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The Quality of Growth

By choice or by necessity, we are going to have to learn to live within our limits.

Russell E. Train

The United States has become the most powerful and prosperous nation in the world. But we have learned, over the past decade, that both our power and our prosperity are subject to increasingly stringent constraints. We have discovered that there are rather severe limits to our ability to employ our military might to further our ends abroad. We have witnessed the steady erosion of our economic position in world markets. At home, where once we imagined we had uncovered the secrets to endless economic growth, we have found ourselves continuously beset by both inflationary and recessionary pressures at one and the same time. We have seen our first serious efforts at "social engineering" fall far short of their aims. Our standard of living has continued to rise at the same time that we have become increasingly less satisfied with the quality and character of our lives. We find that, as we become increasingly able to afford the "good life," it becomes increasingly impossible to buy.

Once we would have shrugged these things off as mere "growing pains." We are just beginning to understand the degree to which many of our pains really do stem from levels and kinds of growth that simply cannot be sustained.

We are beginning to understand, as well, that we can no longer continue to act on the basis of some of our oldest and most ingrained assumptions. I think, in particular, of the assumption that we would never run out of room or of resources and that, as a result, we could forever be free and easy with both; and of the assumption that if, for a time, we found ourselves in a tight squeeze, then we could—in the nick of time and out of nowhere—count on the *deus ex machina* of our unrivaled scientific and technological capability, not to speak of our unexampled ingenuity, to extricate us from our difficulties and set us off once more on our predestined path to the promised land of progress and prosperity.

The space effort was, I suspect, the last hurrah of what seems in retrospect our incredibly uncritical faith in the virtue and value of anything that bore the label of "science and technology"—a faith that we backed not only with billions of public dollars in the space program, but also with billions upon billions of private dollars in the stock market.

I am aware, I must hasten to add, that the words "science" and "technology" cannot be so indissolubly lumped together that we somehow come to regard them simply as different versions or stages of the same thing. There are, for example, those who say that the genuinely scientific purposes of the space program were very early sacrificed and subordinated to what became, in fact, largely an engineering and acrobatic extravaganza. What I am saying, simply, is that the technological offspring of science must now survive far sterner tests before they can command the acceptance and investment that once was theirs almost without asking. The supersonic transport is an excellent instance of a technological option that we might well have ardently and automatically embraced had it presented itself to us a decade or so ago. In my judgment, while the SST was a potential economic and environmental albatross when considered 3 years ago, the new priority which we must accord to energy efficiency should finally put to rest any plans to squander further private or public funds upon the SST.

Our growing environmental concerns and most recently the energy crisis have combined with gathering force to make us understand that we do not have unlimited room or resources. We are starting to see that our energy and environmental ills stem, essentially,

The author is administrator of the Environmental Protection Agency. This article is adapted from the text of a lecture delivered at the annual meeting of the American Association for the Advancement of Science, 25 February 1974, in San Francisco, California.

from the same source: from patterns of growth and development that waste our energy resources just as liberally as they lay waste our natural environment. We no longer live in a time when we were few and the land was wide and waiting for us. We have reached the point where we can no longer insulate ourselves from the punishment and pollution we visit upon the earth and the atmosphere, and where the natural resources we once regarded as so endlessly available and expendable are becoming increasingly hard to get.

The energy crisis is part and parcel of our overall environmental problem—a classic symptom of the strains that occur when an organism begins to exceed the carrying capacity of its habitat. It warns us that we had better begin to face up to the fact that modern man everywhere is pressing the limits of the resources and resilience of the earth. Shortages of metals and other critical raw materials lie ahead. Despite the marvelous productivity of American agriculture—increasingly dependent, I might add, upon abundant energy—and the miracles of the Green Revolution, food shortages and famine are becoming all too common around the world. In the oceans, fishery stocks have been rapidly declining.

We are, it is clear, moving from an age of resource abundance to an age of resource shortages. By choice or by necessity, we are going to have to learn to live within our limits. We are going to have to come to grips with the problems of growth.

I am not one of those who would overwhelm you with the apocalyptic visions of the Club of Rome and exhort you to repent before the catastrophe comes. I do not believe the end of the world is at hand, or even on the horizon. But I do think that we need to begin now to change the ways we grow before change is forced upon us by crises of even greater severity.

Reducing the Growth Rate in Energy Demand

We can begin by setting ourselves the goal of cutting in half by 1985 our recent growth rate in energy demand of about 5 percent. There are any number of ways of achieving that goal that will have no appreciable effect upon overall levels of economic activity or employment and that will measurably improve our quality of life.

If, for example, the average vehicle weight of automobiles could be cut from the current 3500 pounds to 2900 pounds, if the Congress approved legislation setting appropriate standards for space heating in new buildings and restrictions on commercial lighting, and if population growth rates remain at their present low levels, then we could achieve a 2.5 percent energy growth rate by 1985. If we combined these measures with increased use of mass transit, recycling, energy conversion from wastes, and other energy-efficient and energy-conserving measures in the residential, industrial, and transportation sectors of our economy, we could bring the demand growth rate down to 2 percent or less by 1985.

There are, in addition, possibilities for significant energy savings in U.S. agriculture, which consumes huge amounts of energy not only in the growing of the raw product itself but also in the transportation and processing of that product. As world population continues to explode, the world's fossil fuel supplies are rapidly diminishing. Yet it is those fuel supplies that have enabled American agriculture to perform such prodigies of production, and that are the vital ingredient in both American food production technology and the Green Revolution. If we are to produce enough food to meet the rapidly growing demand abroad as well as our needs at home, we must begin to explore such energy-saving measures in agriculture as the substitution of labor for energy and of animal and green manure for chemical fertilizer, the more efficient use of machinery, the greater use of mechanical cultivation rather than herbicides, the breeding of disease, insect and bird resistant seeds, and the transport of materials by train rather than truck.

We can also begin to take advantage of the fact that the United States is the major producer of one of the world's most important and energy-efficient crops—the soybean. Last year, soybeans accounted for about 5 percent of all U.S. income from exports and was the largest single item among our agricultural exports. The increasing production and use of soybeans as a meat substitute would both ease agriculture pressures on energy and environment, and serve as a growing source of strength for our world trade position. Vegetable protein requires substantially less energy to produce than does meat protein.

Changing Patterns of Urban Growth

Perhaps our most enduring changes must come in our patterns of urban growth, in the way we organize our activities in our urban areas. We hear it said, often, that most of our urban ills are the result of overcrowding and congestion. There are just too many people, we are told, jammed together in much too small a space. Yet what creates the sense of overcrowding and congestion is not simply the number of people who live and work in our urban areas, but rather the fact that their jobs, homes, shopping centers, and recreation areas are strewn like debris across the length and breadth of the landscape. It seems quite clear, for example, that we could take the city of Los Angeles—with the precise number of people, schools, airports, and power stations that it now contains—and by arranging these differently achieve a hundredfold improvement in the quality of life and save, in the process, considerable amounts of energy, money, and time. The streets would be less congested; open spaces and recreation areas more open and easily accessible; the air would be cleaner; far more of the services people need and the activities they seek to enjoy would be only a few minutes away by foot, by bicycle, by bus, or by train; and life would be far brighter and far more bearable.

The spread patterns of settlement and development that characterize our urban areas are the unfortunate legacy of our old illusion that we had endless acres of land to build on and unlimited energy to burn. Unlike the cities of Europe, where land was scarce and areas were small, our cities did not grow up—they grew out. They became what Wilfred Owen (*1*) has called "accidental cities," which put "a premium on moving" because they "offer so little in the way of living." We have, as a result, become a country in which licensed drivers outnumber registered voters, in which for every baby born more than two cars roll off Detroit's assembly lines, in which—according to one estimate—the average commuter spends a month of daylight hours every year driving to and from work.

We need to bring our cities back together and reduce all the unnecessary travel and travail that, in Wilfred Owen's words, result "from the inconvenience of having things located in the wrong places." More compact forms

of urban settlement and growth would be far more conservative of both energy and environment, and far more conducive to the "good life" that we so ardently seek.

In general, all of these changes that I have suggested would reduce our demands upon our resources and our environment while, in many respects, improving the quality of our life. If we use a little imagination and innovation in making these changes, they would not require reductions in the level of economic activity, but it should be emphasized that such changes would be far easier to accomplish, and the benefits of these changes secured, if we move more rapidly toward population stability. In my view, we should, as a matter of explicit national policy, do whatever is possible and practicable to hasten the achievement of population stability, and we should take all appropriate steps to provide leadership in achieving global population stability. But we should not deceive ourselves into believing that population stability, even if it were to occur tomorrow, would free us from the necessity of making the kinds of changes I have described.

For the energy and environmental ills that afflict us, along with a great many other aggravations that seem so inseparable a part of modern life, are in large measure the result, not simply of how much and how fast we grow, but of how we grow, of the character and composition and quality of growth.

We can and should seize upon the energy crisis as a good excuse and a great opportunity for making some very fundamental changes that we ought to be making anyway for other reasons. I see disturbing signs, however, that we are responding to the energy crisis on the basis of the same old ideas and attitudes that brought us to our present pass in the first place. All we have to do, we are told, is suspend pollution controls and environmental standards and then pull out all the stops in an orgy of exploration, extraction, and production that will give us enough energy to let us resume once more our wasteful ways of growing and living. (I have, I might add, often been struck by the fact that those who show little reluctance at pointing out the energy costs of certain pollution controls and environmental protection measures are extremely reluctant to acknowledge the large energy savings that many environmental measures would bring, and to draw attention to the often sizable energy costs involved in the very extraction and production of energy.) All we have to do, we are told, is invest vast billions of dollars in a mammoth Manhattan-type project that will once more enable our technological genius to come to the rescue.

Our first priority, in any national strategy that seeks to get at the roots of our energy crisis, must be to move gradually toward a deep and enduring reduction in the growth rate of energy demand. We need, at the same time, to move carefully and cautiously in the extraction and use of our current fossil fuel supplies, making certain that we apply the most effective and advanced techniques available for keeping environmental damage to the barest minimum. We need, finally, to undertake an intensive R & D effort to develop economically and technologically feasible ways of living off of our energy income rather than our energy capital, off of our renewable rather than our nonrenewable energy supplies, off of the sun, wind, tides, and geothermal heat rather than off of our finite and rapidly falling reserves of fossil fuel.

When I testified at the Senate hearing on my confirmation as administrator of the Environmental Protection Agency (EPA), I emphasized two things:

First, my commitment to the fullest possible participation by citizens in the decisions of their government, particularly in the environmental field.

And second, my conviction that EPA's enforcement policy can only be as sound as the standards on which it is based, and that those standards can only be as sound as the scientific data on which they are based. I emphasized my intention to strengthen the agency's ties to the scientific community.

My experience at EPA thus far has strengthened my conviction that public participation and scientific expertise are absolutely essential to our success.

Indeed, not simply the ability of EPA to set sound standards, but the ability of citizens to take part intelligently as well as fully in the decisions of their government, must depend very much on the extent to which the results of scientific research are readily understandable and available.

At precisely the point when the institutions and processes of government and politics are becoming absolutely essential if we are to resolve the intricate and interrelated issues before us, the citizens of this country are becoming more and more alienated and indifferent to those institutions and processes, which seem as ineffective as they are unresponsive. At precisely the point when the discoveries and achievements of our various sciences seem to bear most directly upon so many of our most pressing public problems, the gap between what the scientist knows and what the citizen understands has grown increasingly wider.

More than 15 years ago, Hannah Arendt (*2*) warned that "the 'truths' of the modern scientific world view, though they can be demonstrated in mathematical formulas and proved technologically, will no longer lend themselves to normal expression in speech and thought." To that degree, she went on to point out, these "truths" cannot enter into the political marketplace and serve as a basis for public decision-making, for, in her words, "speech is what makes man a political being" and "men in the plural . . . men insofar as they live and move and act in this world, can experience meaningfulness only because they can talk with and make sense to each other and to themselves."

If we are to come to grips with the issues that I have touched upon, with what might be called the problems of growth, we are going to have to find ways of diminishing the distance between scientific knowledge and public understanding, and between the public and the processes of public decision-making.

To begin with, we are going to have to find new kinds of political leaders, leaders who understand that the fundamental issues before us are not always the isolated and immediate ones, but the interrelated and the long-range ones; leaders who understand that, in an age of growing scarcities, the ancient and honored practice of promising more of everything, of guaranteeing two chickens in every pot and two cars in every garage, is neither relevant nor responsible; leaders, in short, who understand that less is often better.

At all levels of government, we need *first,* to strengthen our ability to assess problems and programs not simply in isolation, but in their interrelationships; not simply over the short-term, but over the longer span of 10 or 20 or 30 years; and *second,* to devise ways of keeping citizens abreast and involved in these longer-range analyses and, on the basis of these, in developing and deciding upon basic plans and priorities as well as strategies for achieving them.

Taking Care of the Things We Own in Common

Long ago, Aristotle observed that "that which is common to the greatest number has the least care bestowed upon it."

Americans, more than most people, have failed to take good care of the things that belong to all of us together: air, water, land, cities, regions, neighborhoods. Yet unless we start taking care of these things that belong to nobody in particular and everybody in general, we are going to find ourselves faced not only with a narrower range of individual choices than before, but with individual choices that are less worth making.

These common choices must be made through political processes and institutions that are both democratic and effective, that are large enough to encompass the problems and small enough to reflect and respond to the needs and desires of the citizens concerned. Most of these common choices involve problems that simply cannot be contained within any single local jurisdiction. Local governments are too feeble and too fragmented to cope with an increasing range of problems such as transportation, air and water quality, and, above all, the problems of growth —of the patterns and pace of development, of the way in which housing, jobs, schools, recreation, and similar activities are distributed within a given area. Citizens within each separate jurisdiction are deeply and directly affected by decisions made within other jurisdictions; yet they have no say in those decisions. Each jurisdiction pushes and pulls against the other. And the citizens of each watch helplessly as their region assumes shapes and directions that are determined by forces they do not understand and cannot influence.

If the citizens of this country are going to have the chance to make intelligent, effective decisions about the patterns and problems of growth, and if they are to exercise any real control over those patterns that so deeply affect and influence their lives, then we are going to have to develop, as rapidly as possible, effective democratic governmental institutions on the state and regional level to direct and regulate growth. As long as we fail to do so, then communities like Petaluma and others across the country that are engaged in what appear to be thoughtful efforts to manage their growth will find themselves increasingly thwarted.

Earlier I mentioned Aristotle. I think we would do well to rediscover two old Aristotelian ideas. The first is the idea of politics as the process by which the citizens of a common area come together to make decisions about the problems and prospects they share in common. The second is the idea of nature as an unfinished creation which man, by his intellect and imagination, can bring to various kinds of completion within the broad boundaries of the laws and limits inherent in nature itself.

If we really understand these ideas, if we accept them and act upon them, then we will I think not only extend our range of individual choices, but discover that our choices are increasingly worth making.

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NEWS AND COMMENT

India: Into the Nuclear Club on Canada's Shoulders

There floated through my mind a line from the Bhagavad-Gita in which Krishna is trying to persuade the Prince that he should do his duty: "I am become death, the shatterer of worlds." I think we all had this feeling more or less.—ROBERT OPPENHEIMER at Alamagordo.

Krishna's words came full circle on the morning of 18 May with India's first nuclear explosion, a shallow underground test of a plutonium device in the great northern desert of Rajasthan. The yield was announced as 10 to 15 kilotons, or slightly less than that of the plutonium bomb that destroyed Nagasaki in 1945.

If an Indian Oppenheimer felt misgivings about his achievement that morning, they were not in evidence in New Delhi. Prime Minister Indira Gandhi praised her nuclear scientists for doing a "good clean job," and she told reporters the test was "nothing to get excited about." Defense Minister Jagjivan Ram, whose hints 2 years ago that India might be working on a nuclear explosive were greeted mainly by yawns, disavowed any interest in nuclear weapons. India was not to be regarded as the sixth shatterer of worlds, but rather as the first, he said, to develop nuclear explosives purely for such peaceful applications as excavation and mining.

Arms control analysts in Washington uniformly discounted these protestations with, as one of them expressed it, "broad winks and leers." Adrian S. Fisher, dean of the Georgetown University law school and a former chief negotiator at the Geneva disarmament talks, noted that "no fundamental difference exists between the innards of a weapon and a 'peaceful' explosive."

With one singular exception, international reactions to the Indian test seemed guarded, with diplomats and arms analysts expressing dismay but not surprise. India, after all, had long been regarded as one of the two nations most likely to follow China into the ranks of nuclear powers (Israel being the other). A vigorous protest from Pakistan was predictable, but the most vehement expressions of thinly veiled outrage came—of all places—from Canada.

It was not without a cause, and a certain touch of irony. Canada, unlike India, has signed and ratified the 1968 Non-Proliferation Treaty and thus has renounced interest in building nuclear explosives for any purpose. But India, it soon became evident, had climbed into the nuclear clubhouse on the shoulders of Canadian technology and Canadian foreign aid.

Two days after the Indian blast foreign affairs officials in Ottawa issued one of their own, accusing India of violating the terms under which Canada had provided technical aid in the