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A PREFACE TO SCIENTIFIC LITERACY

IN the April issue of the *Bulletin of Atomic Scientists* an eminent physicist, Robert R. Wilson, who was head of research at the Los Alamos Laboratory from 1944 to 1956, and now teaches physics at Columbia University, appeals for an increase in general scientific literacy. By this, he says, he means not "familiarity with professional technical journals, but rather a general non-mathematical understanding of enough of the content and method of the various sciences to match our 'literacy' in the other important aspects of life." Prof. Wilson writes as a scientist who, recalling C. P. Snow's account of the wide gap between scientific intelligence and humanist understanding, published twenty-five years ago, feels that the division has become more serious. He says:

> Several decades ago it was not of such critical importance. After all, it seemed then to be a matter of personal taste, not survival, whether sports, or politics, or literature, or physics was to occupy one's attention and interest. But science was just beginning to present the serious problems of technology it does today—problems which in some cases must be dealt with immediately if we are to live our lives even approximately as we do now.

There has been, he thinks, a little progress in closing the gap. Yet books have helped. He mentions Watson's *The Double Helix,* Freeman Dyson's *Disturbing the Universe,* and Weinberg's *The First Three Minutes,* and finds several new magazines—*Omni, Science 81,* and *Smithsonian*—adding to the useful expositions available in the *Scientific American* for many years past, but he ends by remarking that "the general level of scientific literacy is woefully inadequate for life in a scientific age."

What reason does Prof. Wilson give for the importance of "general scientific literacy"? The public, he proposes, must gain the capacity to control, limit, or guide the scientific enterprise. Non-scientists, he says, "must come to realize that they bear the responsibility for the problems, and must somehow learn to control science and the technology it spawns if they are to survive." He admits to not knowing how this can be arranged, but believes that scientifically literate people have the best chance of doing it. Hence his appeal.

In a way, this seems like a cry for help from the sorcerer's apprentice, a few minutes before the big flood, but perhaps we should take this physicist at his word. General scientific literacy would be a very good thing. Yet it is a question, however, whether absorbed reading in the magazines and books named, along with more of the same, systematically presented in the schools—"from kindergarten to college"—will accomplish what is needed. What he really wants—or ought to want, let us say—is a populace of the sort that would have risen up in arms to save Giordano Bruno from the stake, or Galileo from long years of house arrest; and, in later times, would not have permitted the government to bar J Robert Oppenheimer from public service because—forsooth—he didn't believe we should make more devastating nuclear bombs! Prof. Wilson wants the public to cast itself in the role of a Leonardo, the man who refused after a time to invent more devilish weapons for the robber barons of Italy, or to learn from and follow the example of Otto Hahn, the German scientist who discovered the secret of uranium fission in 1939 but refused throughout the war to serve the Nazis with his knowledge of nuclear physics. Then, as an example in this country, there was Norbert Wiener, who denied access to his own research to a company making guided missiles, saying that such a weapon can only be used "to kill foreign civilians indiscriminately, and that it furnishes no protection whatsoever to civilians in this country."

Wiener added: "I do not expect to publish any future work of mine which may do damage in the hands of irresponsible militarists."

Since how to raise the public intellectual and moral I.Q. to this level of sensibility is by no means apparent, Prof. Wilson suggests that at least our representatives in the legislature ought to be "scientifically literate." Well, some of them are, but this does not appear to accomplish a great deal, although the Office of Technology Assessment, of recent origin, seems to be doing good work. But effective scientific literacy would mean much more than wide acquaintance with the trends of contemporary research and development. It would mean, for example, the capacity to answer, at least in part, an open letter written in the 40s by an undergraduate to the President of Yale University.

> You [this student wrote] learned that man is distinct from animals, and yet our biology courses now conceive of man as one species of animal. . . . A logical inference from every psychology lecture we have ever attended would be that man's least thought and act can be wholly explained in terms of cause and effect; that every choice is dictated by a million strings of deterministic factors leading back to the dawn of time. . . .
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> If men are but animals, why not treat them as such? An animal has no rights. The law among animals is the law of the strong. If a man is a slave of determinism, incapable of a free choice, what is the value of the ballot, trial by jury and civil liberties in general?. ..
>
> Isn't it palpably obvious to you that at the root of the trouble lies an apparent contradiction between the implications of our studies and the ideals we are expected to revere?

Should questions of this sort be expected to have an answer from the scientifically literate? Or should we say that this is not a scientific question, but a philosophical problem, or a merely human one? Meanwhile, what is the responsibility of the individual scientist? The scientists themselves are by no means in agreement on this matter, as another article in the April *Bulletin* makes clear. Should scientists adopt something like the Hippocratic Oath? Or is Tom Lehrer's couplet an adequate version of the scientific consensus:

> Once the rockets go up, who cares where they come down? That's not my department, says Wernher von Braun!

We have named some scientists with quite other views, but one, a physicist, who has given much thought to the general question of scientific knowledge, is Erwin Schrödinger, a leading physicist of this century. As an educational preface to any attempt to develop scientific literacy in the non-specialist public, Schrödinger's discussion of the scope, meaning, and implications of science—or some practical equivalent of what he says—would certainly be necessary. Schrödinger has written two small books, *What Is Life?* (1946) and *Nature and the Greeks* (1954), both published by Cambridge University Press. Together they make less than two hundred pages of serious consideration of modern science and its fruits. Here we turn to *Nature and the Greeks.*

Why, in lectures intended to provide a brief exposition of "the present-day scientific world-picture," does he start with the Greeks? He explains that we have learned how to think from the Greeks—that as John Burnet said in *Early Greek Philosophy*, "it is an adequate description of science to say that it is 'thinking about the world in the Greek way'." The earliest Greek thinkers, although philosophers rather than scientists, were the first "objectivists." Schrödinger is interested in what we have taken from their pioneering efforts.

One thing that this small volume accomplishes is the generation of a large respect for science and the spirit of scientific inquiry—an attitude appropriate in any inquiry which sets out to be critical. The Greek philosopher-scientists were determined to look at the world around them with as little "prejudice" as possible. Schrödinger adopts the conclusion of Heraclitus, that what real knowledge we possess is the consensus of the best investigators—what they find in common; and he remarks: "Generally speaking one ought not, I

think, to be altogether too astonished to find occasionally very deep philosophical thought in the earliest records of human thinking about the world; to find ideas which to form or to grasp costs us nowadays some effort and labour of abstraction."

After some review of the ancient atomists, ending with Democritus, he says:

> We are facing here one of the most fascinating cases in the history of ideas. The astonishing point is this. From the lives and writings of Gassendi and Descartes, who introduced atomism into modern science, we know as an actual historical fact that, in doing so, they were fully aware of taking up the theory of the ancient philosophers whose scripts they had diligently studied. Furthermore, and more importantly, all the basic features of the ancient theory have survived in the modern one up to this day, greatly enhanced and widely elaborated but unchanged, if we apply the standard of the natural philosopher, not the myopic perspective of the specialist. On the other hand we know not a scrap of the wide experimental evidence that a modern physicist adduces in support of those basic features was known either to Democritus or to Gassendi.

Was the idea of atoms just "a lucky guess which later proved to be correct?" Or is the "thought-pattern" involved in thinking about atoms "not so exclusively based on the recently discovered evidence as the modern thinkers believe, but on the cooperation of much simpler facts, known before, and on the *a priori* structure, or at least the natural inclination, of the human intellect"?

> If the likelihood of the second alternative can be proved it is of paramount importance. It need not, of course, even if it were certain, induce us to abandon the idea—in our case atomism—as a mere figment of our mind. But it will give us deeper insight into the origin and nature of our thought picture. These considerations urge us to find out, if possible, how were the ancient philosophers led to their conception of immutable atoms and the void?

There follows an account of Democritus as a distinguished geometer and of the problems which confront those who try to relate their abstract computations about matter and space with the facts of experience.

Why did Democritus adopt the atomic theory? Answering, Schrödinger says:

> . . . atomism was forged as a weapon to overcome the difficulties of the mathematical continuum, of which, as we have seen, Democritus was fully aware. To him atomism was a means for bridging the gulf between the real bodies of physics and the idealized geometrical shapes of pure mathematics. But not only to Democritus. In a way atomism has performed this task all through its long history, the task of facilitating our thinking about palpable bodies. A piece of matter is resolved in our thought into an innumerably great, yet finite number of constituents. We can imagine our *counting* them, while we are unable to tell the number of points on a straight line of 1 cm. length. We can count in our thought, the number of mutual impacts within a given time. . . .
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> Thus atomism has proved infinitely fruitful. Yet the more one thinks of it, the less can one help wondering to what extent it is a *true* theory. Is it really founded exclusively on the actual objective structure of "the real world around us"? Is it not in an important way conditioned by the nature of human understanding—what Kant would have called *"a priori"?* It behoves us, so I believe, to preserve an extremely open mind towards the palpable proofs of the existence of individual single particles, without detriment to our deep admiration for the genius of those experimenters who have furnished us with this wealth of knowledge. They are increasing it from day to day and are therefore helping to turn the scales with respect to the sad fact, that our theoretical understanding thereof is, I venture to say, diminishing at almost the same rate.

The intellectual and practical satisfactions of atomic theory seem fairly well known. The doctrine filled a psychological need, and this may be its primary origin.

But there were unanticipated side-effects. Schrödinger gives close attention to one:

> It has a terrible consequence, which has haunted the thinkers of many centuries and in slightly changed form still puzzles us today. The world-model consisting of atoms and empty space implements the basic postulate of *Nature being understandable,* provided that at any moment the

> subsequent motion of the atoms is uniquely determined by their present configuration and state of motion. Then the situation reached at any moment engenders of necessity the following one, and this the next following one, and so on forever. The whole going-on is strictly determined at the outset, and so we cannot see how it should embrace also the behaviour of living beings including ourselves, who are aware of being able to choose to a large extent the motions of our body by free decision of our mind. If then this mind or soul is itself composed of atoms moving in the same necessitous way, there seems to be no room for ethics or moral behaviour. We are compelled by the laws of physics to do at every moment just exactly the thing we do; what is the good of deliberating whether is it right or wrong? Where is room for the moral law if the natural law overpowers and entirely frustrates it?
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> The antinomy is as unsolved today as it was twenty-three centuries ago.

In his last chapter, Schrodinger notes that, as a result of David Hume's discovery that "the relation between cause and effect is not directly observable and enunciates nothing but the regular succession," the positivists have resigned themselves to the view that science "explains" nothing, providing only "a complete and (Mach) economical description of the observed facts." Schrödinger thinks that the situation is not that impoverished, since science has contributed so much order and disclosed basic principles, but he goes on to say:

> There is, however, so I believe, a second feature, much less clearly and openly displayed, but of equally fundamental importance. It is this, that science in its attempt to describe and understand Nature simplifies this very difficult problem. The scientist subconsciously, almost inadvertently, simplifies his problem of understanding Nature by disregarding or cutting out of the picture to be constructed, himself, his own personality, the subject of cognizance.

If, he says, you look at the world as an object, "you have virtually ruled yourself out," which recalls the Heraclitean postulate that the true world is what is agreed upon by the best investigators. "For it is this 'world in common'. . . of Heraclitus that we are constructing . . . And indoing so, everyone willy-nilly takes himself—the subject of cogn

This exclusion of the self from thought Schrödinger holds to be a virtual necessity in scientific thinking. We cannot, save with very great difficulty, he says, think of both subject and object at the same time.

> The following simile is not very good, but it is the best I can think of: a child is given an elaborate box of bricks of various sizes and shapes and colours. It can build from them a house, or a tower, or a church, or the Chinese wall, etc. But it cannot build two of them at the same time, because it is, at least partly, the same bricks it needs in every case.
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> This is the reason why I believe it to be true that I actually do cut out my mind when I construct the real world around me. And I am not aware of this cutting out. And then I am very astonished that the scientific picture of the real world around me is very deficient. It gives a lot of factual information, puts all our experience in a magnificently consistent order, but it is ghastly silent about all and sundry that is really near to our heart, that really matters to us. It cannot tell us a word about red and blue, bitter and sweet, physical pain and physical delight; it knows nothing of beautiful and ugly, good or bad, God and eternity. Science sometimes pretends to answer questions in these domains, but the answers are very often so silly that we are not inclined to take them seriously.

The scientists elaborate their view of nature and the world, feeling that they are doing what may be called "creative work." But as the picture nears completion—or what is believed to be completion—something quite unpleasant happens.

> . . . then comes the impasse, this very embarrassing discovery of science, that I am not needed as an author. Within the scientific world-picture all these happenings take care of themselves, they are amply accounted for by direct energetic interplay. . . . The scientific world-picture vouchsafes a very complete understanding of all that happens—it makes it just a little too understandable. It allows you to imagine the total display as that of a mechanical clockwork, which for all that science knows could go on just the same as it does, without there being consciousness will, endeavor, pain and delight and responsibility connected with it—though they actually are. . . . we have used the greatly simplifying device of cutting our own personality out, removing it; hence it is gone, it has evaporated, it is ostensibly not needed.

> In particular, and most importantly, this is the reason why the scientific world-view contains of itself no ethical values, no aethetical values, not a word about our own ultimate scope or destination, and no God, if you please. Whence came I? Whither go I?. . . .
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> That is the great unfathomable question, the same for every one of us. Science has no answer to it. Yet science represents the level best we have been able to ascertain in the way of safe and incontrovertible knowledge.

Erwin Schrödinger leaves us with this dilemma. He will not hide it by reason of scientific pride. One might say that the "incontrovertible knowledge" he speaks of is what may be seen and accumulated by man as a *witness.* The witness looks at the objective world, studies it, draws conclusions, finds things out. He does things—which may turn out to be terrible—with what he has discovered.

But the witness is only half the man. Humans are also actors. They are filled with longings and intentions. They have ends to achieve, projects to pursue. They are purposive beings. Man as *actor* is man in motion. He is on a search, an odyssey. Such an individual is no impassive witness, no abstract and unrelated observer. He sees the world through the lens of his intentions. His objectivity is wholly subservient to his purpose, as even the example of Democritus may show. Literacy, then, which here signifies maturity, means examining science in terms of human purpose and judging it by the light of the best purpose we know.

REVIEW
A MEETING OF EXTREMES

VINE DELORIA, author of *Custer Died for Your Sins* and *God Is Red,* is a Sioux Indian who lived for eighteen years on a reservation. Apparently, he learned things there which he has now brought to philosophical maturity in his latest book, *The Metaphysics of Modern Existence* (Harper & Row, 19.79, $8.95). His concern, however, is with attitudes, not doctrines. He inquires into the possibility that today, as a result of certain developments in science, there may be a synthesis of the Eastern religio-philosophical outlook with Western scientific ideas, and a corresponding resolution of the differences between "primitive" and modern modes of thinking. Mr. Deloria seeks no converts to traditional Indian belief, but wants rather to show the value of the essential Indian attitude toward life. A closing sentence of the book indicates what he means by metaphysics: "In the re-creation of a metaphysics as a continuing search for meaning which incorporates all aspects of science and historical experience, we can hasten the time when we will come to an integrated conception of how our species came to be, what it has accomplished, and where it can expect to go in the millennia ahead." Metaphysics means "a search for the structure and meaning of reality."

Since this is an "all about everything" book—and one worth reading—we shall give attention here mainly to why Mr. Deloria decided to write it, and why it is different from books by writers of conventional Western background. He sets the contrast in the ways of thinking to be examined in his introduction:

> . . . if an Indian tells other Indians that he or she has seen a ghost, describes the experience, and asks others for advice, he or she is taken to be a serious person with a serious problem. However, if a non-Indian tells another non-Indian that he or she has seen a ghost, it is another matter entirely. Scientists will give the person a suspicious look and recommend a psychiatrist. The priest or minister will take great pains to reassure the person that he or she in fact did not see a ghost. The average listener may or may not believe the person, depending upon the listener's orientation toward the supernatural.
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> Therein lies the difference. The Indian confronts the reality of the experience, and while he or she may not make immediate sense of it, it is not rejected as an invalid experience. In the Indian world, experience is not limited by mental considerations and assumptions regarding the universe. For the non-Indian the teachings of a lifetime come thundering down. Such things do not occur in time and space. Reality is basically physical. No one sees ghosts. Reality, in a certain sense, is what you allow your mind to accept, not what you experience. And a host of other beliefs rush in to cover up, confuse and eventually eliminate the experience itself.

One must of course press this comparison beyond the illustration of seeing a ghost. What do the non-Indian's habits of mind shut out? What does he refuse to think about, and what does this do to him? Much of what Deloria writes pursues thoughtful answers to these questions. The reason he found it necessary to hit the philosophical books of our time—mostly very good ones, which he quotes at length—was that he felt the extreme importance of finding these answers and wanted to make them intelligible for the Western man in the street as well as for inquirers with some acquaintance with the Western cultural tradition who are aware of the transformations now rapidly proceeding. He tells in his introduction why the questions and answers seemed vital:

> Attending school away from the reservation is a traumatic experience for most Indian people. In the white man's world knowledge is a matter of memorizing theories, dates lists of kings and presidents, the table of chemical elements and many other things not encountered in the course of a day's work. Knowledge seems divorced from experience. Even religion is a process of memorizing creeds, catechisms, doctrines and dogmas—general principles that never seem to catch the essence of human existence.
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> No matter how well educated an Indian may become, he or she always suspects that Western culture is not an adequate representation of reality. Life therefore becomes a schizophrenic balancing act

> wherein one holds that the creation, migration, and ceremonial stories of the tribe are true and that the Western European view of the world is also true. Obviously this situation is impossible although just how it becomes impossible remains a mystery to most Indians. The trick is for them an initiatory act that admits them to higher status of employment. They do not seem concerned with the ultimate truth of what they are taught. Indians, for the most part, fail to comprehend the sanity of this attitude at all.

In the case of the author, he found "heretical thoughts" springing up concerning the Western structure of knowledge. So he began to read—scholars like Ernst Cassirer, Mircea Eliade, and Giorgio De Santillana, physicist-philosophers such as Werner Heisenberg, psychologists like Carl Jung, philosophers like A. N. Whitehead, and dozens more writers, including Paul Tillich and some other modern theologians. He discovered what seemed views converging on his own dissident conceptions. The world, he felt, was getting ready for a transformation of the modern theory of knowledge. Mythic tradition was acquiring a new sort of authority, and intuition and spontaneous human feelings were gaining deliberated respect. "Over a period of time," he says, "it became increasingly clear that the trend in modern thought was approaching the Indian conception of the universe; the work of synthesizing ideas became more urgent."

There is much quotation in Deloria's book, drawn from his reading in recent years. By this means he seeks to show what are the lines of development of the best of modern thought, revealing a common direction. This is the book's purpose, "not any startling new revelations on the nature of reality and not some esoteric Indian doctrines that have not yet been revealed to the Western world." He also says:

> Finally, at least part of the motivation for this book comes from the reception that some young Indians gave to *God Is Red*, a previous book that attempted to outline the areas of difference between Western religious conceptions and a generalized theory of Indian beliefs. In the years since *God Is Red* was published, a number of young Indians have thanked me for writing it, saying they always believed in the migration, creation, or revelation stories of their tribe but were unable to defend the reality they experienced in the face of disbelieving non-Indians. That a catastrophic theory of interpretation could be used to verify their tribe's traditions and, in some instances, could show them how to relate their traditions to modern developments in physics, medicine, psychology, and religion encouraged me to attempt a more thorough outline of the differences that exist between traditional Newtonian and Darwinian interpretations of the world and the new ideas now surfacing. I thus firmly believe that the newly emerging view of the world will support and illuminate Indian traditions and that Indian traditions will prove extremely useful and accurate when cast in a new and more respectful light.

A passage from the chapter on "Tribal Religious Realities" illustrates the temper of the author's comment and criticism:

> It would be comforting, of course, to claim that primitive peoples derived the principles of modern energy theory from their religious experiences thousands of years before Western scientists formulated their complicated explanations, but it is not necessary to be extravagant. It is sufficient to note that the observations and experiences of primitive peoples were so acute that they were able to recognize a basic phenomenon of the natural world religiously rather than scientifically. They felt power but did not measure it. Today we measure power but are unable to feel it except on extremely rare occasions. We conclude that energy forms the basic constituent of the universe through experimentation, and the existence of energy is truly a conclusion of scientific experimentation. For primitive peoples, on the other hand, the presence of energy and power is the starting point of their analyses and understanding of the natural world. It is their cornerstone for further exploration.

In his analysis of our changing institutions, Deloria borrows from Charles Reich the term "Public Interest State" to indicate the present transformation of government from being a kind of "umpire" in the game of individual and corporate acquisition to becoming an actual *source* of wealth. More and more, Reich maintained in an article in the *Yale Law Journal*, wealth is flowing from government largess instead of from private property and enterprise.

Commenting, Deloria says: "Since the beginning of the second World War, private industries have become almost totally dependent on some form of defense or defense-related contract work to remain in business." And the large educational institutions of the country could hardly survive without contracts with various federal agencies. He lists the income from government of the top ten universities in 1974, with the University of Washington receiving the most, close to $80 million, and UCLA obtaining almost $74 million.

Drawing on Reich's analysis, Deloria argues that through such benefactions or subsidies, "the government establishes a formal relationship with institutions and corporations in giving funds that require the surrender of a great portion of the private identity of the recipient." The recipient becomes "responsible for assisting in transmitting and promoting the government's image of American society."

> The government in this sense. . . no longer behaves as an impartial objective structure designed to express the wishes of the constituency but takes on the ominous task of determining personal values and reshaping beliefs. . . . Defining major areas of income as privileges and demanding loyalty as the condition for receiving income meant a fundamental reversal of the relationship between the citizen and the state. The state, in granting privileges in return for loyalty, was in fact purchasing individual freedoms because dissent from government policies, for whatever reasons, was regarded not as the exercise of freedom of speech but disloyalty. The irony of this situation was that many programs were not voluntary. Citizens were forced to participate in them but received the benefits only by a demonstration of loyalty to the government. American democracy had substituted government largess for private property. . . .

Deloria sees no way to reverse this process save by a logical *tour de force* which would make the loyalty of individuals apply to the world of nature instead of the state, abolish property, and establish the rights of all people to economic security without interference with their personal freedom of thought and action. And this, he suggests, points to the tribal way of life. "Our technology and our social institutions are themselves guiding us in this direction."

The Metaphysics of Modern Existence ranges widely over philosophical, scientific, religious, and social terrain, regions often familiar to the general reader by reason of recent books, but Deloria's serious purpose and the intensity of his investigation give his work a unique value.

COMMENTARY
QUESTIONS AND ANSWERS

IN this week's Frontiers, one of the contributors to *The Farm and the City*, Brian Berry, is quoted on the problem of improving the condition of our cities. Change is not impossible, he suggests. After the second World War, he points out, there was a great increase in home ownership, with far-reaching effect on the cities. He proposes:

> There is no reason to believe that another restructuring could not be designed to lead in other directions. In a highly mobile market system nothing is as effective in producing change as a shift in relative prices.
>
> There is, then, a way. Whether there is a will is another matter. Under conditions of democratic pluralism, interest group politics prevail, and the normal state of such politics is business as usual.

So, finally, a crisis is his prescription. The people, in short, cannot be expected to change their ways, their business-as-usual decisions, unless impending and obvious disaster forces them to. "Nothing less than an equivalent crisis," Mr. Berry concludes, "will, I suggest, enable the necessary inner city revitalization to take place."

Were, then, the teachers, the biologists and psychologists that the Yale student (quoted on pages 1-2) was exposed to, right? Is economic pressure the sole motivating force in our society? The answer, in statistical (political) terms, is almost certainly yes, but for some individuals—who knows how many?—it is a resounding no. But those individuals are not numerous enough, it will be said, to assure political action. True. Yet there are individuals in the South Bronx of New York who are already changing their part of the city. They were in crisis, you could say. But they made changes because one woman decided that "it ought to be possible to do something with what you've got."

A similar question arises in relation to Robert Wilson's appeal (on page I) for better scientific education. How many parents will look away from "business as usual" long enough to see that their children are brought up to know what the scientists are doing and what it may mean to the world? Statistically, not enough. Anyone can see that. But some parents are already trying to educate themselves along the lines suggested in our lead article. A few scientists are taking part in this effort. It would help if there were more of them.

CHILDREN
. . . and Ourselves
ODDS AND ENDS

WE hasten to add, *good* odds and ends, and somehow related ones, however subjective the connections. We have been reading lately in Lin Yutang's *The Wisdom of Laotse,* already an "old" book, about a much older one, and if excuse be needed for speaking of it here, we could urge that no one has an education unless he has saturated himself with this wisdom—which is not of course found only in Lao tse. Emerson, declares Lin Yutang, is a magnificent Taoist, adding that Emerson's essays on "Circles" and "The Over-soul" are appreciated even more after reading Lao tse. Of Taoism, Yutang says:

> It is a philosophy of the essential unity of the universe (monism), of reversion, polarization (*yin* and *yang*), and eternal cycles, of the leveling of all differences, the relativity of all standards, and the return of all to the Primeval One, the divine intelligence, the source of all things. From this naturally arises the absence of desire for strife and contention and fighting for advantage.

Lao tse appeals mainly to the feeling in us of what is true, while explaining either why or exactly what he means is next to impossible. For explanations, one should go to Holmes Welch's *Taoism—The Parting of the Way* (Beacon paperback) for the best exploration of possible meanings in the *Tao Te Cting* that we know of. But there is one passage in Lao tse that, when we first read it many years ago, seemed almost impossible to agree with—until, that is, about now. It is in the section on Government (in the Lionel Giles translation):

> Were I ruler of a little State with a small population, and only ten or a hundred men available as soldiers, I would not use them. I would have people look on death as a grievous thing, and they should not travel to distant countries. Though they might possess boats and carriages, they should have no occasion to ride in them. Though they might own weapons and armour, they should have no need to use them. I would make people return to the use of knotted cords. They should find their plain food sweet, their rough garments fine. They should be content with their homes, and happy in their simple ways. If a neighboring State was within sight of mine—nay, if we were close enough to hear the crowing of each other's cocks and the barking of each other's dogs—the two peoples should grow old and die without there ever having been any mutual intercourse.

Could anything be further from the approved American way of life? . . . Well, we might quote here from a Schumacher essay on the effects of excessive mobility, but equally to the point would be a brief essay by Jane Folmer in the *Community Service Newsletter* for January-February. She says:

> I grew up in a small town where there was "nothing to do" and no one to do it with. Everyone knew everybody and there was no place to hide. My friends and I couldn't go anywhere or do anything without everybody knowing about it. And yet today I am intent on providing my children with a similar environment. My hope is that I will also be able to instill an awareness and appreciation of the beauty of small communities and the people who live there.

The town was really small—thirty or so houses and a few stores around the oval park, with the town hall in the middle.

> I knew the names of all the people in those houses, where they worked and what they did because most of them worked in town and I could watch them at their jobs. There were two grocery stores, a delicatessen, a Ford dealer, a repair garage, a feed mill, a sand and gravel company. a telephone service, a post office, a church, a school, an electrician, a building contractor, a music teacher and maybe a few more that I have forgotten about.
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> As a child I treated the whole town as a playground—the sidewalks, the steps and porches and yards of the neighbors, the school yard, the village park and bandstand, the family grocery store with its huge porch, and the cornfield and woods behind my house. There were no fences. My playmates and I were under the unseen but watchful eye of somebody's mother wherever we went. A cry for help would bring two or three. By the age of 10 I joined my parents and grandfather at work in the family store, bagging coffee, crating eggs and stocking shelves. Feeling needed and capable builds self-confidence

and self-esteem at any age. My grandfather stayed young and active by working there until the age of 90.

But it was not until many years later that I came to appreciate the experience of living in a small town. Now I realize that a community is the whole of life on a small enough scale for even a child to participate in the weaving of intricate patterns of human relationships. All the activities of life are there, flowing through the community without artificial boundaries to isolate work and play, business and pleasure, friends and family.

As you read this, you can feel the looming presence of a new-old set of values, born from within, but stirred from without. There are now lots of people able to walk by the window of a travel agency without being tempted to look at the posters and brochures. Yet if they need to go abroad, they'll go, and probably learn more than most tourists. Jane Folmer has one other point:

More than just a small town, more than just the sharing of a geographic area, community is a feeling, a sense of belonging. When we see ourselves as one small element in a vast society of ills and evils, the inevitable result is a sense of powerlessness, hopelessness and fear. There is a limited number of people we can relate to as individuals. When there are too many names, too many faces, we stop trying to differentiate. The small community can provide us with the opportunity to deal with people as human beings and to work with them on problems that are within our grasp.

The Flowering Earth, a now seldom-referred-to but enduringly lovely book by the naturalist, Donald Culross Peattie (Putnam, 1939), begins with description of another community—the world of nature encountered in the California coastal town of Santa Barbara:

To the east, toward the breadth of the continent, the mountains rise. I see, beyond the walled garden outside my study window, their arid ranges, where canyons are carven, looking deceptively easy of ascent. The white-limbed sycamores, at least, troop up to them, winter-naked now and clearly seen across this western distance. Higher in the peaks, I know, the cedars and firs begin; higher still, cold lakes are mirroring sugar pines, the greatest in the world.

Close at hand the wild tangle of chaparral, sun-baked, sends up a pillar of incense. All of the life that is not ours, the other half, by which and with which we the animal life share earth, holds up its hands to the sunshine.

Blake said that only the play of imagination could save the world. We agree. How much would be "saved" if Peattie's way of seeing and understanding could spread apace!

As the brain of man is the speck of dust in the universe that thinks, so the leaves—the fern and the needled pine and the latticed frond and the seaweed ribbon—perceive the light in a fundamental and constructive sense. The flowers looking in from the walled garden through my window do not, it is true, see me. But their leaves see the light, as my eyes can never do. They take it, as it forever spills away radiant into space in a golden waste, to a primal purpose. They impound its stellar energy, and with that force they make life out of the elements. They breathe upon the dust and it is a rose.

Reading later in the book—about the yucca and yucca moth—we thought how splendid it would be if the righteous enemies of "evolution" teaching in the schools would, instead of demanding "equal time" for a Bible story, ask that the yucca blossom and its winged companion be made to confront the advocates of "natural selection" as the source of all organic diversity and wonder:

The only pollinator of those shining spires is a certain little furry white Pronuba, the yucca moth. She has specially modified parts to scrape together the sticky pollen from the stamens of one yucca flower, this she carries to another, and in the ovary of this second flower she lays her eggs, being careful to rub the pollen she has brought well into the stigma. Only thus will the seed certainly be set, and some of these seeds must serve as food for the moth larvae hatching safe within the waxy ovary.

FRONTIERS

Waiting for. . . a Crisis

WHAT is happening to the cities and the farmlands of the United States is the subject of *The Farm and the City* edited by Archibald M. Woodruff, who is also a contributor, and published in paperback at $5.95 by Prentice Hall. If you wonder who puts together the frightening figures given in the daily papers on the loss of fertile farmland to urban development, this book is the place to look for an answer. It has eight chapters, one on city problems, one on rural problems, a discussion of coordinating rural and urban management, of what can be hoped for from the free play of the market, a chapter on land ownership, one on the environment, and a survey of governmental control of land-use around the world.

In short, this is a book for policy-makers and for citizens in their much reduced role as managers of their country's affairs. It is also a book about possible ways of causing change in the use of land. It becomes clear that since 1945, far-reaching changes in land-use and living patterns have taken place. As William H. Sullivan says in the preface:

> The center cities lost not only population but also industries, as corporations followed their employees outside the city limits. With both these losses, they also lost substantial tax base and, hence, operating revenues.
>
> The farms, which had been losing population as mechanization increased, accounted for less than 4 per cent of the nation's population by the end of the 1970s. Most of those who left the farms, like those who left the cities moved to suburbia and exurbia.
>
> At the same time, prime farmland was voraciously consumed in real estate development for the suburbs. While statistics vary, it has been authoritatively estimated that by the end of the 1970s, prime farmland in the nation was down to about 380 million acres [diminishing at the rate of about three million acres a year, according to the Soil Conservation Service].

Farmers, the smaller ones, sell their land to developers who are able to increase its value from ten to eighty times. There are other pressures which make farmers give up farming. As A. M. Woodruff says:

> Green crop acres disappear for more than one reason. Some farmland has been abandoned because, given the 1980 state of agricultural technology, some crops cannot be grown in competition with the expansive fields of the Middle West. This is partly a function of size. Modern farm machinery has grown very large, and, like the giant dinosaurs, the large machines need room to maneuver. They cannot operate close to fences; small fields are not for them. Furthermore, they are enormously expensive, a small-scale operator cannot afford them. The little farms which once dominated eastern agriculture simply could not operate this way. They could, on the other hand, operate, and not inefficiently, with the scale of machinery that was in common use as recently as twenty-five years ago.

Complex problems are spelled out in detail in this volume. Predictions are difficult because at any time new factors may arise. Mr. Woodruff comments:

> A diet with more vegetable protein and less meat would reduce demands on middle western farmland. Solution of the energy problem within America's own boundaries would relieve one economic need to export food to pay for imports, leaving "compassion" exports to help ease world hunger. A gross error in either direction in population forecasts or any other assumption could change all other estimates. Considering the past record of population forecasts, gross errors are not a remote possibility.

The tools and measures available to the U.S. government for affecting what people buy and sell and how they use the land are mainly taxes and mortgage financing, although in other countries agriculture is closely protected by law and regulation. At the end of his discussion of rural and urban land use, Robert C. Weaver focuses what seem the essential issues:

> In the final analysis we have to ask ourselves these basic questions: (1) Do we *want* to make sure to preserve enough productive farmland to feed our present and future population and provide a surplus?

> (2) Can urban development be approached in a comprehensive manner so as consciously to integrate its basic geographic elements: exurbia, suburbia, and central cities? (3) Can and should cities be renewed and, if so, are we prepared to pay the necessary price?

It seems evident that these questions go to the heart of the matter, but they don't go to the heart of the average American, who has other things on his mind. Mr. Woodruff's book, as we suggested, is a guide for managers; but how will the managers, once they feel that they understand what needs to be done, get the people (and the Congress) to go along? This is the question that haunts the reader in all such studies.

In his chapter on the urban problem, Brian Berry makes this comment:

> After World War II, a restructuring of incentives played an important role in the increase in homeownership and the attendant transformation of urban form. There is no reason to believe that another restructuring could not be designed to lead in other directions. In a highly mobile market system nothing is as effective in producing change as a shift in relative prices.
>
> There is, then, a way. Whether there is a will is another matter. Under conditions of democratic pluralism, interest group politics prevail, and the normal state of such politics is business as usual.
>
> The bold changes that followed the Great Depression and World War II were responses to major crises, for it is only in a crisis atmosphere that enlightened leadership can prevail over the normal business of politics in which there is an unerring aim for the lowest common denominator. Nothing less than an equivalent crisis will, I suggest, enable the necessary substantial inner city revitalization to take place. Until that crisis occurs (and I leave open the question of whether the OPEC has engineered such a crisis), dispersion and differentiation will prevail.

So the general reader—that is, the non-specialist, nonacademic, and non-managerial reader—will wonder what he can do with all this well-organized information. Should he give his attention to what ought to be done—but won't be, without the pressure of a crisis, or several of them in close succession—or should he think about what is within his power to do by himself?

Very nearly everything you read these days, if it is of a serious nature, raises this question. Another, long-term, question has to do with how a society of people who think naturally of the welfare of the whole might be brought into being. The experts seldom wonder about such improbable matters; the engrossing task of telling what is wrong with the way things are leaves them little time.