

AN INTERVIEW WITH E. F. SCHUMACHER

QUESTION: Dr. Schumacher, you founded the Intermediate Technology Development Group in 1965 as an organization to mobilize knowledge about small-scale, locally built technologies which developing nations could use to pull themselves out of poverty. In the last three years the enthusiastic response to *Small Is Beautiful* is certainly an indication of the number of people around the world who are now searching with you for ways to humanize the face of technology and foster the growth of healthy, self-reliant communities. During the last ten years that you've been devoting more and more time and energy to these activities, how have your attitudes toward development changed?

E. F. S.: Well, in this kind of work it's impossible to remain static in any theory or approach to particular problems, since you are always working with people and the world continues to change. But you still really only have two choices when you're looking at development problems anywhere in the world. You can start from goods, or you can start from people. Everything depends on that point of departure.

Suppose I live in a Third World country, and I want to fight poverty, and to fight poverty I decide that I have to have more goods. Well, let's find out how I get more goods. Ah yes, I take my money and go to the West where they have machines of mass production, and I have transfer of technology. But because these machines are very big and complex, I am immediately conscious that to actually make them work well I have to have an elaborate infrastructure to support them.

I find that I have great management problems with such large production units, and to get good management I have to have institutions training managers. Mass production means concentrated employment of people, although the techniques are highly labor-saving. But I'm still deft having

to pay wages and I may want computers to handle that chore, which involves a school for computer programmers. And so on and so forth. There is no flaw in this logic at all.

But then, good gracious me yes—goods, goods, goods, but not enough employment. I find that these units of mass production really only fit into a few big cities. These cities then become magnetic to the rural population and the peasants abandon the land. But of course very few of them find a job in such a highly technological production system. The others become slum dwellers, and so on and so forth. All this is perfectly logical, perfectly understandable.

Now let's start with the idea of people. And you say in order to fight poverty, instead of more goods, people must become more productive. As Gandhi said, "We do not need mass production but rather production by the masses." How can people become more productive? Well, by having better implements. And if you have millions of people, you want millions of small machines. But these machines are not the same machines as in the other logic. These machines are small-scale, highly simplified and easy to build, something better than what the people had but nothing very grand, machines which can draw out the best that is in people—their skills, their ingenuity and their enthusiasm. This is what development is all about; it means developing competence to meet one's needs.

Q.: Gandhi also made the distinction between a tool and a machine. He believed the spinning wheel was a tool which could become the foundation of self-contained village industries across India, whereas the power loom was a machine which destroyed livelihoods and drained the villages of creative talent.

E.F.S.: Yes, he did, and this is the terminology I want to see firmly established. The sewing machine is a tool. A person can say this tool belongs to me and I am working it. It's an extension of my arm or my eye, but I'm in charge and what I produce is my own work.

Q.: What exactly do you mean by *infrastructure*? Are you talking about that whole network of services like schools, hospitals, roads, pipelines and so on that we take for granted but which makes our way of life possible?

E.F.S.: Yes, and I think the best way to explain infrastructure as it relates to development is with a parable I told while I was in Burma.

There's a road and from the road there's a path and by the path there's a shed. In the shed is a hen that lays an egg. Well now, all that—the road, the path, the shed, the hen—is not what you want. You want that one egg. If you spend all your money on the road, the path and the shed and you're then broke and can't even have a hen to lay an egg, it's not very good business. You want to produce in such a way and at such a location that you don't have to spend all your money on those infrastructure requirements of roads, paths, sheds, et cetera, and can spend more money on getting hens to lay eggs. . . . And if you have small-scale operations you can almost immediately become productive with local materials and labor.

Q.: As I understand it, then, the ITDG focuses on developing these small-scale implements and tools rather than on heavily mechanized equipment.

E.F.S.: We are not actually against anything, we are only in favor of developing those tools that are now lacking. If tractors are the right answer, then we are in favor of tractors. We're only against tractors when it's automatically assumed they're always the right answer. In Britain we now have tractors with 24 gears. Is this really necessary?

So we look at all these things from several points of view. Can we make implements so small

that ordinary people can afford them and handle them on small fields? Can we make them less complex so that the troubles of spare parts and repairs don't become overwhelming? And can we establish a methodology of evaluation to determine whether for this or that particular operation any mechanization is required at all?

Q.: You mean there are times when even simple implements don't really benefit a village?

E.F.S.: We normally insist that there should first be an assessment of the work load through the twelve months of the year, and where the work load is the highest mechanization can logically be considered. But we encourage people to look at all the factors involved. If mechanization really increases unemployment during the one or two months when it is used, is it worth it? Many of the traditional aid organizations have failed to adequately look at what may be involved with the introduction of even one new tool or method.

In one Third World community, for example, some Westerners introduced new and more productive ways of growing crops. The people were eager to learn, and soon were able to greatly increase their production. But the next year the Westerners came back to check on their progress only to discover that crop yields were once again back down to the old levels. And they said, "Ah well, these stupid people haven't been able to remember what we told them." And they went away.

Now our group happened to be in the country at the time on some other project and heard of this. We knew very well that something else must be going on here. These people were not stupid. They were in fact quite intelligent, but perhaps not very articulate. So what had happened?

The village had formerly been growing just enough to meet its own needs and had little left for any kind of trade. With the new methods it soon had an abundant surplus, and the people welcomed this. But how to get it to market? As

it turned out, the women of the village had to carry the; produce in baskets on their heads and walk to the market, sometimes twenty miles in a day. And the men in the village quickly learned that this was a highly unsatisfactory state of affairs. . . . So the people decided that the new ways of growing crops just weren't worth the trouble they were causing. The people still wanted to grow a surplus, but they had no readily available tools for transporting it to market.

Q.: So you were able to introduce some sort of cart which could be manufactured locally?

E.F.S.: It wasn't that simple. Wooden ox carts could indeed be built in the village, but wooden wheels just would not do the job. To import iron-clad wheels from outside the village would only further upset the balance of their tenuous economy. So again, what to do?

We put some of our researchers back in England to work on the problem and before long they had discovered a long-forgotten metal-bending tool, which had once been used in France, I think. Now, not only could iron wheels be made locally, but the metal-bending tool itself as well.

Q.: Do you always try to design tools like this that people can build themselves, and then use to build other pieces of equipment?

E.F.S.: This is always the ideal. We now have, for instance, on our publication list dimensional drawings of 24 items of locally made agricultural equipment—ox carts, harrows, cultivators, seeders and so on—which any village blacksmith or carpenter can easily build. Certainly parts of this equipment are sometimes sold to a country which can't yet make it for themselves. We don't grieve over this or take the view that total self-sufficiency is a necessary condition of all intermediate technology development.

Q.: Does the ITDG have a large staff back in England to coordinate all of this research and field work?

E.F.S.: We started the Group without any money and very soon realized that in the initial

development of tools like the agricultural equipment, we couldn't and didn't want to build up our own workshops. So how could we get the work done? Only by infiltrating into existing workshops such as those of the National College of Agricultural Engineering. The students there want their degrees, the teachers want to do original research and we at the ITDG can produce very attractive subjects for them to work on. And this has really turned into a highly suitable arrangement.

This specialized work in such areas as agriculture, building, food, cooperatives, health, power and water is organized into what we call panels. Each panel is served by at least one full-time Project Officer, whose main task is to find the facilities and the people to carry out the research, design and fabrication work. These project coordinators also arrange for separate funding of their projects.

The permanent staff at our headquarters in London helps coordinate these special panels and their projects and is generally responsible for overall administration of the ITDG. The Group has also formed four subsidiary companies to assist it in carrying out its work. Development Techniques Ltd. arranges actual production of specialized equipment for developing countries. Inter-Technology Services Ltd. organizes the Group's overseas consulting work, and maintains a register of other consultants qualified in many branches of intermediate technology. Afro-Art (London) Ltd. provides a marketing outlet for mainly African craftsmen. And Intermediate Technology Publications Ltd. publishes our reports, technical brochures and, for nearly four years now, our quarterly magazine *Appropriate Technology Journal*.

Q.: So the *Appropriate Technology Journal* provides the ITDG with a regular opportunity to keep people informed about the work it is doing?

E.F.S.: The *Journal* is designed to help fill a knowledge gap. That gap can be filled out of the results of our own work, but also out of the

results of work that's already been done by others. There's no need to reinvent the wheel or do work that has been successfully accomplished in the Philippines or in India or for that matter in Canada or Switzerland. We are actually expecting each issue to have the great majority of articles referring to other people's work.

At this level of technology there has been very little international communication. Very often the only means of communication between two groups in a developing country is some foreigner who happens to visit. People ask me time and time again. "Could you take this problem to London?" And then I have to tell them, "Look, fifty miles down the road from you somebody has already found the solution."

So I think the time is ripe for a journal of this sort, for some effort to tie together this kind of information without in any way invalidating the independence or enthusiasm of all the many groups hard at work around the world.

Q.: In talking about the ITDG's work with universities, you've touched upon a successful method of solving problems which you call the "A-B-C combination" in your book. Would you talk about this approach a little more?

E.F.S.: All of us share the conviction that this development problem of the world is a very difficult one. We don't believe it can be solved merely by governmental administrators or businessmen or communicators (as we call the people of the word, the academics) acting by themselves. These three groups represent our "A, B & C" factors, and the talents and experience of each one are necessary to the solution of almost any problem. So how can we use our negotiating skill in bringing A, B & C together?

Government officials in Britain say, "Am I representing my ministry?" No, no, we tell them, you're not representing your ministry. "Is what we're discussing at this panel confidential?" No, it's not confidential. The businessman asks, "Am I committing my firm?" No, no, you're not

committing your firm. We just want your knowledge of how to make things viable. You live under a hell of a discipline which the civil servant and the academic do not. You've got to have enough money to pay wages every Friday. And of course to the academic we say, yes, well come along if this problem interests you. You have the research facilities and the students and we want you with us.

When these three groups actually do meet, they discover, often to their surprise, that the very low opinion they previously had of each other is not justified, and that you have not only lazy civil servants, but very diligent ones. Not only grasping businessmen, but very generous ones. And not only ivory tower academics but quite practical ones.

Q: You know, this brings me to an attitude toward business which I have noticed growing stronger in this country, and you have no doubt observed it in Britain as well. This attitude amounts to a basic distrust of all business, a notion that business as such is totally evil. Some people seem to think that running a gentle and decentralized world would not require any kind of business knowledge at all.

E.F.S.: Yes, and I mean this attitude has been a shock to me, particularly here in the United States. But the bitterness of these people doesn't stay there. You change the subject slightly and they have the same opinion of government. And then you switch to the universities . . .

Q.: Or the media . . .

E.F.S.: Not to mention the media, and they have the same opinion really of A, B and C. Perhaps most virulent against B, but good Lord, the remarks that are made against the governmental machine, the bureaucrats, the this, that, and the other. And of course they often say that the government and the academic institutions are all in the pocket of business. . . . You know, I don't see how anybody can get any work done. Of course you can drop out and do it all from

your own resources and experience, but that really is a rejection of the positive achievements of mankind over the last two hundred years. To work it all out yourself from zero is so hard that only heroes can stand it.

Q.: Have you personally encountered this kind of criticism in your work with the ITDG?

E.F.S.: People imagine that if I do any work at all with a multinational company, I will somehow get tarred by this particular brush. First of all I never work with a company, I work with selected people I have found sympathetic. And I always approach this kind of contact on the assumption that I'm a darned sight cleverer than they are and also much freer to act. And quite invulnerable.

Q.: In your work as economic advisor to the British National Coal Board, were you ever criticized for dealing with a business whose very base was a non-renewable resource? Did people feel that you were tarring yourself with the coal brush?

E.F.S.: No, on the contrary, my main concern was to try and persuade people to make the distinction between renewable and non-renewable.

Q.: To learn to stretch the coal out as long as possible?

E.F.S.: Well, at least to understand what's what. There are people who don't even understand that once you have taken the coal out of the ground it's no longer there. You know, they say wheat or coal or oil or services, they're all the same. A hundred dollars worth of wheat equals a hundred dollars worth of coal equals a hundred dollars worth of nights in a hotel room. This is the tragedy.

You can increase your wheat production and, assuming that you don't ruin the soil and aren't dependent on oil, you can keep your production at that new level. But if you increase oil or coal production, you haven't achieved anything at all, except you have increased the rate of fetching

things out of the larder. You have increased the rate of larder depletion.

But all through the Sixties nobody would hear of this kind of talk. The criticism I got being associated with the Coal Board was, "Why is the Coal Board dragging its feet in the process of shutting down mines? After all, in this day and age why send people down to fetch this dirty stuff out of the ground, when there is oil, forever and ever cheap oil. Government says it, all the newspaper economists say it and the old fogies at the Coal Board don't understand."

I don't know, I guess they assumed we couldn't even read, that we didn't realize that oil was cheaper than coal. This was a *nationalized* industry, mind you, so that we weren't even defending our own pockets, we were just administering a national asset. We pleaded with society, "Don't ruin it. Once you have shut down a deep pit it is for practical purposes lost forever, including the unworked coal."

Q.: You mean it's impossible to ever reopen these mines again?

E.F.S.: When a pit is abandoned the shaft fills with water, but this is no problem really since you can always pump the water out. But once you've gone out sideways from, let's say, 700 meters deep, every square yard is under a geological pressure of 700 tons per square yard. That pressure cannot be taken by any material, only by the type of construction of your underground roadway. Once they start breaking the whole caboodle will come down and the cavity is squashed out of existence. If you want to dig into it again, tons of stuff may come down on your head. I exaggerate a bit, but it's like tunneling in dry sand, you just can't.

Q.: So you spent most of your time in the Sixties as a consultant to the Coal Board, trying to convince the public and the government to slow down the switch to oil?

E.F.S.: Well, I wasn't a consultant, I was inside. I was the Coal Board's chief planner,

director of statistics and economic advisor. As central planner I had to work with chairmen who made the final decisions on what pits to shut down, how to make ends meet financially, and longer term planning for the coal industry. As director of statistics I had the whole machine of information-gathering to tend. I was in a very favorable position here to learn not only about coal, but also oil, nuclear energy and all the other competing fuels. And as economic advisor I was supposed to understand the whole economic society, particularly the fuel economic society, within which we live.

I did spend a lot of time then trying to convince government and public opinion. I said it very, very freely, "Watch it, we are having a lean time for ten years or so, but come the Seventies, we are going to run into a god-almighty oil crisis and then we shall weep if we haven't got the coal." And we did at least slow down the vandalism. . . . But you know the posted price of oil during that time was on the order of \$1.80 a barrel. If it had been \$2.10 a barrel hardly a pit would have been shut down except for exhaustion. Now it's \$12.00 a barrel and we shut pits because of a thirty cent difference. We just couldn't convince society that the cheapness of oil was not a permanent feature ordained by God.

Q.: The fact that people did not listen to your predictions in the Fifties and Sixties must have been particularly frustrating for you, since you held such prominent positions at the Coal Board then.

E.F.S.: It was a puzzle to many people how a man who said such foolish things could from the Coal Board in 1970 still keep his job. I retired because there was nothing more to be done now that the situation had declared itself, and because I also had other things to do.

(To be concluded)

REVIEW

SICKNESS OF THE WORLD

THE editorial by Norman Cousins in the *Saturday Review* for Feb. 21 leads to long thoughts in several directions. He writes on the formidable problems and threat of mental illness, introducing nine articles dealing with major areas in an ever-growing region of human affliction. Anyone wanting to inform himself on this difficult subject would do well to begin by reading Mr. Cousins.

His report is discouraging. The doctors disagree. The critics within the field as well as those outside it give little practical guidance. The parents of a child or the family of an adult who needs psychiatric help may be pressed by desperation into making decisions haunted by uncertainty, and which lead to no reassurance after they have been made. Whom should they consult? Speaking to this question, Mr. Cousins says:

They will be told about Thomas Szasz, a psychiatrist who has written a book titled *The Myth of Mental Illness*, and they will read the book only to find it an abstruse and murky exposition that doesn't adequately support the title.

Or they will be told by well-meaning friends that they should consult the writings of R. D. Laing, the British psychiatrist. What they will find in the main is a highly subjective cry of pain about the world by someone who is himself a sufferer, rather than a searching examination of mental disease. To be told that the world is insane, not the schizophrenic individual, can hardly be considered useful advice for a parent, however striking and interesting Dr. Laing's personal theory may be philosophically.

Or parents will be urged to consult a psychoanalyst, only to discover that the price of admission is starkly prohibitive. . . . Even if parents are able to win an appointment with a psychoanalyst, they may find themselves in an emotional wringer in which long-past family experiences are exhumed and relentlessly combed, providing catharsis or valuable clues in some cases but all too often leading to deepened anguish, despair, and terrifying hostilities. Ultimately, they may discover that psychoanalysis is more useful to people who are unhappy or unfulfilled rather than to people who are suffering from serious and specific mental illness.

Mr. Cousins considers various forms of treatment now gaining popularity, such as chemotherapy, which, he says, may have quite serious side-effects, and the megavitamin approach, which sounds like a promising alternative to complicated treatment yet which few therapists endorse. Of electric shock treatment he remarks that delicate brain tissue may be destroyed, and that, finally, "the percentage of patients who show improvement as the result of electric shock is no higher than the percentage of patients who improve without it."

This, he says, is true of other "much-heralded" treatments: "The chances of improvement generally run about 50 per cent—the same percentage that holds for other forms of treatment, or no treatment at all."

This means that half the enormous population of mentally ill people in the United States—who constitute a larger group than those who suffer from cancer and advanced tuberculosis put together—are casting about for help that may never come.

After nearly a page on the terrors and costs of hospitalization of the mentally ill, Mr. Cousins concludes:

Evidence of scientific progress in almost every field is abundant, but the general situation of the mentally ill in America—despite tranquilizers, insulin, lithium, niacin, ascorbic acid, anti-histamines, convulsive shock, and group encounters—is a national disgrace. The victims are not just the afflicted but all those who are trying so desperately, and often so futilely, to help them.

It is of substantial value to have these comprehensive generalizations about mental disorder by an exceptionally literate layman. The editorial puts into words considerations that everyone needs to think about, and—in view of the rising incidence of mental disease or disturbance—may be compelled to think about. While those with personal experience in the field may take exception to some of the things Mr. Cousins says—perhaps with reason—he writes from an impartial stance, attempting to give an overall account of what may be justly called a broad cultural failure. As a civilization we have little understanding of mental illness. When it strikes

there is no common agreement concerning what to do. The virtue of the editorial is that Mr. Cousins makes this plain. (One could say that a virtue of Dr. Laing's work is that he, too, in another way, makes it plain.)

But who or what is being judged by this editorial? Are the doctors and therapists of various persuasions to blame? Is it right to ask: Why don't those people get together and decide how to deal with this problem, so that the public can have some hope and confidence in what they are doing?

The question may seem natural, but is this because asking it reflects the irritation of the engineering frame of mind when confronted by the uncertainty and ambiguity of human nature? There is a sense in which *nobody* has objective certainty about the mysteries of the *psyche*—that love, art, and intuition are the most important elements in the healing, when this is possible, of the mentally ill; and that there are no universally approved methods or agreed-upon canons for practice in this held. The skills of psychotherapy, in short, are neither clearly definable nor easily transferable. Nor are they common. This is not to argue that training in the area of mental health is without value—which would be ridiculous—but to suggest that those who enter this work have chosen—wisely or unwisely—to involve themselves in the basic problems and dilemmas of modern civilization. They undertake to deal with issues of common ignorance rather than common knowledge. They are trying to cope with ills which occur on the frontier where modern knowledge—and society itself—breaks down. No wonder they don't agree! Ask the next person you meet how to stop war or to put an end to corruption in government!

Mr. Cousins observes that "psychotherapy is in a period of ferment and stock-taking." So is the entire culture of modern man. And if, as Mr. Cousins suggests, the claim that the world is insane is no help to a parent seeking treatment for a disturbed child, it is no help to the world to pretend that its common practice and everyday way of doing things is *sane*. This is precisely the question at issue in the worldwide ferment of the times.

Are the problems of mental illness and health "scientific" problems? The answer must be yes and no. It depends upon what one means by science. Curiously, the books on this subject which seem enduringly useful are those in which "scientific knowledge" is somehow subordinated to the free play of a disciplined imagination. Who are the best writers on the mystery of the mind? Everyone will have his preferences or favorites, but most readers would agree that William James, Carl Jung, Karen Horney, Erich Fromm, Henry Murray, Viktor Frankl, and A. H. Maslow will come high on the list.

The doctors that impress us most by their work in this area are always sensitive and civilized human beings, often capable of engaging literary expression. Readers may recall Hannah Green's *I Never Promised You a Rose Garden* and Virginia Axline's *Dibs* as examples. A book in a class by itself is Alan McGlashan's *The Savage and Beautiful Country*. There is science in what these people write, but it floats in a tide of perceptive insight that will never submit to codification. Other writers of scientific background (not related to medicine) often have this same quality—Loren Eiseley, for example. What appeals to the general reader is the lifting effect of the author's imagination, which both uses and reaches beyond the facts in a pursuit of meaning.

One thing that usually comes out in searching cultural evaluations by psychotherapists is the idea that the world *is* seriously ill or unbalanced in mind or emotions. The little-known work of Trigant Burrow is founded on this conception and reading him might help to explain why the general situation of the mentally ill in America is likely to remain "a national disgrace." More recent psychologists providing light on cultural illness include Horney, Andras Angyal, Maslow, Carl Rogers, and Rollo May. Ever since the paralysis of philosophy in centers of higher learning, the psychologists have been turning into society's most effective and widely read critics.

COMMENTARY REQUIREMENT OF CHANGE

ONE reason for keeping the institutional arrangements for better education at a minimum (see "Children") lies in the fact that new ventures will almost certainly be polluted by the typical motivations of the old institutions, especially if they are formally organized before they are independent and strong. These are matters of pervasive habit, not to be blamed exclusively on the schools. As James Boggs said a few months ago:

One of the main reasons why we cannot create communities today—even though we can create almost any material or technical thing that we can imagine, and even though we all feel the need for community—is that so many of the young people are still going to college to make careers for themselves as individuals. Creating communities in the modern world can't just happen naturally. It requires people who are deeply convinced that being part of a community is more important than material things or the status individual success brings—but which are the motivation for these young people going to college in the first place.

The institutions of the future will have to be free of this motivation from the start. Other tendencies that need elimination are described by Michael Rossman:

We seem unable to construct social or educational authority not embedded in a punitive framework. Our motto might well be, "Eat your carrots like a good boy, or Papa spank." For the Authority Complex extends to the deepest and most intimate levels.

This implies that there are both legitimate and illegitimate authorities. The non-coercive wise have legitimate authority, and so do the principles to which the wise have reference. But our society, as John Schaar shows (in "Reflections on Authority," *New American Review* 8), put aside the conception of shared moral bonds as the basis of authority, and adopted in its place the gamesmanship of an exercise in acquisition. A pragmatic system of rewards and punishments

resulted, and today, when the rewards grow thin and unpalatable, only the punishments remain. It begins to be apparent that the entire mood and philosophy of the culture will have to change, before another spirit can be reflected in large educational institutions which, as Mr. Rossman points out, have become little more than pretentious service stations for the intellectual requirements of the technological society.

CHILDREN ... and Ourselves AUTONOMOUS LEARNING

IN *On Learning and Social Change* (Vintage, 1972) Michael Rossman begins a section, "The Failure of the University," by saying:

To put the matter simply, the university does not equip us with the tools to begin to solve the critical social problems of our time. It does not produce the knowledge we need: designed to serve corporate power, its sociology and political science have not informed us usefully. It does not instill the skills we need; its graduates, taken all together, do not know how to control their government in a way that ensures the satisfaction of their needs within a healthy society. Indeed, few of them seem to have the sense that government is a thing to *be* controlled.

Many good people, even some who recognize that we are flirting with genocide at home and abroad, still feel that the university should not serve as a tool to make the tools to solve our society's problems. They do not reply directly to the fact that our society has no other institution that fills this function. But they argue that the university's basic purpose is quite different: to preserve and transmit the intellectual heritage of our culture, and to train new workers in those vineyards. If you want results, go somewhere else.

What does Mr. Rossman want the universities to do? He wants them to try to produce what he calls "autonomous learners"—an undertaking for which, he says, they are now entirely unfitted. Today the university—

trains people in the styles of technical expertise and prepares them for pre-established social and technical roles. The man educated in this model makes himself useful in immediate, limited, and necessary ways. He is prepared to deal with problems whose nature is well-defined, which can be approached from within already-formalized disciplines or styles of thought. . . The trouble is that all real human problems are transdisciplinary. Even designing a building requires the integration of a whole spectrum of skills, of which structural engineering is the least important.

As generalized criticism, this is hard to beat. The frustrations of graduate students who want to

work in ecology illustrate its point. The formal disciplines are a straitjacket of narrow and increasingly sterile requirements (see Garrett De Bell's contribution to *The New Professionals* edited by Ronald Gross). Michael Rossman wants the universities to stop being places of authority-centered learning and to devote their facilities to autonomous learning:

What is a good learner? It seems useful to think of him as someone with a certain set of skills. He knows how to formulate problems. He can identify the relevant resources, of information or whatever, that are available in his environment. He is able to choose or create procedures and to evaluate his results. Beyond this, there is a set of higher skills, skills which we might call "meta-skills." Stated very loosely, they include the ability to see clearly the *process* of his learning; and the ability to interact with others to help learn these meta-skills. Out of all this, he is able to create useful knowledge. Let us rail him an autonomous learner for he directs himself.

These skills and meta-skills are somehow *natural*: little children are wizards at accomplishing useful learning. And if older children and their institutions were as skilled, we would be less involved with death than we are. The problem, I think, is that we construct environments that stunt and warp the development of these skills.

Well, how shall we make over the special environments devoted to education? Start afresh or reform the existing places? It seems obviously necessary to do both. Both are required because so vast a change can only take place little by little—if somewhat rapidly in the new but tiny places, always sluggishly and reluctantly in the big ones. Moreover, designing educational institutions on paper is easy compared to making them do what is hoped for them, and preserving these intentions for a reasonable cycle of life. Actually, autonomous learning is not a new idea: the problem is to get it into practice. Back in the twelfth century, John of Salisbury, who had gone to school to Peter Abelard—a very autonomous learner—wrote:

Those to whom the system of the Trivium has disclosed the significance of all words, or the rules of the Quadrivium have unveiled the secrets of nature,

do not need the help of a teacher in order to understand the meaning of books and to find the solution of questions.

To make autonomous learning the rule instead of the exception will be like rebuilding a house while living in it—difficult, inconvenient, uncomfortable. Is there a simple way to identify what must be done? Years ago Ortega dramatized the situation. He started out by rejecting the conception that the purpose of education is to "transmit the cultural heritage." The only students who really learn, he said, are those who challenge the heritage. But they, alas, are few. They are the ones who have to know for themselves. They are constitutionally incapable of relying on authority. Ortega says:

Certainly there are people like that, but it is hardly sound to call them students. It is not only unsound, it is unjust. Because these are the exceptional cases of creatures who, even if there were neither studies nor science, would, by themselves, invent them for better or worse, and would by the force of an inexorable vocation, dedicate their strength to investigating them. But . . . the others? The immense and normal majority? It is they, and not those other more venturesome ones, who bring into being the true meaning—not the utopian meaning—of the words "student" and "to study." It is unjust not to recognize them as the real students, and unjust not to question with respect to them the problem of what studying as a form and type of human occupation, is.

Ortega sets up this contrast between the typical "student" and the maverick, the autodidact—the autonomous learner—because it is true to life and at the heart of the problem. What then is the objective? It is to increase the proportion of autonomous learners.

How?

The solution, Ortega says, consists of

a deep reform of that human activity called studying and hence, of the student's being. In order to achieve this, one must turn teaching completely around and say that primarily and fundamentally teaching is only the teaching of a need for the science and not the teaching of the science itself whose need the student does not feel.

This is indeed the true pedagogic calling—to teach *hunger for knowledge*, not "knowledge." If this is not accomplished first, as having the highest priority in any educational reform, then all the old habits will reappear in every new institution. They will begin by being known as Gospel, but end as entrenched "formal disciplines" that another generation will have to revolt against in order to start all over again.

How do you teach hunger for knowledge? How do you teach the archetypal virtue in education? Unfortunately, except for Socrates and a few others like him, the ones driven by this hunger in themselves usually make the mistake of supposing that everyone is animated by the same intense longing to know. But the naturally autonomous learners are only two or three in a hundred. More might develop this longing in a provocative educational or community environment, but those who are destined to bring about durable change need to learn how to feel it in any old environment, and to feel it from better provocation than simply pain.

It doesn't seem reasonable to expect this sort of thing to happen, or be made to happen, in institutions of higher learning. Institutions are not noted for their capacity to undertake radical or "deep" reform in the student's being. Such things are much more likely to happen in loose, informal associations of people who are committed to some basic innovation—working together, young and old, in the light of a coherent vision. The rebirth of education—almost casual, unheralded, unclaimed and unnamed, but real—will be a by-product of such happy undertakings.

FRONTIERS

Commercial Organic Farming

A RESEARCH team of the Center for the Biology of Natural Systems, headed by Barry Commoner, compared the 1974 crop production of sixteen mixed crop-and-livestock "organic" farms in the American Corn Belt with sixteen comparable conventional farms (using chemical fertilizers and pesticides), finding that the value of their crops was about equal, while the organic farms used only one third the energy consumed by the conventional farms. This research was undertaken to dispose of the claim that organic farming is "hopelessly non-competitive," and that commercial agriculture "is virtually impossible without the use of inorganic fertilizers and synthetic pesticides." Of initial interest is the fact that in 1974 there were enough organic farmers earning a living in agriculture to make this test possible. The farms are located in Illinois, Iowa, Southern Minnesota, Eastern Nebraska, and Northern Missouri, and had all been "organic" for at least four years. Not one is a subsidized or "hobby" farm. Each organic farm was paired for comparison with a conventional farm of similar size operating under the same conditions. The crops are predominantly livestock feeds—corn, soybeans, and hay—for hogs and fat cattle. All the farms studied raise either hogs or beef cattle or are dairies. The study examined these operations in terms of value of crops per acre, the economic return (value of production less costs), and the energy consumed by crop production. The farms averaged 266 acres in size. Following is a significant passage in the report:

On the average, the organic group spends \$16 less per acre than the conventional group. This difference . . . almost exactly offsets the \$14 difference in the value of production per acre. . . . Most of the difference in operating costs comes from fertilizers, which is hardly offset at all by the slightly greater expense for manure spreading on the organic farms. The organic group has only slightly greater expenses for field operations (e.g., some extra cultivation).

The writers of this report (CBNS-AE-4, July, 1975, issued by the Center for the Biology of Natural Systems, Washington University, Saint Louis, Mo.) say in their conclusion:

On the conventional farms, expenditures for fertilizers, other soil amendments, and pesticides constituted about one-half of variable operating costs, amounting to an average of \$23 per acre of cropland. This compares to an average of \$7 per acre on the organic farms. Our data show that this considerable additional expenditure for fertilizer and pesticides by the conventional farms, as compared with the organic ones, results in no net gain in income. The slightly higher value of the crops produced (estimated at eight per cent not a statistically significant difference) is offset by higher production costs. Because the organic farms achieve the same economic returns and production as the conventional farms without the use of pesticides or inorganic fertilizers, they use only about one-third as much energy as the conventional farms for the same level of output. . . our results indicate that the organic farms will be less vulnerable than conventional ones to further disruptive effects of the energy crisis of the kind that have already been experienced in the Corn Belt. Because the organic farms are not dependent on the use of inorganic fertilizers or pesticides, they are protected against shortages and increased prices of these materials, which are very likely to be aggravated by expected increases in energy costs. That these factors have already begun to affect the operation of conventional farms is indicated by the finding that 47 per cent of the conventional farmers in our study used less fertilizers in 1974 than they would have liked, either because they couldn't obtain it, or because it was too expensive.

After these fundamental findings, the implications broaden out to general considerations such as the greater economic stability of organic operations and the importance of the research to countries where fertilizer is in short supply. For them organic methods obviously mean greater total food production.

One comment of the organic farmers was that crop yields drop appreciably during the transition to organic methods, returning to former levels after about three years. This seems a universal experience. Two Colorado fruit growers, Bernie and Judy Heideman, who bought an eleven-acre

apple orchard in Paonia (seven thousand feet high) five years ago, resolving to be "organic," encountered this drop in production and other problems:

They discovered that not only did they have to wean their orchard from a dependence on chemical sprays and fertilizer, but they also had to hope that consumers would eventually learn to prize freedom from chemicals and good taste more highly than looks and color.

Heideman says: "It takes seven years to establish a properly balanced organic orchard. Our transition problem was the woolly aphids. "Everyone told us we'd have to spray to control them. But we banded the trees and released lacewings, whose larvae eat enormous quantities of bugs, and the problem disappeared."

According to Heideman, the chemical grower depends on pesticides which wipe out all insects. "I've gone into orchards after they'd been sprayed and all the insects are dead—mosquitoes, flies, toads, everything. It's like going into a quiet room. If you go into my orchard after it's been sprayed, the insects are still going crazy. We haven't harmed the beneficial insects.

Heideman depends on a combination of organic sprays and natural controls to keep the pests in check. He sprays with ryania—a powder made of the root of a South American plant.

This spray is believed to have little effect on small mammals and it does not affect beneficial insects, although it stops the coddling moths. He also uses a species of tiny wasps which lay their eggs in coddling moth eggs. "We set out 60,000 wasp eggs every week."

Heideman's chief problem in marketing his fruit is the consumer's apparent preference for bright red apples at the expense of good taste. That, he says, is "cosmetic appeal." Too much attention to looks is bad for taste:

"For example, red delicious apples taste great if they're allowed to ripen on the tree. If you pick them too soon they look good but taste like sand. But how do you educate people in cities who have never even tasted tree-ripened fruit?"

The Paonia weekly, *North Fork Times*, in which this article appeared, is published and edited by Ed Marston, the physics teacher who wrote *The Dynamic Environment* (MANAS, Sept. 10, 1975). Prof. Marston went back to the land in a logical way for a teacher. He publishes a newspaper for this apple-growing and coal-mining mountain community.