

Education Automation

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Education Automation, Freeing the Scholar to Return to His Studies

Foreword by CHARLES D. TENNEY

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My feeling about today's meeting with you is first, that it is a tremendous privilege as a human being to stand with other human beings who are concerned fundamentally and deeply, as you are, with the process and further implementation of education and to be allowed to disclose to you what I think I have discovered regarding education's trending evolutionary needs. I am quite confident that the Southern Illinois University's new Edwardsville Campus studies are uniquely important.

Because President Morris has mentioned it in his introduction of me to this meeting, let me begin with some of my own student experiences at Harvard, for what I have to offer to you today springs from my several educational experiences. I am a New Englander, and I entered Harvard immaturely. I was too puerilely in love with a special, romantic, mythical Harvard of my own conjuring an Olympian world of super athletes and alluring, grown-up, worldly heroes. I was the fifth generation of a direct line of fathers and their sons attending Harvard College. I arrived there in 1913 before World War I and found myself primarily involved in phases of Harvard that were completely irrelevant to Harvard's educational system. For instance, because I had been quarterback on a preparatory school team whose quarterbacks before me had frequently become quarterbacks of the Harvard football team, I had hoped that I too might follow that precedent, but I broke my knee, and that ambition was frustrated. Just before entering college I was painfully jilted in my first schoolboy into-love-falling. Though I had entered Harvard with honor grades I obtained only "good" to "passing" marks in my college work, which I adolescently looked upon as a chore done only to earn the right to live in the Harvard community. But above all, I was confronted with social problems of clubs and so forth. The Harvard clubs played a role in those days very different from today. The problems they generated were solved by the great House system that was inaugurated after World War I. My father died when I was quite young, and though my family was relatively poor I had come to Harvard from a preparatory school for quite well-to-do families. I soon saw that I wasn't going to be included in the clubs as I might have been if I had been very wealthy or had a father looking out for me, for much of the clubs' membership was prearranged by the clubs' graduate committees. I was shockingly surprised by the looming situation. I hadn't

anticipated these social developments. I suddenly saw a class system existing in Harvard of which I had never dreamed. I was not aware up to that moment that there was a social class system and that there were different grades of citizens. My thoughts had been idealistically democratic. Some people had good luck and others bad, but not because they were not equal. I considered myself about to be ostracized or compassionately tolerated by the boys I had grown up with. I felt that my social degradation would bring disgrace to my family. If I had gone to another college where I knew no one, it would not have mattered at all to me whether or not I was taken into some society. It was being dropped by all those who had been my friends that hurt, even though I knew that they had almost nothing to do with the selecting. I became panicky about that disintegration of my idealistic Harvard world, went on a pretended "lark," cut classes, and was "fired."

Out of college, I went to work and worked hard. In no time at all, reports went to Harvard that I was a good and able boy and that I really ought to go back to college; so Harvard took me back. However, I was now considered a social maverick, and I saw none of my old friends; it hurt too much. Again I cut classes, spent all my year's allowance, and once more was "fired." After my second "firing" I again worked very hard. If World War I hadn't come along, I am sure the university would have taken me back again, and I am sure I would have been "fired" again. Each time I returned to Harvard I entered a world of gnawing apprehensions, not an educational institution, and that was the problem.

But I did get an education in due and slow course—but an education largely of my own inquiring, experimenting, and self-disciplining. Forty-seven years later Harvard's Dean Bundy, who is now one of Kennedy's White House advisors, invited me to come back to Harvard in 1962 to be the Charles Eliot Norton Professor of Poetry. This is regarded as an honor. The Norton professorship is a one-year appointment. The chair was founded because its donor felt that the university needed to bring in individuals who on their own initiative have long undertaken objective realizations reflecting the wisdom harvested by the educators, which realizations might tend to regenerate the vigor of the university world. Harvard fills this professorship with men who are artists, playwrights, authors, architects, and poets. The word poet in this professorship of poetry is a very general term for a person who puts things together in an era of great specialization wherein most people are differentiating or "taking" things apart. Demonstrated capability in the integration of ideas is the general qualification for this professorship. I am able to accept the Norton professorship for 1961-62 even though I am a professor on the faculty of Southern Illinois University because I have to be in residence at Harvard only for the months of February and March, 1962, when I am officially absent from Carbondale.

In the last thirty years of the half century that has passed since my Harvard fiasco, I

have been invited as a lecturer, critic, or experimental seminarist to visit 106 universities around the world, and many of them quite frequently. I have had appointments, for instance, to Princeton University nine times, starting back in 1929, M. I. T. eight times, North Carolina State eight times, University of Michigan five times, Cornell University four times, and that's the way it has gone. There have been many revisits, and all of my visits have been entirely a consequence of their inviting me to come. I developed a self-discipline long ago regarding exploration on the science, technology, philosophic, and economic frontiers which requires that I must not spend any time asking people to listen to me or to look at what I may be doing. If, however, what I am discovering seems to be of interest to others and they ask me what it is that I am working on, I will tell them. I am quite confident that if in the evolutionary processes we deliberately attempt direct personal exploitation of the economic advantages accruing to our personal scientific explorations, we inadvertently become preoccupied and prejudiced with the item we have to sell and are no longer free to explore scientifically with a wholesome intellectual integrity.

By my own rules, I may not profess any special preoccupation or capability. I am a random element. Considering these self-imposed conditions, I am happy that I have been asked back to the universities, and I am happy that several of them have seen fit to give me an honorary degree. At Washington University, where I had been a one-month visiting critic and lecturer for four successive years, the University gave me a degree of Doctor of Science, "with all the rights and privileges thereunto attached." I feel that this was not an exclusively honorary degree ; the circumstances were akin to those of a doctoral candidate. My degree was voted unanimously by the University faculty as a direct consequence of my campus work. Though I have degrees awarded by other leading universities under similar working or earned circumstances as Doctor of Arts, Doctor of Design, and Doctor of Humanities, I am confident that I am not professionally classifiable. I do know, however, from personal experience that there is nothing even mildly extraordinary about me except that I think I am durable and inquisitive in a comprehensive pattern. I have learned much; but I don't know very much; but what I have learned, I have learned by trial and error. And I have great confidence in the meager store of wisdom that I have secured.

As a consequence of my university visiting, I have had about two thousand students who have worked with me in different parts of the world. As I go around the world I find these students active and doing well. When I arrive in New Delhi, Nairobi, or Beirut I find that the students know that I am coming. They are waiting for me with programs they have arranged, and I am able to assess the effect of the kind of learning and communication we have shared. I am confident that the boys I have worked with are trending to become strong citizens around the world. That, I find, is one of the best tests of the validity of whatever communicable wisdom I

may have harvested and disbursed from my experiences.

My experience is now world-around. During one-third of a century of experimental work, I have been operating on the philosophic premise that all thoughts and all experiences can be translated much farther than just into words and abstract thought patterns. I saw that they can be translated into patterns which may be realized in various physical projections by which we can alter the physical environment itself and thereby induce other men to subconsciously alter their ecological patterning. My own conclusion is that man has been given the capability to alter and accelerate the evolutionary transformation of the a priori physical environment that is to participate objectively, directly, and consciously in universal evolution and I assume that the great, complex integrity of omni-coordinate and inter-accommodative yet periodically unique and nonsimultaneously co-operative generalized principles, and their myriad of special case realizations, all of which we speak of as universe and may think intuitively of as God, is an intellectual invention system which counts on man's employing these capabilities. If he does not do so consciously, events will transpire so that he functions subconsciously in the inexorable evolutionary transformations.

As a consequence of man's having the faculty to apprehend patterns external to himself and the capability of altering those patterns, interesting changes in the conscious relationship of man to universe are now multiplyingly in evidence. Unlike any of the other living species, man has succeeded both consciously and subconsciously in greatly altering his fundamental ecological patterning. None of the other living species have altered their ecological patterning. All the species other than man are distinguishable throughout geologic and biologic history by their approximately unaltered ecological patterning. In the last half-century, man has graduated from a local twelve-mile radius daily domain into a world around multi-thousand-miles radius daily domain, as a consequence of his ability to alter his own ecological patterning.

I have for a third of a century been convinced that thoughts must be translated into patterns that can be articulated out of the organized capabilities of man and that these patterns, which can be translated from our thoughts into physical actions, then become utterly impersonal facilities that begin when adopted in emergencies to change the relative advantage of man spontaneously and subconsciously with respect to his total environment. It is a philosophic requirement of my comprehensive working hypotheses that the intellectually-projected tools which result in new ecological patternings must give man, consciously appreciable, advantage increase. My experience shows that these impersonal tools tend to eliminate many of the errors of conceptioning that men who have not translated their thoughts into experimental physical undertakings have heretofore imposed upon one another as inherited conventional thoughts and misinterpretations of

their respective experiences, misconceptions which they have hopefully and lovingly gone on relaying for ages from one generation to the next.

I am convinced that humanity is characterized by extraordinary love for its new life and yet has been misinforming its new life to such an extent that the new life is continually at a greater disadvantage than it would be if abandoned in the wilderness by the parents. For an instance of misconception extension there is my own case. I was born in 1895. The airplane was invented when I was nine years old. Up to the time I was nine years old, the idea that man could fly was held to be preposterous, and anybody could tell you so. My own boyhood attempts to make flying machines were considered wasted time. I have lived deeply into the period when flying is no longer impossible, but nonetheless a period in which the supremely ruling social conventions and economic dogma have continued to presuppose a non-flying-man ecology.

My daughter was not born into the kind of a world that I was; so she doesn't have to struggle to sustain the validity of the particular set of spontaneously-logical conceptions that were pronounced "impossible" in my day, nor need she deal with the seemingly illogical concepts that the older life thought to be "evident" and "obvious" in my day. The new life is continually born into a set of conditions where it is easier for it to acquire more accurate information, generated almost entirely outside of family life and folklore, regarding what is going on in human affairs and in nature in general; and, therefore, the new life has the advantage of much more unshaken intellectual courage with respect to the total experiences than have its as yet living elders who have had to overcome these errors, but who retain deep-rooted delusively-conditioned, subconscious reflexes.

As a startling consequence of the as yet prevalent and almost total misconceptioning regarding traditional education, both formal and informal, I have heard the following problem discussed among leading scientists. A serious question arises when a university student demonstrates extraordinary capability in science as judged by our present academic criteria. The exceptionally high-ranking student has completed his graduate work, and if enabled to develop further there is high probability that he might be able to make important contributions to science and there through to society. There are funds available to foster the super education of this promising individual, but first there is a decision to be made concerning resources much more important than money. This man is going to have to be associated with some of the senior, proven, living scientists, some of the very rare great men, in order for the latter to find out whether the neophyte is a real front-rank scientist. The neophyte is going to have to be given the opportunity to grow in that association with the proven great one. Therefore, society is going to have to risk wasting some of the preciously meager remaining lifetime of its proven, really high-powered intellects, should the candidate fail to demonstrate

exceptional capability. Whether that risk is warranted becomes the strategic question. As a consequence, the kind of examination procedure that our science foundations and other science leaders have developed is one in which they explore to discover whether this capable student is able to unlearn everything he has learned, because experience has shown that that is what he is going to have to do if he is to become a front-rank scientist. The frontiers of science are such that almost every morning many of our hypotheses of yesterday are found inadequate or in error. So great is the frontier acceleration that now in a year of such events much of yesterday's conceptioning becomes obsolete.

I said I started a number of years ago exploring for ways in which the individual could employ his experience analytically to reorganize patterns around him by design of impersonal tools. To be effective, this reorganization must incorporate the latest knowledge gained by man. It also should make it an increasingly facile matter for the new life to apprehend what is going on. It should eliminate the necessity of new life asking questions of people who don't know the answers, thereby avoiding cluttering up the new minds with bad answers which would soon have to be discarded. I felt that the evolving inventory of information "decontaminated" through competent design might be "piped" right into the environment of the home. Please remember my philosophy is one which had always to be translated into inanimate artifacts. My self-discipline ruled that it would be all right for me to talk after I had translated my philosophy and thoughts into actions and artifacts, but I must never talk about the thoughts until I have developed a physical invention, not a social reform.

That is the philosophy I evolved in 1927 when at thirty-two I began my own thinking. I have been operating since then on the 1927 premises, looking exploratorily for tasks that needed to be done, which would, when done, provide tool complexes that would begin to operate inanimately at higher advantage for the new life. I am the opposite of a reformer; I am what I call a new former. The new form must be spontaneously complimentary to the innate faculties and capabilities of life. I am quite confident that humanity is born with its total intellectual capability already on inventory and that human beings do not add anything to any other human being in the way of faculties and capacities. What usually happens in the educational process is that the faculties are dulled, overloaded, stuffed and paralyzed, so that by the time that most people are mature they have lost use of many of their innate capabilities. My long-time hope is that we may soon begin to realize what we are doing and may alter the "education" process in such a way as only to help the new life to demonstrate some of its very powerful innate capabilities.

I went to the World Affairs Conference in Colorado last week. At the meeting were many important individuals, the ambassadors of Ghana, Nigeria, and so forth. Also

participating

were economists, sociologists, and scientists, and among them was a Yale scientist, Dr. Omar Moore. Dr. Omar Moore, you may recall, was reported on in Time magazine last year. At Yale University in the Child Study Clinic, he began to be suspicious that there were drives in human beings other than those of fear and longing which have been the assumed fundamental drives. He developed a hypothetical working assumption that there was a drive of the new life to demonstrate competence, and began working with his own child when she was two and one-half years old. He took an electric typewriter and colored the keys to correspond with the touch system. He then colored his child's fingernails to correspond with the keys each finger should operate. He had a hidden electric key, and when she didn't match the correct finger to the typewriter key the circuit was not closed. When she put the correctly colored finger on it the key worked, and quickly she learned to match her fingers to the proper keys. Every time she touched a key with the proper finger, not only did it print on the paper, but a big letter also came up in a window. By the time the child was three she was typing swiftly with the touch system the stories that were generated in her imagination. She seemed to find it just as easy to communicate this way as by talking. Dr. Moore's community and a number of his colleagues who happened to live in the same little town became fascinated, and began working experimentally with their children. There was a wave of excitement. These men say they used to like to get the children to bed early so they could have the evening to themselves, but now they hate to have the children go to bed early because everyone is so excited and stimulated by what this new life is demonstrating in capacity and capability. These are just some of the inklings corroborating what I am saying regarding very powerful faculties born in the human being which, if given the opportunity, may very readily regenerate to higher advantage for other men.

As a consequence of my kind of technically objective philosophy, I have had wide and copious experiences and firsthand practice in mechanics and structures. I am an engineer by tutorial work with one of our country's leading engineers of the 1920's; I am capable in the general world of physics and mildly capable in the world of chemistry; I am a mathematical explorer. I have been able to translate many of my philosophies into physical inventions in gap areas where there have been no previously recognized functions whatsoever where people have not thought of the problems as being soluble by some device, but soluble only by social procedure reforms. As a consequence, I have developed quite a number of unprecedented devices and structures. At the present there are almost two thousand of my geodesic domes in forty countries around the world. All of those structures are of an unprecedented type. They were patentable in the countries around the world because they were unprecedented and were not included in structural engineering theory and therefore were true inventions. They enclose environments at about 1 per cent of the invested weight of resources of comparable

volume enclosed by conventional structures with which you are familiar. They had to meet the hurricanes, the snow loads, and so forth. My structures are also earthquake proof; most of their comparable conventional counterparts are not. I have found it possible to do much more with less.

I have been able to demonstrate that there are important patterns to be employed by men and that there are inherently available ways of thinking which are simple and logical. My exploration into mathematics has disclosed extraordinary and comprehensive mathematical patternings of nature. I am quite confident that I have discovered the coordinate system employed by nature itself, in contradistinction to the arbitrarily adopted X,Y,Z system which science employs and by virtue of which it translates its calculus through analytical geometry into informations which can be used technically.

All my discourse to you thus far has been given as an introduction in which I have related examples of my experiences and their derived philosophy. I gave you this in the hope of earning your credit for whatever I may be able to say exploratorily regarding what I think is going to happen in the immediate, educational-process future with which you are specifically concerned.

I am a student of trends. I am confident that my over-all trend data is good and that my forecasting capability has proven reliable. From 1938 to 1940, I was technical editor on Fortune magazine—at least that was my function; they don't have that title on their masthead. In the period 1936 to 1938, I had been assistant to the director of research of the Phelps Dodge Corporation, which was the third largest copper corporation in the world. For Phelps Dodge, and indirectly for the World Copper Committee, I developed some comprehensive world economic-trend patternings in order to learn what the over-all trend in world industry might be and what copper's functioning within it might be. Many of my trend prognostications were fulfilled and acknowledged by Phelps Dodge. These world economic-trend patterns were of renewed value when my suggested main theme and research were adopted by Fortune magazine in February 1940 for the subject of their tenth anniversary issue. I had to employ a number of the accounting staff of Time, Inc., to carry out the large-scale work, because the subject was "U.S.A. and the World." We went into all that was known at that time about the economic patternings of man on earth, the industrial equation, and the posture of the U.S.A. in that picture. That issue of Fortune was so successful that it went into three reprintings and took Fortune from the red into the black side of the ledger.

Incidentally, the relative world economic advantage of the United States as of 1940 was so prodigious that it was astounding. Our relative advantage today is anything but that. It was not that we had about 75 per cent of all the world's industrial products but that we had the confidence of much of the world that democracy was unbeatably the most favorable political system. We have been frittering away an enormously high credit that the world spontaneously extended to us. Our world credit has deteriorated. The ambitions of world man and the needs of man have not been wisely serviced by us in the last score of years, 1940 to 1960. Because national, foreign, and domestic policies of government and business failed to heed such world-trend studies and continued to revert to the pre-air-age conventions and concepts of independent local sovereignties and business anarchy we have lost that world credit of our initiative and integrity. It can be won back, but only through the integrity of education.

Out of my general world-pattern-trend studies there now comes strong evidence that nothing is going to be quite so surprising or abrupt in the forward history of man as the forward evolution in the educational processes. People think that it is exciting to consider going to the moon and that such a trip will be a revolutionary affair. Of course it will. We may have all kinds of world warring and so forth, and these are spectacular. But in our shifting times the world tends to think of its educational processes as well-developed and quite reliable, needing only expansion, therefore not subject to excitingly important changes, and therefore the antithesis of news-making moon-shots.

As a consequence of this public attitude there is the prevalent tendency of politicians to feel that they are going to be secure of their return to office by virtue of getting all they can for their constituents in the way of "educational facilities" as a well-established and familiar commodity. It is very characteristic of all those undertakings that when the politicians think about education they immediately begin to think about buildings and apparatus. There is a conventional picture or concept of school that is very powerful in most men's minds, and I think a great surprise is coming. I don't think that what is going to happen in education is apprehended or anticipated at all by the political states. I know that there is awareness of coming change amongst the forward thinkers of the educational ranks, but, I feel, even they will be astonished at the magnitude of the transformation about to take place in the educational processes.

I have put up on the wall my Dymaxion Airocean World Map. I am sure it doesn't look familiar to you. Some of you may have seen it there was an early version of it published in Life magazine in 1943 but it was a little different from the one on the wall. The same spectrum colors were used, but it was a slightly different geometrical pattern. If we were to go around this school building and look at the world maps on its walls, we would probably see several Mercator maps. Sometimes we would see U.N. maps. These projections do not show the Antarctic. The U.N. map is a north-polar azimuthal. It is greatly distorted in the Southern Hemisphere and has no Antarctic and, therefore, misses a very large continent. You are probably thinking that my world map is

"interesting," but that you would rather have a "regular" map. Our concept of the "regular" map is typical of our mental fixation in the educational processes. On the Mercator, as you know, the North Pole area is so completely distorted that it is seemingly thousands of miles from Greenland to Alaska. Many thousands of miles are indicated at the top edge of the Mercator between North Pole points one mile apart—completely misinforming. The Mercator map tends to show Europe and Asia split in two, so that "never the twain shall meet," as Kipling said. The Americas are in the center. The "tops" of the continents don't join together at all, and there are the great open blank spaces of the Arctic and Antarctic. Those were very good maps for the era of sailing when the Arctic and Antarctic were unexplored "infinities."

My world map which you are looking at on the wall has strange sixty-degree angle-edge patterns. If you will cut out along the gray edges and bring them together, you will find that the map will make an icosahedron—that is, a "solid" faced with twenty equilateral triangles. If you will compare its data and graphic patterning with that of a globe, you won't find any fault with it at all. It will seem to be saying just what the world globe says. The shapes of the land masses are correct; there is no visible distortion of the relative shapes or relative sizes of its geographical features. This is a pretty good map because no other projection will do that. The polar azimuthals, the polyconics, and the Mercators—the prime "regular" types—all have a very great distortion in them. My map does not. I discovered a topological transformation between spheres and planes. I was able to get a United States patent—the first United States patent ever granted on a method of projection. Though my map is hung in many distinguished men's offices, the fact is that it is not hung in the schools. The big map companies go right on turning out the maps that, as far as I am concerned, are extremely distorted, misinforming, and obsolete.

Let me point out next that when you transfer the projected data from the surface of a sphere to a plane you have to break open the spherical skin in order to "peel" it. There will be various angular cuts in the periphery of the skin when it is layed out flat, just as when you take the skin off an animal. The openings along the edge are called sinuses. The sinuses on my map all occur in the water. None of the cuts go into the land. Therefore, I am able to take all of the data off the earth globe and make it accurately available to you in the flat. You can't see around the world globe; in fact you can only read one fourth of the globe at any one time; so it is good now that you can see all the data at once in the flat without visible distortion or breaks in the continental contours. My map in effect shows one world-island in one world-ocean. We have been aware that only one quarter of the earth's surface is dry land, but we have not acknowledged that there is one ocean. We speak of at least three Oceans. When this one world-island is rotated as you now see it displayed on the wall, you say, "I see the United States now and it is 'right side up.'" The fact is, there is no such orientation in the universe as "right side up"; so what you mean is your habitual way of looking at things. This map can be cut into triangles. You can put them together in many different ways. The arrangement

on the wall just happens to be a preferred way of putting the triangles together. I watched the head of the mathematics department of a leading university observe his children putting a similar map together on the floor. He said, "No, darlings, you have it upside down. You are supposed to have the United States so that it's up." The children were quite right, of course, and the head of the math department was wrong. He was demonstrating a debilitating fixation on the conventional map. I assert that this disclosure is typical of our entire educational process, of the kinds of conceptual fixations we have that are debilitating to the older people in considering the needs of the young peoples' world and the enormous new potentials that can be integrated to the advantage of the young.

Four per cent of humanity is for the moment in South America. One per cent is in Central America, 7 per cent in North America—a total of 12 per cent in the combined Americas. From anywhere in the United States, as only my map shows, I can fly on the shortest great-circle routes to reach 84 per cent of humanity without flying either over the Atlantic or Pacific oceans. This is not the pattern that we have been thinking about with our Mercator maps. With them we think in terms of necessarily crossing the Atlantic and Pacific, going back to the great sailing era days and the great significance of the ports of embarkation and debarkation and of the great tonnages being shipped between them. In terms of air transportation, however, this—the one-world-island land mass on the Fuller map—becomes the airstrip of the world which is most significant, and this airstrip is oriented at 90 degrees to the Mercator stretch-out. This is the appropriate world communications and transport orientation for the present moment. Older people still think they must go to New York from St. Louis to go to Europe, but that really is not the right way to go. This is the right way to go—northern great-circle routes. That is why Chicago, despite New York and San Francisco being very attractive places to embark from, is the most heavily used airport in America.

People generally think "go north go cold, go south go warm." That is a fixation which is also not true. On my map, the spectrum colors are used. I use these for the mean low temperatures for the year. The mean highs are about the same everywhere; that is, in Eastern Siberia it gets as hot in the summer as it gets in mid-continent Africa on certain days. The major climatic differences between the various parts of the world are in the extremes of cold, or the "lows," not in the "highs," or heats. The hottest days in Brazil and India are about the same as the hottest days in Eastern Siberia and Alaska. The cold pole of the Northern Hemisphere is in Eastern Siberia. The cold pole for the Southern Hemisphere happens to coincide geographically with the south pole of the earth's rotational axis. You see on my map how the colors change from blue to green to yellow to red. Blue is coldest. Red is hottest. We find that the red masses of Africa, South America, and South Asia belong to the Northern Hemisphere's color-spectrum bull's-eye. The world thermal map in effect makes a "target" pattern, with the spectrum coloring zones primarily co-ordinate in terms of the Northern Hemisphere. There is also a small secondary color-spectrum temperature-zone bull's-eye associated with the

Southern Hemisphere's cold pole, but it is much smaller than the Northern. It has green in the southern tip of South America and some yellow and red. There is a little yellow and mild red that belongs to the Southern Hemisphere in Australia. Only the southernmost tips of Australia, Africa, and South America are primarily affected by the south cold pole. The rest of the world temperature-patterning relates to the north cold pole. Ninety-nine per cent of the world's population lives at present in the north cold pole's weather domain.

In Europe you will find that the spectrum of thermal-zone lines runs north and south, contrary to the "go north go cold, go south go warm" fixation. The hottest place in Europe is Spain, and Europe gets colder as we go east, not north. Napoleon, thinking as everybody does, that when you stay in your home latitude you will have about the same temperature and weather, went east into Russia prepared to find conditions similar to his home conditions. He was licked by the cold. He dissipated enormous amounts of energy against the cold, the great negative of energy. You would think that by the time Hitler came along men would have learned something about this thermal map. They had not, and Hitler, too, went east into Russia. He was licked logistically by the unexpected magnitude of cold. For an instance, he did not have the right locomotive greases for the temperatures that his army ran into. As a consequence of the thermal ignorance, his forces were not properly supplied, and their hitting power was dissipated by the cold. The cold turned Hitler's tide. This was due, then, to the fact that the concept of go north to cold is wrong. This is ignorance again typical of the educational fallacies. I am sure that parents are still going to teach this geographical error to their children, but the fact is that where 76 per cent of humanity now exists it is "go east, go cold" and in only 24 per cent of the world's land is "go north go cold, go south go warm" true.

We can also look at the colors on the map and compare them with the colors of men's skins. The map temperature colors have to do with the radiation, the inhibition of energy from the sun. As we get into the great cold areas, the skin gets very, very white. Men have to hibernate a great deal of the time. In other parts of the world they could be naked with a great deal of sun. The colors of the map are related, then, also to the color of pigmentation of the skins. This has something to do with the solar system and nothing to do with some mysterious "different kinds of tribes" around the faces of the earth. If there are any special differences in the shapes of noses or heights of men, it has to do very much with the long isolation of men and the developing of certain amounts of hybridism in relation to adapting to special local conditions. There are some dark-skinned people up in the Arctic among the Eskimos, and they are people who came there relatively recently from the tropics and Japan, from the darker regions, by water. They are water people. That is enough discussion of the map.

I was asked to speak in Japan a month ago by Governor Azuma of Tokyo, now the

world's largest city. Tokyo is a province as well as a city. There are so many people they make it a province with a governor. He asked me to speak to his planners and council about planning for Tokyo's future. I pointed out to him that in most of the universities I visit we get into town planning. The planning game is always operative in the terms of a "San Francisco plan," a "St. Louis plan," "East St. Louis plan," or "Lack of East St. Louis plan." Planning as taught is a target-town discipline. I pointed out that this is no longer an adequate way of looking at the planning problem. We will have to find out first what is happening to humanity in the big world pattern—where it is going—find out what the world's probable and comprehensive changes are in order to understand what you've got to plan for any particular city. I recalled that at Massachusetts Institute of Technology in 1949 the planning department was working on the greater Boston plan. It turned out in the end that despite M.I.T.'s exclusively local considerations what was really happening to Boston in an entirely unplanned manner was that it was becoming a vast clover leaf for a continental highway delivery system of our national hitting power from the entire complex of industry in the Eastern United States focussed to the northeasternmost "jump off" point of the United States, should there be a hot war. They were really rubbing out old Boston to make room for the military highway system. The preoccupation with Boston was nonsense. M.I.T.'s planners ought at least to have been talking about the larger highway system and much better about the big world traffic patterns that are developing and how Boston might possibly function in them. They should have been asking: "What does Boston have that is going to make it of any importance whatsoever tomorrow?" If you can find out what that is, then you will know how not to be surprised by what happens and you will know how to accommodate what is going to happen. Boston, despite much "planning," is in 1961 one of the United States' prime depressed areas while many nonplanned areas are booming.

There are many big patternings transcendental to man's general apprehension which are developing gradually into inevitable recognition in the world. One of the biggest inevitables concerns world-man ecology and discloses the fact that at present men are completely mistaken in fundamental ecological thinking regarding themselves. They tend to think of themselves as a tree, as having roots. Up to World War I, the "good citizen" was the man who "owned his own home"—a very well-known expression even today. Men also think of themselves as natives of one country, of one state, of one town, of one homestead. There are two ways in which life tends to be ecologically successful. One is in a static way as a tree. Trees do have roots, and the pine tree as a species "goes around the world" by having its seeds airborne. The pine moves around the world not as an individual tree but by successive generation relaying and airborne regenerations. Man is one of the species that does not have roots and is successful by virtue of his dynamic ability to advance and retreat. He is mobile. Man's little legs are very small, and he doesn't cover much territory compared, for example, with a sea gull. Man, therefore, has tended to think of himself as being more like a tree simply because of the diminutive size of his daily peregrinations.. He found it difficult to get along without close association with other men, and up to World War I, with minor exceptions,

remained essentially within a very small geographical pattern—that is, the territory or even the town in which he was born.

The average distance viewed from the top of a tree to the horizon is fourteen miles. To the horizon and back is, then, about twenty-eight miles. One learns in the Army that twenty-five miles is a very good day's hike. When man's movement was only by legs very few people ever went all the way to the horizon. They stayed pretty well within the sight of one another. They had to develop very static rules and mores—customs that would be acceptable to the dullest and rudest while seeing a whole lot of one another. Our popular political and social and economic reflexing developed along those lines, and holds vigorously today. The concepts of real estate, or of banking and mortgage economics, are theoretically predicted upon people staying "put." Our whole political system is based on the assumptions that people belong to special pieces of land, as do trees, and they are expected to stay there. They have political representatives from each geographical point. "Where is your home?" or "Where do you come from?" are considered logical questions.

In the last two United States' censuses there were some surprises for those static-roots concepts. The census seven years ago showed that every year an average of 20 per cent of America moved out of town. When I was a little boy, we had two "moving days" each year in the New England towns, and I understand they had them in the Western towns, too. About twice a year people made new lease contracts for the next year's rented quarters. The economic successes of the previous year began to show up; so some people moved to worse quarters and some to better quarters—a kind of economic musical chairs. What we learned from our census seven years ago was that every year 20 per cent of America moved out of town. They didn't just move around and play musical chairs in town as they used to forty years ago. This meant that, in effect, every five years all of America moved out of town. The preliminary figures are coming in from the last census of a year and a half ago, and they show that America is now moving out of town every three years. This is quite an acceleration. Within six years America has accelerated from moving out of town every five years to moving out of town every three years. We are not staying put at all. We are in an enormous pattern of comprehensive acceleration which, however, like the hands of a clock, is a subvisible rate of motion. If you or any one else can say, "I have never moved out of town," it is because many such as I move out of town every week or month.

Up to World War I most men had only their feet to get around on; a relatively few people had horses. Men all around the world—as has been measured with pedometers by a number of the world's armies—averaged 1,300 miles walking per capita per annum. This is an average which includes the extremes ranging from the postman to the bed-ridden invalid. Up to World War I those 1,300 walked miles constituted the limit of man's possible ecological sweepout—1,300 miles per annum local to-and-froing. As we entered World War I, Americans were getting from one place to another by some means

other than their own legs, a distance of approximately 350 miles a year. They were walking 1,300 and riding 350 by trains, horses, or ships; so they were predominately a walking device, and the mechanical addition though notable as yet added only 25 per cent. As we came out of World War I, the phenomena of mobilization—the production of trucks, cars, railway rolling stock, and ships in enormous numbers—suddenly brought about a change in America. By 1919 the average American was moving annually 1,600 miles by mechanical vehicles and continuing to walk the 1,300 as well. For the first time in all history, man had suddenly increased his ecological sweepout. The wolves don't increase their ecological sweepout; the gulls don't; the crabs don't. But man suddenly occupied a bigger territory, ergo, entered into an entirely new kind of "life." Since that time, the miles per capita per annum of man have increased enormously not only in America by Americans but all around the world by almost all the world's peoples.

As we entered World War II, in America we were up to 4,000 mechanized miles per capita per annum in addition to the constant 1,300 miles of annual footsteps. However, special categories of man were doing much more. The average American housewife was doing 10,000, salesmen 30,000, the air hostess 100,000 miles per year. At the present moment we are sweeping out an average of approximately 9,000 miles per capita per annum. Also, at the present moment there are more Americans at all times outside of the United States—actually in world travel—than the number of people populating the U.S. when it was founded. We are swiftly approaching a complete annual world sweepout by all world people. By the end of this coming decade man will be able to take a commercial plane, catching it at the nearest commercial airport, and after breakfast reach any part of the world, do his day's work, and be home for dinner. We will be in a "one town world" in a realistic way.

We talk about ourselves as a nation. We are not a nation and never have been. Russia has about 150 nations. These nations are people who have been isolated remotely from other nations for thousands of years and have become enormously hybrid in relation to their special success in their special geographical areas. This hybridism is temporary, a consequence of the areas and environments, and not of there being fundamentally different species of people around earth. How does that evolutionary hybridism come about in the Darwinian mechanics? It does not come about through physical transformation in any one man in his lifetime but through changes in successive generations. For instance, certain birds live in an area where they get out of the water something vital that is their main food. Suddenly the water begins to recede in that area, and the birds have to dig even more deeply into the mud for food. The birds that don't have long beaks can't reach the food, and though the longer-beakers could relay food to the shorter-beakers there is not time enough for them to do so and survive. Thus only the long-beakers survive; the shorter-beakers starve and become extinct. This means that when the long-beakers want to get married there are only long-beakers around; so they begin to inbreed long-beakers, for the probability is that two similar hybrids will produce a similar hybrid. This is the way the hybrids develop in any

special area. That is why nations require many generations of utter isolation to develop unique national characteristics.

What is happening on our world during recent milleniums is that there has been a net western motion of man. In the very early days there was a comprehensive eastern motion of man drifting with the tides and the prevailing winds, but for the last eight or ten thousand years, there has been a net comprehensive motion westward heading into the prevailing winds. Implemented with the swiftly improving tools which came out of the seafaring evolution, people moved on the high sea, and with the kinds of technology and economics which the sea developed these people became great structural and geographic and mathematical and commercial and piscatorial pattern masters. Off of the early raft came the shelter, which had to be a very light hut structure, else the raft would sink. Gradually some raft people took their sheep up on the land, and they didn't have to carry the structure with them for their housing, because they could remember the structural pattern. They could get saplings where they went and weave them together as a large upside down basket from the remembered pattern. Then they could take the skins of the goats and sheep which they tended and ate and make them into covers. Consequently, they were able to survive in very cold areas. The 150 nations of Russia today are people who went westward from the seashores of the Orient into the vast Asiatic hinterland many cold milleniums ago.

As men began to learn with catamarans how to design ships that would sail into the wind they went westward into the prevailing winds. These westbound seafaring people kept coming together westwardly along the Indian Ocean coasts with the hinterland wandering peoples coming down finally out of the hills from their cold hibernating westward peregrinations. Finally, these coastal convergences of westward-bound overseas and overland peoples occur in a very big way historically as the westbound into-the-winds overland tribes and the westward-bound into-the-wind sailors came together in Mesopotamia and next on the Mediterranean shores. The Ionian Greeks are a crossbred product of the people coming both from over the vast inland reaches of the Eurasian continent and from over the Indian Ocean waters having first hit the eastern coast of Africa and then boated northward "down" the Nile to the Mediterranean or navigated with camels, "ocean schooners," across Mesopotamia and Arabia to the Mediterranean. Thereafter we have a continual pouring together of these westbound land and sea people along the northern and southern shores of the Mediterranean flowing eventually into Europe. Ultimately, many overland and overseas westbound tribes crossbreeding, crossbreeding, crossbreeding, completely absorb the earlier static European nations of long-pocketed hybrids. The westward migrating overland and sea people were continually developing more comprehensive adaptability out of the complex of hybrid-demonstrated functions through invention of better and better tools to replace those integral body-articulated functions. Then we have the western jump completely across the Atlantic to America. The people who first came to the eastern shores of America from Europe were already extremely

crossbred the French, English and Germans. America's population today is, then, a westbound, complexedly crossbreeding man not a nation.

Very interestingly, I heard at the World Affairs Conference in Boulder four years ago a leading English journalist get up and say, "We might as well face it, the white race is about to be exterminated by the black and the yellow." I asked him what color white is, and he said, "Well, what color is it?" I told him it is all colors. What we call the white man is really a pink man. We pink-whites are the products of Arabic-Indian sailor men and overland Vandals, Goths, Mongols, etc., moving along the waterfronts, running into the local hybrids, and crossbreeding with them over a great period of years. We are not only a crossbreed people in America but also an advanced state of reversion to a generalized type which becomes the pink-white, all-colors man the antithesis of local national hybrid types. We are simply the westernmost frontier of crossbreeding men trending toward a generalized world-man type, and very rapidly, evolutionarily speaking. You will have to realize that this is so in preparing your new educational processes in which you will have all kinds of problems arising from false fixations of society in respect to a supposedly persisting and valid nationalism, which in reality scarcely exists anywhere anymore and not at all in America except amongst the Indians.

The headache of a president of a great university is today probably the next biggest headache to that of a quasi-nation's president. Take the problem of how to get the funds for this enormous educational undertaking. You educators are uniquely associated with people who are well educated and who have a great feeling of responsibility toward the new life. There is an enormous task to be done, and the budget gets to be formidable. How do you raise the funds? The now world-populated state universities have to keep raising funds from a political base which as constituted is inherently static, operating exclusively in terms of Illinois or Ohio or whichever state it may be.

The point is that we both as individuals and as society are quite rapidly uprooting ourselves. We never were trees and never had roots, but due to shortsightedness we believed blindly and behaved as though we did. Today we are extraordinarily mobile. In this last election, 10 per cent of the national electorate were unable to vote because they hadn't been in their new places long enough. The accelerating mobility curve that I just gave you indicates that by the next election 25 per cent of America will not be able to vote due to recentness of moving, and in the following election possibly less than the majority will be able to vote. We are simply going to have to change our political basis. We are now at the point where the concept of our geographically-based representation which assumes that it realistically represents the human beings is no longer valid. The political machine alone will continue to stay local. It sees the people as statically local. So those who are politically ambitious just stay put while society moves on, and, therefore, the static politicians become invisible to the swiftly moving body politic, which cannot keep track of their static machinations since society does not stay

long enough in any one place to be effective in reviewing the local political initiations. The political machines soon will have no one to challenge realistically their existence validity except the local newspapers, whose purely local political news becomes progressively of less interest to a world-mobilizing society.

Comprehensively, the world is going from a Newtonian static norm to an Einsteinian all-motion norm. That is the biggest thing that is happening at this moment in history. We are becoming "quick" and the graveyards of the dead become progressively less logical. I would say, then, that your educational planners are going to have your worst headaches because you will have political machines that are less and less visible to the people because the people are more and more mobile. You will have to be serving the children of the mobile people who really, in a sense, don't have a base, and you will have to justify it with very hardboiled local political exploitation. I am not particularly optimistic about the kind of results you are going to get. Therefore, when I begin to talk about the educational revolution ahead I see that the old system is probably going to become paralyzed. That is why your headache will get worse and worse until nature just evolves and makes enormous emergency adjustments. President Morris, I not only recognize that your job is fabulously challenging, I recognize you as an extraordinarily able man. Yet I see that you are going to have a harder and harder time, and nobody could care more than you do about the good results you might get. What I am saying, then, is realistic. It is also going to be obvious to you, I am sure, that the kind of changes I will talk about next are probably going to have to take place.

We know that our world population is increasing incomprehensibly swiftly. There are enormous numbers to be educated. We are going to develop very new attitudes about our crossbreeding and our reversion to universal pigmentation. That is going to be slow, but it is going to be a great and inevitable event. In the end we are going to recognize that there are no different species of living man, and we will get over that kind of color class-distinction.

The big question is how are we, as educators, going to handle the enormous increase in the new life. How do we make available to these new students what we have been able to discover fairly accurately about the universe and the way it is operating? How are we going to be able to get to them the true net value won blindly through the long tradition of ignorant dedications and hard-won lessons of all the unknown mothers and all the other invisibly heroic people who have given hopefully to the new life, such as, for instance, the fabulous heritage of men's stoic capacity to carry on despite immense hardships?

The new life needs to be inspired with the realization that it has all kinds of new advantages that have been gained through great dedications of unknown, unsung heroes of intellectual exploration and great intuitively faithful integrities of men groping in the dark. Unless the new life is highly appreciative of those who have gone

before, it won't be able to take effective advantage of its heritage. It will not be as regenerated and inspired as it might be if it appreciated the comprehensive love invested in that heritage.

The old political way of looking at things is such that the political machine says we first must get a "school house" for our constituents, and it must look like Harvard University, or it must be Georgian and a whole big pile of it. "We see that the rich kids went to school in automobiles; so let's get beautiful buses for our kids." "Harvard and Yale have long had football; our school is going to have football." There is nothing boys used to have that they are not going to "get" from their politicians, who, above all, know best how to exploit the inferiority complex which they understand so well as handed down from the ages and ages of 99 per cent have-not-ness of mankind. There is a sort of class inferiority amelioration battle that goes on with the politicians in seeking the favor of their constituents to get into or back into office, and little if any attention is paid to the real educational problems at hand.

In thinking about these problems, I have thought a lot about what I have learned that may be useful as proven by experiments in my own self-disciplining. I have met some powerful thinkers. I met Dr. Einstein. I wrote three chapters in a book about Dr. Einstein, and my publishers said that they wouldn't publish it because I wasn't on the list of people who understood Einstein. I asked them to send the typescript to Einstein, and they did. He then said he approved of it that I had interpreted him properly and so the chapters did get published. When Einstein approved of my typescript he asked me to come and meet him and talk about my book. I am quite confident that I can say with authority that Einstein, when he wanted to study, didn't sit in the middle of a school room. That is probably the poorest place he could have gone to study. When an individual is really thinking, he is tremendously isolated. He may manage to isolate himself in Grand Central Station, but it is despite the environment rather than because of it. The place to study is not in a school room.

Parents quite clearly love their children; that is a safe general observation. We don't say parents send their children to school to get rid of them. The fact is, however, that it is very convenient for mothers, in order to be able to clean the house for the family, to have the children out of the way for a little while. The little red school house was not entirely motivated by educational ambitions.

There is also a general baby-sitting function which is called school. While the children are being "baby sat," they might as well be given something to read. We find that they get along pretty well with the game of "reading"; so we give them more to read, and we add writing and arithmetic. Very seriously, much of what goes on in our schools is strictly related to social experiences, and that is fine that's good for the kids. But I would say we are going to add much more in the very near future by taking advantage of the children's ability to show us what they need.

I have taken photographs of my grandchildren looking at television. Without consideration of the "value," the actual concentration of a child on the message which is coming to him is fabulous. They really "latch on." Given the chance to get accurate, logical, and lucid information at the time when they want and need to get it, they will go after it and inhibit it in a most effective manner. I am quite certain that we are soon going to begin to do the following: At our universities we will take the men who are the faculty leaders in research or in teaching. We are not going to ask them to give the same lectures over and over each year from their curriculum cards, finding themselves confronted with another roomful of people and asking themselves, "What was it I said last year?" This is a routine which deadens the faculty member. We are going to select, instead, the people who are authorities on various subjects—the men who are most respected by other men within their respective departments and fields. They will give their basic lecture course just once to a group of human beings, including both the experts in their own subject and bright children and adults without special training in their field. This lecture will be recorded as Southern Illinois University did my last lecture series of fifty-two hours in October 1960. They will make moving picture footage of the lecture as well as hi-fi tape recording. Then the professor and his faculty associates will listen to this recording time and again.

"What you say is very good," his associates may comment, "but we have heard you say it a little better at other times." The professor then dubs in a better statement. Thus begins complete reworking of the tape, cleaned up, and cleaned up some more, as in the moving picture cutting, and new illustrative "footage" will be added on. The whole of a university department will work on improving the message and conception of a picture for many months, sometimes for years. The graduate students who want to be present in the university and who also qualify to be with the men who have great powers and intellectual capability together with the faculty may spend a year getting a documentary ready. They will not even depend upon the diction of the original lecturer, because the diction of that person may be very inadequate to his really fundamental conception and information, which should be superb. His knowledge may be very great, but he may be a poor lecturer because of poor speaking habits or false teeth. Another voice will take over the task of getting his exact words across. Others will gradually process the tape and moving picture footage, using communications specialists, psychologists, etc.

For instance, I am quite certain that some day we will take a subject such as Einstein's Theory of Relativity, and with the "Einstein" of the subject and his colleagues working on it for a year, we will finally get it reduced down to what is "net" in the subject and enthusiastically approved by the "Einstein" who gave the original lecture. What is net will become communicated so well that any child can turn on a documentary device, a TV, and get the Einstein lucidity of thinking and get it quickly and firmly. I am quite sure that we are going to get research and development laboratories of education where

the faculty will become producers of extraordinary moving-picture documentaries. That is going to be the big, new educational trend.

The documentaries will be distributed by various means. One of the ways by which I am sure they will be distributed eventually has very much to do with an important evolution in communications history which will take a little describing. First, I point out to you that since the inauguration of the United States and adoption of its Constitution some very severe alterations have happened in the evolution of democracy's stimulation and response patterning and the velocity and frequency rates of that patterning's event-transformations.

At the time we founded our country, men were elected in small local areas out of communities wherein all the people were familiar with all the faces. Everybody knew Mr. Forbes or whatever his name was, and they trusted him and elected him to represent them in their federal assembly meetings. These "well known" representatives of the eighteenth and nineteenth centuries had to go to the Congress by foot or horse, for those were the means of travel. For instance, they went from some place in Massachusetts to Philadelphia or Washington, wherever the Congress was convening, and it took them a week or so to get there. They stopped along the way, meeting many friends and other folk and finding out what the aspirations of the different people's localities were.

Let us hypothetically consider how they conferred at their Congress on their individual needs and requirements; how they found certain things that were of general pertinence to all of them and found some things that were relevant only to individual areas. While they were meeting they received a letter from France, and they were very excited because France, who had helped them in the Revolution, now critically needed some help from the new United States of America. They talked about what they might do about that letter. All of these men then went back by foot or horse to their different homes and conferred face to face with their townspeople. They told their constituents what they had found out about the various things, and they said: "Here's a letter from France; this is what the various representatives at the Congress thought about it—what do you think about it?" Then they went back to the central meeting place again and acted on that letter and other pertinent matters in view of their direct knowledge of their constituents' thoughts and ambitions. The term of office that we gave representatives was predicated upon this ecological pattern of on-foot and horseback traveling. It took about four years to complete the two trips just outlined to effect a basic democratic stimulation and response cycle. The velocity rates of stimulation and response were in a one-to-one correspondence.

Suddenly new industrial technology made scientific harvesting available through invention. Lincoln became the first "wired" president—the first head of a state to be able to talk directly by telegraph to his generals at the front. This was the first time generals

no longer needed to be sovereignly autonomous, because now the head of state became practically available for the highest policy decisions right at the front. World War I brought in the radio, and in World War II, for the first time, the admirals at sea were hooked up directly to Washington. They didn't need the autonomy they had to have when they took the fleet away for a year with no way to communicate with the president other than by a messenger sailing ship. Now "we the people" have radio and TV, and we obtain world-around event information from the telegraph, newspaper, and broadcast. With world-around news broadcast to us in seconds, there is no way we can respond directly to their problem-content stimuli.

We no longer have the one-to-one velocity and frequency correspondence between stimulation and response that we had in the early formative days of the U.S.A. We now have enormous numbers of stimulations and no way to say effectively what we think about them or what we would like to do about each of them. By the time that presidential voting comes around every four years we have accumulated ten thousand unvented, world-around emanating stimulations, and usually we are no longer in the same town with the representatives that we previously elected.

Automobiles move through the streets with pictures of political candidates' faces on their sides, and we try to pick out the candidates whom we think least offensive. We rarely know them or whether we may trust them. So we vote superficially for the "least offensive" ones, depending primarily on the major party selections. That is about the best we can do.

Because all this is so, those now doing the representing, wishing to be returned to office, wish to know what people are thinking about all the important issues. So the surveys of public opinion have developed, and congressional investigations of many phenomena have increased. We have to have a kind of anticipatory political reconnaissance going on all the time. Even then, when the elected man comes in he knows that it is only as the result of indirect effects of total psychological moods; so he pays little attention to any specific "mandates," and he begins to work right away on the psychological culturing of his next election. He is not really sure that there are any true mandates. He doesn't really know what the people think. That is one large reason why democracy is in great trouble today, because of the vacillation and compromise arising from the lack of one-to-one correspondence between stimulation and response of the electorate. The Communists and dictatorships scoff at democracy saying it doesn't work. I am sure that democracy is inherently more powerful and capable and appropriate to man's needs than any other form of government, but it needs proper updated implementation to a one-to-one velocity correspondence in respect to each and every stimulation-and-response, and then democracy can work magnificently.

Section 5

I have talked to you about solving problems by design competence instead of by political reform. It is possible to get one-to-one correspondence of action and reaction without political revolution, warfare, and reform. I find it possible today with very short electromagnetic waves to make small reflectors by which modulated signals can be beamed. After World War II, we began to beam our TV messages from city to city. One reason television didn't get going before World War II was because of the difficulty in distributing signals over long distances from central sources on long waves or mildly short waves. We were working on coaxial cables between cities, but during the war we found new short ranges of electromagnetic frequencies. We worked practically with very much higher frequencies, very much shorter wave lengths. We found that we could beam these short waves from city to city. Television programs are brought into the: small city now by beam from a few big cities and then rebroadcast locally to the home sets. That is the existing TV distribution pattern. My invention finds it is now possible to utilize the local TV masts in any community in a new way.

Going up to, say, two hundred, three hundred, or four hundred feet and looking down on a community you see the houses individually in the middle of their respective land plots. Therefore, with a few high masts having a number of tiny massers, lassers, or reflectors, each beam aimed accurately at a specific house, the entire community could be directly "hooked up" by beams, instead of being broadcast to. This means a great energy saving, for less than 1 per cent of the omnidirectionally broadcast pattern ever hits a receiving antenna. The beaming makes for very sharp, clear, frequency-modulated signals.

In the beaming system, you also have a reflector at the house that picks up the signal. It corresponds directly to the one on the mast and is aimed right back to the specific beaming cup on the mast from which it is receiving. This means that with beam casting you are able to send individual messages to each of those houses. There is a direct, fixed, wireless connection, an actual direct linkage to individuals; and it works in both directions. Therefore, the receiving individual can beam back, "I don't like it." He may and can say "yes" or "no." This "yes" or "no" is the basis of a binary mathematical system, and immediately brings in the "language" of the modern electronic computers. With two-way TV, constant referendum of democracy will be manifest, and democracy will become the most practical form of industrial and space-age government by all people, for all people.

It will be possible not only for an individual to say, "I don't like it," on his two-way TV but he can also beam-dial (without having to know mathematics), "I want number so and so." It is also possible with this kind of two-way TV linkage with individuals' homes to send out many different programs simultaneously; in fact, as many as there are two-way beamed-up receiving sets and programs. It would be

possible to have large central storages of documentaries < great libraries. A child could call for a special program information locally over the TV set.

With two-way TV we will develop selecting dials for the children which will not be primarily an alphabetical but a visual species and chronological category selecting device with secondary alphabetical subdivisions. The child will be able to call up any kind of information he wants about any subject and get his latest authoritative TV documentary, the production of which I have already described to you. The answers to his questions and probings will be the best information that man has available up to that minute in history.

All this will bring a profound change in education. We will stop training individuals to be "teachers," when all that most young girl "education" students really want to know is how they are going to earn a living in case they don't get married. Much of the educational system today is aimed at answering: "How am I going to survive? How am I going to get a job? I must earn a living." That is the priority item under which we are working all the time < the idea of having to earn a living. That problem of "how are we going to earn a living?" is going to go out the historical window, forever, in the next decade, and education is going to be disembarassed of the unseen "practical" priority bogeyman. Education will then be concerned primarily with exploring to discover not only more about the universe and its history but about what the universe is trying to do, about why man is part of it, and about how can, and may man best function in universal evolution.

Automation is with us. There is no question about it. Automation was inevitable to intellect. Intellect was found to diferentiate out experience continually and to articulate and develop new tools to do physically repeated tasks. Man is now no longer essential as a worker in the fabulously complex industrial equation. Marx's worker is soon to become utterly obsolete. Automation is coming in Russia just as it is here. The word worker describing man as a muscle-and-reflex machine will not have its current 1961 meaning a decade hence. Therefore, if man is no longer essential as a worker we ask: "How can he live? How does he acquire the money or credits with which to purchase what he needs or what he wants that is available beyond immediate needs?" At the present time we are making all kinds of economic pretenses at covering up this overwhelming automation problem because we don't realize adequately the larger significance of the truly fundamental change that is taking place in respect to man-in-universe. As automation advanced man began to create secondary or nonproductive jobs to make himself look busy so that he could rationalize a necessity for himself by virtue of which he could "earn" his living. Take all of our bankers, for example. They are all fixtures; these men don't have anything to do that a counting machine couldn't do; a punch button box would suffice. They have no basic banking authority whatsoever today. They do not loan you their own wealth. They loan you your own wealth. But man has a

sense of vanity and has to invent these things that make him look important.

I am trying to keep at the realities with you. Approximately total automation is coming. Men will be essential to the industrial equation but not as workers. People are going to be utterly essential as consumers<what I call regenerative consumers, however, not just swill pails.

The vast industrial complex undertakings and associated capital investments are today so enormous and take so long to inaugurate that they require concomitantly rapid regenerative economics to support them. The enterprise must pay off very rapidly in order to be able to refund itself and obtain the economic advantage to inaugurate solution of the next task with still higher technical advantage. In that regenerative cycle of events, the more consumers there are the more the costs are divided and the lower the individual prices. The higher the frequency of the consuming the more quickly the capital cost can be refunded, and the sooner the system is ready for the next wave of better technology. So man is essential to the industrial equation as a consumer<as a regenerative consumer, a critical consumer, a man who tasting wants to taste better and who viewing realizes what he views can be accomplished more efficiently and more interestingly. The consumer thus becomes a highly critical regenerative function, requiring an educational system that fosters the consumer's regenerative capacity and capability.

At present, world economics is such that Russia and China work under an integrated socialist planning in competition with our literally disorganized economic world (for our anti-trust laws will not permit organization on a comprehensive basis). The Communists have high efficiency advantage because of their authoritarianism. We have very little centralized authority, save in "defense." The Communists now have the industrial equation, too, in large scale, and soon complete automation will be with them. They are very much aware of the fact that the more customers there are, the more successful the operation will be, because the unit costs are progressively lower. This is why the Soviets were historically lucky in getting China as customers. They would like also to have, exclusively, India and Africa as customers. If Russia acquires the most customers, we will not be able to compete. They will always have the lower costs on any given level of technology. We are going to have to meet this possibility and meet it vigorously, swiftly, and intelligently. Within the next decade, if we survive at all as an organized set of crossbreeding men on the American continent it will be because we will have suddenly developed a completely new attitude on all these matters. In case you are apprehensive that social and political economics are to be so laggard as to impede your advanced educational programming, it is well to remember that the comprehensive world economics are going to force vast economic reforms of industries and nations, which incidentally will require utter modernization of the

educational processes in order to be able to compete and survive.

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.