

EDUCATION AUTOMATION

Freeing the scholar
to return to his studies

by **R. BUCKMINSTER FULLER**

Foreword by CHARLES D. TENNEY

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Every time we educate a man, we as educators have a regenerative experience, and we ought to learn from that experience how to do it much better the next time. The more educated our population the more effective it becomes as an integral of regenerative consumer individuals. We are going to have to invest in our whole population to accelerate its consumer regeneration. We are going to be completely unemployed as muscle-working machines. *We as economic society are going to have to pay our whole population to go to school and pay it to stay at school.* That is, we are going to have to put our whole population into the educational process and get *everybody* realistically literate in many directions. Quite clearly, *the new political word* is going to be *investment*. It is not going to be *dole*, or socialism, or the idea of people hanging around in bread lines. The new popular *regenerative investment* idea is actually that of making people more familiar with the patterns of the universe, that is, with what man has learned about universe to date, and that of

getting everybody inter-communicative at ever higher levels of literacy. People are then going to stay in the education process. They are going to populate ever increasing numbers of research laboratories and universities.

As we now disemploy men as muscle and reflex machines, the one area where employment is gaining abnormally fast is the research and development area. Research and development are a part of the educational process itself. We are going to have to invest in our people and make available to them participation in the great educational process of research and development in order to learn more. When we learn more, we are able to do more with our given opportunities. We can rate federally paid-for education as a high return, mutual benefit investment. When we plant a seed and give it the opportunity to grow its fruits pay us back many fold. Man is going to "improve" rapidly in the same way by new federally underwritten educational "seeding" by new tools and processes.

Our educational processes are in fact the upcoming major world industry. This is *it*; this is the essence of today's educational facilities meeting. You are caught in that new educational upward draughting process. The cost of education will be funded regeneratively right out of earnings of the technology, the industrial equation, because we can only afford to reinvest continually in humanity's ability to go back and turn out a better job. As a result of the new educational processes our consuming costs will be progressively lower as we also gain ever higher performance per units of invested resources, which means that our wealth actually will be increasing at all times rather than "exhausted by spending." It is the "capability" wealth that really counts. It is very good that there is an international competitive system now operating, otherwise men

would tend to stagnate, particularly in large group undertakings. They would otherwise be afraid to venture in this great intellectual integrity regeneration.

I would say, then, that you are faced with a future in which education is going to be number one amongst the great world industries, within which will flourish an educational machine technology that will provide tools such as the individually selected and articulated two-way TV and an intercontinentally net-worked, documentaries call-up system, operative over any home two-way TV set.

The new educational technology will probably provide also an invention of mine called the Geoscope—a large two-hundred-foot diameter (or more) lightweight geodesic sphere hung hoveringly at one hundred feet above mid-campus by approximately invisible cables from three remote masts. This giant sphere is a miniature earth. Its entire exterior and interior surfaces will be covered with closely-packed electric bulbs, each with variable intensity controls. The lighting of the bulbs is scanningly controlled through an electric computer. The number of the bulbs and their minimum distance of one hundred feet from viewing eyes, either at the center of the sphere or on the ground outside and below the sphere, will produce the visual effect and resolution of a fine-screen halftone cut or that of an excellent television tube picture. The two-hundred-foot geoscope will cost about fifteen million dollars. It will make possible communication of phenomena that are not at present communicable to man's conceptual understanding. There are many motion patterns such as those of the hands of the clock or of the solar system planets or of the molecules of gas in a pneumatic ball or of atoms or the earth's annual weather that cannot be seen or comprehended by the human eye and brain relay and

are therefore inadequately comprehended and dealt with by the human mind.

The Geoscope may be illuminated to picture the earth and the motion of its complete cloud-cover history for years run off on its surface in minutes so that man may comprehend the cyclic patterning and predict. The complete census-by-census of world population history changes could be run off in minutes, giving a clear picture of the demological patterning and its clear trending. The total history of transportation and of world resource discovery, development, distribution, and redistribution could become comprehensible to the human mind, which would thus be able to forecast and plan in vastly greater magnitude than heretofore. The consequences of various world plans could be computed and projected. All world data would be dynamically viewable and picturable and relayable by radio to all the world, so that common consideration in a most educated manner of all world problems by all world people would become a practical event.

The universities are going to be wonderful places. Scholars will stay there for a long, long time—the rest of their lives—while they are developing more and more knowledge about the whole experience of man. All men will be going around the world in due process as everyday routine search and exploration, and the world experiencing patterning will be everywhere—all students from everywhere all over the world. That is all part of the new pattern that is rushing upon us. We will accelerate as rapidly into “yesterday” through archaeology as we do into “tomorrow.” Archaeology both on land and under the seas will flourish equally with astronautics.

As I came to this meeting today, I wasn't surprised by East St. Louis, because I have been here many times. I have been traveling around the world so much that seeing East St. Louis once again reminds me that right in the center of America, pretty close to the center of population, we have the worst living and housing conditions that I have seen anywhere in all the world. There is nothing in Calcutta, Johannesburg, or Hong Kong that equals the squalor of the East St. Louis slums. There are some miserable conditions around the world, but East St. Louis shows the greatest lack of organized capability to deal with the great challenges of democracy and crossbreeding world man. It is shocking.

Your educational forces, if competently organized and instrumented, should stimulate the self clean-up. The politicians won't clean up; the only hope is through education. This would be much better than building some kind of a socialized system where money is put up for more "buildings" just to keep the construction industry going and to provide jobs for political pay-offs. I am very glad that what I hope will be a powerful new magnitude of the educational system is coming to East St. Louis. This is appropriate. This is S.I.U.'s historical opportunity.

I think that all the patterns I have been giving you are going to unfold rapidly and that primarily the individual is going to *study* at home. That is in elementary, high school, and college years. Not until his graduate work days begin will he take residence on campus. I am quite sure that the students of all ages will keep on going to "school houses" to get *social experiences*—or to be "baby-sat." We will probably keep the schools open in the evening because of the growing need for baby-sitters. Real education, however, will be something to which

individuals will discipline themselves spontaneously under the stimulus of their own ticker-tapes—their individually unique chromosomes. Everyone has his own chromosomal pattern. No two persons have the same appetite at the same time. There is no reason why they should. There is no reason why everyone should be interested in the geography of Venezuela on the same day and hour unless there is some “news” event there, such as a revolution. However, most of us are going to be interested in the geography of Venezuela at some time—our own time—but not all on the same day. *Simultaneous curricula are obsolete*. We must make *all* the information immediately available over the two-way TV’s ready for the different individual human chromosomal ticker-tapes to call for it.

There are two more things I would like to talk about if we have the time. I am a comprehensive designer—that is, I try to organize all the data and challenges and problems in such a manner that they may be solved by inanimate technology, as I mentioned to you earlier, rather than by organization reforms. Therefore, when I talk about educational problems, I am interested in how these can be satisfied by some kind of physical apparatus along the lines of the trend requirements I have been outlining to you. The kind of equipment that would be involved would be such as the two-way TV and the Geoscope and also what I call *automated education facilities*. We know about teaching machines, etc., today, and much of this is sound. In our consideration of equipment we must also include the environment-controlling structures which will house the computer-integrated equipment and activities.

I am going to give you one more “big” introductory concept that may shed considerable light on these problems and may lead to acquisition of logical apparatus of solution. C. P.

Snow, the writer, has a great following today. He writes about "two worlds." His two worlds are the literary world and the scientific world. In the literary world, man writes the books that people can understand with least effort. They seem to be good romance books because they seem to fit many lives. Science writes in ways that require complete dedication of effort to comprehend. Snow says the dichotomy between the two worlds began approximately two centuries ago with the inception of the industrial revolution. In England it is as yet evident that the popular writers of a century ago and since were not helped by the scientist. The scientist tended to be preoccupied, obscure, and not interested in the literary man's needs. A pertinent fact that Snow does not mention is that the important scientific events were often withheld from the public because of their unique military advantages. The scientist's information began to be the grist of the industrial technology. The scientist was intimately tied up with industry, even though he didn't look upon his personal work in terms of economics. The scientist was aloof to the ultimate fact that industry was the user of the information that he was able to gather.

The literary man, not understanding either science or its technology, developed an animosity toward industrialization. Snow points out for us that in America this dichotomy was in evidence, for instance, in Emerson and Thoreau, who were antipathetic to industrialization. As I grew up at the turn of the century I saw that society looked on industrialization as something noisy, smoky, and full of so-called "artificialities." (In my viewpoint, there is no meaning to the word "artificial." Man can only do what nature permits him to do. Man does not invent anything. He makes discoveries of principles operative in nature and often finds ways of generalizing those principles and

reapplying them in surprise directions. That is called invention. But he does not do anything artificial. Nature has to permit it, and if nature permits it, it is natural. There is naught which is unnatural.)

The literary and popular concept of industrialization grew out of erroneous definitions and terms. The static viewpoint was seemingly supported by the Newtonian statement that “a body persists in *a state of rest* (or in a line of motion) except as affected by other bodies.” Primarily the norm was “at rest,” and changes were therefore abnormal and undesirable. Changes were exploited from time to time only because of military advantage or because men could make large amounts of money out of the changes and not because of any social voting that the changes were constructively desirable. The literati just didn’t try to understand change, and they stayed apart from science and abhorred the changes. Snow says the gulf between the scientist and the literati is now so great that the chasm is no longer spannable. He feels there has now developed an irreparable dichotomy between literary and scientific man. I do not agree with him as you shall learn.

Alfred North Whitehead came to Harvard University early in this twentieth century from the great universities of England. He said that one of the things that was very noticeable at Harvard was that this great private school was initiating a new kind of pattern. It was beginning to build and staff the great graduate schools. The graduate schools dealt in specializations. In England the special preoccupations could be taken up within the general university. There were no special schools. Whitehead said that the American populus applauded the high specialization, and Whitehead saw that this pattern was being followed by the other leading private schools, colleges, and universities.

Of course, the public schools and public universities immediately followed suit, taking on the graduate school patterns, because the political representatives of the public saw that their constituents would want the state school to incorporate these educational advances of the rich man's private schools. So specialization in graduate schools also became the "thing."

Whitehead said this meant that we deliberately sorted out the students, sieved them, picked out the bright ones, and persuaded the brights to stay in the university and to go on to the graduate school. This meant that we began to make specialists out of our bright ones. The bright ones within their own special category of their special school went on to develop further special nuances within their special areas. This all worked toward expertism and hybridism in the educational pursuits. It meant that the bright ones would learn much about their special subject. The public thought this to be desirable, because people like the idea of an "all-star" team. They thought that if we took groups of all-stars and put them together our commonwealth would surely prosper.

Whitehead said, "So far so good, and everybody is applauding." But he then said that the educational hybridism would mean that these men who were of high intellectual capabilities would have very high intellectual integrity. As men of high intellectual integrity they would quickly discover that they were making great progress in highly specialized areas of inquiry and thus also they would know how little any other man outside of their own field could possibly understand of what was going on inside their own and inside any one field other than their respective specializations. Therefore, no specialist of integrity would think of going into some other expert's field and making quick assumptions as to the significance of that unfamiliar

work. This would be considered preposterous. There would thus develop an increasing tendency to break down generalized communications and comprehensive prospecting between these experts. Certainly, they would not tend to join together and say: "I see I am developing this and you are developing that; if we associated them thus and so, such and such would be the economic consequences; therefore, let us do so by employing our credit as scientists with the banks in order to fund our undertakings." These men, Whitehead said, would do just the opposite and would become more and more subjective, growing into purer and purer scientists, to whom no banker would think of lending money on the basis of intellectual integrity alone. The scientists went in just the opposite direction of applied science. The more expert they were the less they would think of searching into the concept of how society might enjoy the fruits of their discoveries.

Whitehead pointed out that this system tended to break down the communication between the men of high intellectual capability in all special fields. Inasmuch as society wanted exploitation of the gains of their "all-star" teams, it meant that someone other than the prime intellects had to integrate and exploit their capabilities and their findings.

Then Whitehead said—which came as quite a surprise—inasmuch as we have deliberately sorted out the bright ones from the dull ones, we have inadvertently created a class of dull ones. Just as in mining, we have a big pile of tailings, and no one thinks much about tailings because they are interested only in the high-grade, quick-cash ore and the net metal that is taken out of the latter. He said that inasmuch as the "bright ones" are not going to be able to realize, integrate, and exploit their own potentials we will have to leave it to the not-so-brights to put

things together. This is what I have termed "Whitehead's dilemma."

I have developed "Whitehead's dilemma" a little further than he could go at that time. I find that there is a second grade of men who get passing marks, but are not selected to be specialists, who, however, though not "gleaming bright" have a dull polish and are good healthy fellows who play good football and are liked by everybody. These second grade "clean ones" become the first choice for executives in business, which does integrate potentials of demand and supply. Then as corporation executives these not-quite-so-brights take on the pure scientist experts and cultivate them like special hybrid egg-laying hens in special houses. The corporations take on the task of putting appropriate specializations together to exploit the synergetic advantages thus accruing. The businessman becomes the integrator of the bright ones' capabilities. The business executive himself, however, tends to be a specialist of a less fine order. Pretty soon, he will say, for instance: "I am in the automobile business and don't know anything about stockings; so I am just going to stick to my automobiles." He might also say: "I find that an automobile won't run across an open field. Therefore, it is only half of the invention—automotive transportation. The *highway* itself is a large part of the invention—high speed highway transportation." Automobiling is schematically like a monkey wrench—the ratchet half is the "highway," and the thumbscrew-adjustable traveling jaw is the "automobile." The automobile is literally geared by its tire-treads to the road. So the business executive might say: "An automobile company could not possibly afford to build the highways—it is a very difficult political matter; you have to have costly condemnation proceedings and so forth to get a highway through; it is all so

expensive that our company would never make a profit if we took the responsibility of providing highways. All we can produce is automobiles. To get the show going, however, we will have a little auto race track over here, and we will have automobile shows in many big cities and at county and state fairs. We will get people very excited about the way our automobile can go and how fascinating it looks." Thus it went, and the people began to envision personal use and enjoyment of the automobile "if only they had a highway." What the auto executive did was to excite the people into demanding highways for the cars.

We next come down to a duller class of not-so-brights—much duller—who didn't even go to college. This much duller class is that of the politicians. The politicians saw that the people in general wanted automobiles and wanted to "joy ride"; so they immediately voted for highways to get the peoples' votes for themselves.

Thus, a much bigger geographical pattern of the automobile emerged than the domain of the factory and the auto executive's specialized territory. The bigger pattern was the total highway system—state, interstate, and federal. We also find that generally speaking *the geographically larger the physical task to be done, the duller the conceptual brain that is brought to bear* upon the integration of the scientific discoveries and their technically realized applications. Finally, we get to international affairs, and you know what is happening today. The most highly polished of the dumbest class, scientifically and intellectually speaking, may wear their striped pants very beautifully and be charming fellows, but they have not produced any mutually-acceptable, constructive, world peace generating ideas. They traffic successfully only in peoples' troubles and emergency

compromises. One of the great mistakes that society has been demonstrating in our last century has been that of leaving the most important problems to the men who are bankrupt in creative thinking ability.

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By R. Buckminster Fuller

In a perceptive and penetrating essay devoted to a definition of the modern world as he sees it, the world-renowned inventor of the Geodesic dome discusses the place of education in that world. In applying his dymaxion principles to educational planning Mr. Fuller makes a strong case for technological aids in teaching and for comprehensive planning of campuses of the future.

R. Buckminster Fuller's many honors include: Charles Eliot Norton Professor of Poetry at Harvard University, 1962; Fellow, Royal Society of Arts; Fellow, American Association for the Advancement of Science; and Honorary Life Member, American Institute of Architects.

"Education Automation can be read with interest and pleasure by anyone concerned with higher education."—*Times Literary Supplement*

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