand how elevators and highrise construction techniques interact with mass transit and urban water systems to produce cities. Or why urbanization leads to floods which lead to dams which lead to denuded beaches. But when they calculate how many tons of silt enter Lake Mead each day and how many railroad cars it would take to haul that sand to the coast, they begin to see the magnitude and depth of our man-made changes.

Prof. Marston has other impressive illustrations of the sort of knowledge citizens need to govern themselves effectively in a technological society. He says in conclusion:

> Perhaps much of this could be better taught by an ethician or a sociologist, but it seems to me that physical scientists start out understanding present and possible future technologies, and that this is a great advantage. In addition I find that I teach more about physical models and applications of numbers than I was ever able to teach in the conventional physics course for nonscience students. But most of all I have found that the study of technology does not fit into any one or even any collection of disciplines. It must be approached on its own terms. Interdisciplinary programs focusing on technology will succeed only to the extent the participants are willing to abandon their disciplines and struggle with technology's very special and uncompartmentalized problems. Technology is far more folk art than engineering or economics or sociology.

Under "Education" in the January/February *Environment,* David Kriebel, a student at the University of Wisconsin, describes the focus on environmental issues provided by several groups, including the student organization, Union of Young Environmentalists, to which he belongs. Following are some accomplishments:

> . . . a group of high school students near Akron, Ohio became concerned with a large shopping mall that was all that was going to be built nearby. They questioned the need for the mall, as well as its location. Through research into zoning regulations, and the land and water quality of the proposed site, they became convinced that the mall should not be built. By approaching the town government with solid, reputable data, they were eventually able to halt construction of the mall. . . .
>
> A group of high school students in New York City spent the better part of a year making a film for public television which explored the ecological problems created by major airports. A great deal of time was spent investigating both airports and film-making. The resulting film, broadcast over educational television, helped create a general public awareness of the harmful side effects of air transportation.

Teaching and educational projects along these lines seem likely to generate attitudes toward both nature and society in which individual responsibility is spontaneous and the rule.

FRONTIERS

Beyond The Wasteland

[This article by Theodore Roszak is reprinted from *Trends* for January/February, with permission of the author.]

PERHAPS what we need, as much as an ethics of energy, is an *aesthetics* of energy—a feel for the texture and quality of the many kinds of power nature offers us. Might this not be part of a school curriculum?

Some forms of energy—the power of wind, wave, solar light, waterwheels, perhaps the beasts of burden—have a grace, serenity, and purity about them that lends them a special charm. We ought to feel comfortable and easy in their presence, knowing that they do little to deplete or mar the environment. All these possess a natural economy of limitations and a becoming modesty.

Other forms of energy—oil, natural gas, nuclear fission, coal, and wood combustion (along with the steam or electricity they might generate)—have a violence about them that is not necessarily ugly (on a limited scale) but that is surely formidable. We ought to experience their presence as somewhat intimidating, perhaps ominous—like the power of a smouldering volcano. And that perception should counsel restraint in their use. All these fuels work through the harsh, domineering agency of fire, all require that something of the earth's body be incinerated and destroyed like a sacrifice to that flame; all leave behind unsightly, if not deadly, wastes. One thinks of these energies in association with furnaces and forges, roaring engines and great industrial infernos—Blake's "dark Satanic mills." Behind them somewhere is the hard, aggressive labor of mining, drilling, boring or hacking up the earth to tear away its substance. Often this labor takes men to the most uninhabitable regions: deep under ground or to scorching deserts. And these fuels have become such industrial treasures as nations and corporations cheat, steal, and make war to possess.

Significantly, the energy sources surrounded by this ethos of force and rapacity are the great polluters. It is almost as if the earth attached a heavy environmental price to their use, warning us that *the greater our appetite for these nonrenewable energies, the greater the filth, ugliness, discomfort and* (*in the case of atomic wastes especially*) *noxiousness we must steel ourselves to live with.* These are also the energies that have made modern warfare the total horror it is. All things considered, how badly off would we be had we made only minimal use of their services?

I am not sure where hydroelectricity fits into this classification. It is, on the one hand, an astonishingly clever extension of the waterwheel and has much the same ingenious grace and cleanliness. But it is obviously of colossal scale and, in the wrong locations, its damsites can crush out much natural beauty. Myself, I think we should allow solar, wind, and thermal energy plus hydroelectricity to be the main determinant of our electrical power budget. That is, whatever number of solar-, wind-, thermal- and hydroelectric projects we can tastefully locate about the earth should stand as our main sources of supply, with all others cut back sharply to marginal use. This would leave us, probably, with much less electricity at our disposal and so perhaps we should have to sacrifice color television, neon advertising, electric hair dryers and ice crushers, a great deal of air-conditioning and piped-in music, etc. Recently, without too much application to the task, I found myself able to list in twenty minutes ninety-four uses of electricity that I could do without and whose absence would actually *improve* my standard of living. Begin with your automatic dishwasher and see how far you get.

The trouble is, of course, that in our artificial environments we are screened off from the origin, nature, and byproducts of the energy we are dependent upon. For most people, energy is something that simply flows out of sockets or

happens under the hood of the car when you turn the key. It is always there at the flick of a switch, and there is never need to think back along the magic wires and pipes that deliver the product until one reaches their distant sources—the vast expense of labor and resources that provides this power, the quality of life and work that attends its acquisition.

Much less is there any need to contemplate the awesome geological history of these fuels. *The housewife motoring to her hairdresser, the trucker delivering four tons of Hostess Twinkies at seventy-five miles per hour are, in fact, burning up the residues of primeval forests and dinosaur herds.* These fuels are so many pages of the earth's prehistoric biography, a billion years in the making . . . and now scarcely two centuries in the using up. Are these subterranean deposits not perhaps the earth's memory stuff, her way of treasuring away her growth and experience? And should not such materials be used with at least a modicum of the respect we pay to the remnants of our own human history? I don't suggest we must never use these fuels at all. But surely it is a sort of vandalism to consume them utterly and so frivolously.

But who finds occasion to ponder such matters while a distracted attendant pumps ten gallons of our favorite brand into the gas tank so we can make it from here to the bowling alley in time? Most of us do not even lay eyes on the refined fuel as it flows into our car, but only see figures flashing by on the pump gauge.

There is another reason for our remarkable ignorance about energy. Energy means hard work, and hard work—in our industrial culture—has come to mean the sort of alienated drudgery we associate with crushing lack of status. Hard work is for troglodytes and proletarians, for suckers and off-white minorities. It is an evil we wish to be rid of. So we flee from it and all that is associated with it. Work is something we want machines to do while we model white collars, initial memos, or finger paint at the university extension. Meanwhile a great deal of the human energy we call "fat" accumulates on many a well-fed frame and must then be "worked" off at the gym. Whenever the discussion of wasted energy comes up, be sure to look out the window and count the number of joggers you see struggling by. Every ounce of carbohydrates you observe being burned up that way *could* have been used to do something we would not then need electricity, gas, or petroleum to do . . . like walking across the room to change the channel, or opening our own garage door without benefit of the photoelectric effect, or walking up a few flights instead of using eight tons of elevator.

Machines are our slaves and the energy that feeds them is none of our concern if we can help it. We aspire to rise above such vulgarities. *To a very large degree, the energy crisis is a work crisis in our culture.* Having no positive and joyful conception of physical labor, we fastidiously make ourselves ignorant of everything associated with it.

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