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Ecolibrium

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Ecolibrium is a word I coined for this talk from the obvious roots Greek "oikos" (home) and Latin "libra" (balance)—balance in our earthly home.

The wished-for ecology, which is a harmonious pattern of relations between organisms and their environment, often runs counter to peoples' desires in economy, which is management of affairs with a view to maintenance of productiveness. How do we reconcile these desires toward an "ecolibrium"?

How urgent a problem this is, is shown in the program of this, the 138th annual meeting of AAAS, where we have symposiums on such topics as the search for a steady-state earth, the management of a resource-limited world, population control, the impact on environment, and science in the service of urban areas.

My own remarks will be a plea for careful and continuous long-range planning—planning not only to supply the basic physical needs of shelter, water, food, air, and fire (which is energy), but planning which is also sensitive to people's "wants." These often may be ill-defined psychological needs in mobility, communications, recreation, culture, and beauty which keep us intellectually well and humanly alive.

Choice as a Basic Guide in Planning

When people live scattered and far apart, what they choose to do does not impinge on others, but what they have to choose from is limited. Cities increase the number of choices, but when people overcrowd into too few cities and these grow too big (as they are doing all over the world today), we reach a point of diminishing returns, and choices become more and more restricted once again. This is why I have suggested elsewhere that we attempt to find and build cities of optimal size. Vague phrases such as the quality of life, progress, standard of living, and so forth are ill-defined; one measure, however, is the kind and number of choices that individuals may make. To increase choices is to increase freedom. Increasing choices is democratic. Increasing choices enables individuals to make combinations for themselves which most closely fit their own views of "quality of life." Increasing choices, therefore, preserves individuality. The difficult problem of government is how to multiply the choices for each individual in such a way as to impinge least on the choices of other individuals.

Let us examine, therefore, the problems of population, man's needs, his work to satisfy these needs, and the energy required to accomplish these works in the light of choice as the basic index.

A continually increasing population can only reduce the number of choices for the individual. If we compound this with a philosophy of equal shares of the world's bounty, we must ultimately end up, to paraphrase Garret Hardin, with equal shares divided by too many, so that everyone would get too little. Setting a limit to the numbers in population is basic if each human is to retain or increase his choices. Increasing the number of different things that people want in order to ease their lives multiplies choices, but at the same time it causes pollution during the manufacturing process and, by the so-called disposal of things after use, reduces the choices of a clean environment. The solution here is not to limit the choices of things and services that people want to ease their lives, but to rebuild the industries and works of man that provide these things and change them so that they are saving and clean. Similarly, increasing mobility and communications increases choices for people, but we must find ways to provide these without decreasing other choices, as we do by gobbling up land for concrete highways or by cluttering up the radio spectrum with radiation communications. The great challenge is how to continue providing for people's needs and wants and yet, at the same time, to manage the environment by containing wastes in the manufacturing plants—by recycling, reprocessing, and reuse—and by rebuilding industry to be saving of both materials and energy.

It is the mature industries—those that are thought of as "old-fashioned" industries—that particularly need scientific and technological attention. Steel manufacture, aluminum, wood, paper, cement, the basic bulk industries, have been forgotten in the excitement over the newer glamour industries. Finally, all the efforts to maintain and increase choices use energy. Hence, if we are to continue to provide choice or increase choices, we must expect and plan to increase energy per capita in saving and clean ways.

But to come full circle, when we accomplish these intermediate steps and increase energy per capita, if, at the same time, there is a continual increase in population, we will eventually arrive at a point where getting rid of the non-equilibrium heat generated on earth will become a problem. Inescapably, therefore, population limits which will maintain choice with no additional expenditure of energy are fundamental and most urgent.

Choice is the possibility for an in-

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dividual to decide among reasonable and attractive alternatives. But those who confront the public to make them aware of the environmental problem and those who defend unclean industrial processes tend to recite extreme choices which then become no choices at all. When the public is told that the choice is between having adequate power or running cataclysmically out of air, or when they are told that the choice is between our use of the sea or poisoning the whole ocean, the public is being given overstated, unreasonable alternatives that perform a disservice to the legitimate causes of ecology and environment. Similarly, when those defending industry do it with phrases such as "dead babies or dead lakes," the extreme overstatement is a disservice to the legitimate cause of economy. Choices like these are no choices at all.

The balance we seek is to provide choices which people may select to ease their lives from among a variety of products and services emanating from man's ingenuity and yet to provide these in a manner that will not remove choice of quality of living space on earth. The challenge to science and technology and business and industry is to do all this in a manner that is thrifty of energy. An equally urgent and perhaps much greater challenge is for the social sciences to point the way to do these engineering things in consonance and harmony with important social goals. We cannot achieve these ends by instant reaction to real or imagined crises.

Most of our present, but not new, dichotomies center around how to reap the benefits of the productiveness of science and technology while at the same time working against social injustices.

I have heard advisers with the best intentions say that, before we increase the production of food in a developing country, we should work out an equitable distribution system. This could result in a perfect distribution system with an inadequate amount of food to distribute. Progress is not made evenly. One element of a solution leaps forward and hopefully stimulates others to catch up. Rather than slow that which jumps forward (in this case, the scientific and technological improvements in the production of food) we should place emphasis on the lagging part of the system (in this case, the social design of a distributing system).

Human labor can be reduced for the same productivity by the use of science, as in the green revolution, by increasing each human being's tool kit, as in the use of tractors and farm machinery, and by the use of power. Strong, healthy nations will develop from those that properly limit the numbers of their population while realizing the fullest potential of their population through education to ensure full and proper use of science and technology. With an increasing population without the multiplying power of science, machines, and energy, any humanitarian measures to reduce inhumane labor and conditions must necessarily decrease productivity and hence decrease the realization of available resources and thus be self-defeating.

Just as technological invention cannot remove the need for social invention, neither should our slowness in changing outmoded social practices, institutions, and traditions be allowed to slow technological realizations of potential benefits to all.

A case in point where societal stresses exist because we have not applied available modern technology to their solution is found in the housing "crisis" in the United States. Through our preoccupation with the quality of environment *outdoors* we sometimes lose sight of the other environment most important to people—the quality of their environment *indoors*. Housing is in the forefront of our national problems today. We are still in the medieval age of house building—brick on brick, board on board—and need desperately to have step jumps through use of the most modern technology and science to provide better housing for all. In addition to the quite proper immediate concern of providing housing for low-income families, we need a parallel, longer-range program which would provide better housing for people at all income levels.

The number of shelters (housing) needed in the coming years is so great that it can *only* be met with quality and economy by mass-produced, high-technology, industrialized housing. In the United States alone just to supply shelter for the new population requires building a housing unit about every 20 seconds. Can we not switch to dimensional materials that hold their size and form and can be fashioned by largely unskilled labor and erected easily on the site? We think of walls extruded as a sandwich of various materials to provide an outside with an absorptive or reflective coating, with a filling forming a thermal, vapor, and noise barrier and containing built-in telephone lines, television lines, water pipes, and electric conduits and perhaps having an inside finish designed for minimum care, with, possibly, electrophoretic means for coping with dust and giving an entirely new dimension to the chore of housekeeping. Such walls may come off the manufacturing lines as a continuous sheet and be sliced into many different modular sizes for easy assembly into buildings.

Only by mass production can the application of modern science and technology be afforded in the design of the most important thing that people use, namely, their homes. Mass-produced housing will not be low-cost housing for low-income people—it will be lower cost, higher quality housing for all people.

Let us compare mass-produced housing to the much maligned automobile. The automobile, when it was first produced, was a very expensive luxury item owned almost as a toy by the rich. Had the original inventors set out to design an automobile with the restraint that it must be available for the poor, no one would have had any automobiles. Then this expensive toy was put in the world's showcase and was wanted by people. Henry Ford's genius soon mass-produced it and it came within the reach of all when it was put out in such volume until now we have a saturation, perhaps oversaturation, of automobiles. For all its faults, and until different choices in personal transportation become available, the automobile has brought to all segments of society a mobility that they otherwise would not enjoy. Furthermore, it is a very "democratic" article; the person who buys an inexpensive vehicle gets essentially the same quality of transportation as the person who buys a Lincoln or Cadillac. The difference is not so much in the transportation provided as in the additional amenities, such as decor.

Television is an even more striking example. Television was not produced initially with the restraint of low cost, and for a few years after World War II only a small percentage of people had television sets. Then, mass production rather suddenly reduced the price and made sets available to all

within a few years. The number in use jumped to what is now the saturation level. Here again, with television sets there is little difference between the expensive and the cheap in the use of the set for its basic purpose in communications.

The first prototypes, where we apply new technologies to make things for people, are always very expensive. At present prototype safety automobiles are being built at a cost of millions. When proven features are put into the mass production of these automobiles, however, a new dimension of safety will be within the reach of all.

Why do we not spend comparable sums on prototype high-technology houses which we may put in the nation's showcase so that people may make this choice and thus generate a market sufficient to warrent mass production? We would then no longer need to talk in derogatory terms about low-cost housing for low-income people—all would obtain a better quality of housing at lesser cost.

What choice is there now to those of limited income but the sprawling, shoddy sameness of housing developments or the urban high-rise slums with high maintenance costs?

The mass production of well-engineered housing components would increase choice by reducing costs and by allowing the assembly of components to meet individual needs and desires. That the basic quality of man's shelters be raised is an important goal.

There is another example of social practices and controls (perhaps necessary and good at the time they were introduced) that now work counter to our efforts to join economy and ecology. This was treated by Professor Solow at our Chicago meeting last year when he presented a paper describing "an economist's approach to pollution and its control." The message I received from his paper was that "Free costs everybody more."

Control of prices to unrealistically low levels works counter to the aims of joining economy with ecology.

"Free" is a word loosely used for things we pay for without knowing it. We have necessities which traditionally were free and now are partially free in the sense that their cost to the user is kept below the real cost. Such unrealistically low costs promote waste which in turn raises real cost by increasing scarcity.

Water was free in the past. It was free before there were so many of us. Clean air, clean water, and even natural foods were free for the taking before our numbers made it necessary to produce them faster than nature can supply them. Water is still almost always priced far below its true cost, even where it is in short supply. Yet food, equally fundamental to our bodies, is priced according to its scarcity. We can no longer think of water and air as free, inexhaustible supplies. Nor can we think of fouled air and water as natural bounties which can be cleaned up at a price once and for all. As we continue to use them we'll continue to dirty them and must continue to clean them for reuse at a continuing cost of energy.

The Proper Use of Water Is to Dirty It

The very use of air and water in our bodies or in the industrial organisms we engineer entails dirtying them. Nature has ways of cleaning air and water but can no longer keep up with the rate at which we in our multiplied numbers get them dirty. This means that, just as we grow, use, and regrow food, we must continually clean, use, and reclean our air and water. To the culture of our renewable plant and fiber crops which we call agriculture, we must now add "atmoculture" and "hydroculture"—a continuing job of renewing used air and water to good quality for reuse.

Air and Water as Commodities

Air and water then become essential commodities which, after use, have to be reprocessed by "manufacture" for further use. Containment and separation of pollutants is probably easiest at the source of the pollution, right at the factory that dirtied the air and water. The cost of the reprocessing to clean the air and water can then be properly added to the cost of the product of that factory.

In comparison with factories, where pollutants are simpler to contain, we have a more difficult problem with individual users. The real costs of man's basic need for a decent outdoors are obscured when people gain the impression that a clean environment can be a political gift. Any political gift simply means that costs are hidden; when people do not know what the real costs are, they have no incentive to be sparing. There is no feedback to cause them to make choices that prevent escalation.

When costs of water, garbage collection, and sewer usage are hidden in inclusive taxes, the result is waste of water, overelaborate expense of packaging, and overburdened sewers. Should we not internalize the externalities by paying the real cost per gallon of water we use and the real cost of the collection and reconversion of our wastes by the amount we generate? We only have to think of how saturated the telephone service would be if unlimited use and abuse were permitted by hiding the costs in a blanket tax instead of by direct payment per call.

The same thing applies to energy. Air and water are as essential as the fuels in the manufacture of energy. And to internalize these costs, the price of power must be allowed to go up to a reasonable point. This not only provides a way to finance the renewal of our new commodities—air and water—but acts in the direction to promote thrift in energy. When energy is kept to an artificially low price, then not only are individual users wasteful of it, but industries using cheap power will produce things at less than real cost and people are encouraged to use more than they otherwise might. Artificially low prices breed waste. The difference between artificially low prices and real cost must be paid somewhere, usually in some blanket assessment or tax. Thus, we strip the thrifty person of his choice to reduce his use of water or power and to use the saving for something he values more than leaving a tap running or all the lights on. Of course, if we allow the price of these "new commodities" to reflect the real costs and thereby help protect the environment, there is an essential and simultaneous social development required—namely, to increase income maintenance for low-income sectors of society at an adequate rate to offset the increases in the real costs of these "new commodities."

Even the things that we enjoy or want to ease our lives or that are not basic necessities for bare existence present a dilemma. In earlier remarks, I emphasized the disappearance of ownership of things we use as we move toward recycling, reprocessing,

and reuse. We will all tend to become users rather than owners. "We already see it. We have rental cars, rental clothes, and other euphemisms of ownership embodied in such devices as condominiums, time-payments plans for even such simple things as household furnishings." People would then own nothing except treasured works of art, roots in the earth, or other individually cherished items that would not be recycled. When the reward for labor will be to enjoy the use of things and human services—substituting "usership" for "ownership"—may this not increase waste? How can we have "rental economics" and maintain the individual responsibility to preserve and care for things? Just as free or undervalued things lead to waste, rental economics could lead to lack of care, lack of individual responsibility, and consequent wasteful use of things. Such wasteful use would lead to more rapid recycling than necessary and consequent waste of energy. It will take the most sensitive kind of long-range planning to encourage the virtues of responsibility and individual care. Perhaps thrift in energy will dictate that our technology should change in order to lead to a change in our attitudes so that we may extend the useful life of things and once again have pride in the preservation of a more beautiful piece of machinery that need not be recycled so often.

What Is Meant by a Steady-State World

In environment, steady state does not mean and cannot mean conservation of nature as it was 100 or 1000 years ago. Ecologies will continue to be "engineered" as they have been since the beginning of agriculture. We must learn to change them in accord with the changing needs of people, but maintain steadily the desired qualities.

Steady state does not mean that things for living would not continually be improved or changed as people's choices dictate. Neither does it mean a static number of choices. There can be exciting change, continual improvement, without escalation of the amount of things. A steady-state world should not inhibit experimentation. On the contrary, it should open up a great new field of scientific and technological experimentation and discovery to develop the "saving" industries to produce things to satisfy new wants with less materials, using energy more efficiently. In a steady state, there must be continual invention to increase choices and give variety to life.

Ideally, the steady-state world should remove the day-by-day crises of human physical needs. Then we will more clearly recognize that welfare is not merely the provision of these needs, but that to fare well is to have rewarding work and continual learning and, relieved of the chore of keeping physically alive, time for the important business of being human.

All this requires the wisest, broadest, long-term planning with its continuity ensured.

Planning Is Suspect

In the United States, planning is suspect. The reaction of some "liberals" to long-range, far-reaching plans is to label them demagogic or autocratic. On the other hand, the reaction of some "conservatives" to the same plans is to label them wild-eyed, idealistic, or socialistic.

These reactions seem to stem from a fear that planning *for* people entails experimenting *on* them. Planning and experimenting for people and with people are not to be labeled either "liberal" or "conservative" in the customary use of these terms. It may, indeed, be daring or pedestrian. If plans are daring, they can be stimulating and exciting not only for the planners but for the participants—the people. If we are dealing with new technologies for people, we must involve people in the experiments to evaluate the choices. Also, we must recognize the possible failure and plan long in advance for a way to turn off or change the experiment if, indeed, it doesn't work. We must design the "off-switch" before we turn on the "on-switch."

Long-Range Planning and Daring Experiments

Technological and economic developments have not been matched by social and cultural developments. Our technological economic evolution proceeds rapidly, but the slowness of social and cultural change in governing or in long-range planning for community values to which government responds splits the two and causes greater and greater mismatch.

Our elective system, excellent though it is, does not lend itself to long-range planning. It encourages focusing on immediate crises and accomplishes well the necessary, often rapid, actions within budgetary constraints that lead to rapidly visible outcomes. I am not criticizing this system. Its checks and balances work well for essential short-range action. But we need in addition, for long-range planning, something else. For long-range planning, the constraints of quick, cheap, and rapidly visible are an uncomfortable, if not impossible, combination.

How can we, therefore, provide for long-range planning; provide for the stability of projects for people which may take 20 or more years to achieve? T. Hoopes, my colleague at the Woodrow Wilson Center, has written of this missing link in our system, the missing link of long-range planning, in a different context in these words: "Our difficulty is that as a nation of short-term pragmatists accustomed to dealing with the future only when it has become the present, we find it hard to regard future trends as serious realities. We have not achieved the capacity to treat as real and urgent as demanding action today problems which appear in critical dimension only at some future date. Yet failure to achieve this new habit of mind is likely to prove fatal." This he wrote in 1960.

For 40 years some have recognized the need of a larger, longer planning effort and many good half-steps have been taken. With the present preoccupation with the environment and how to match it to continued productivity, we are in a better climate for acceptance of the commitment to long-range planning. Now is the time to revive ideas of how to plan for large national objectives that transcend local and state interests and that look far beyond present immediacies. There are many good steps in the direction of longer range planning and stability for carrying out such plans. The Supreme Court, established in the Constitution, provides long-term continuity in the interpretation and stabilization of law; the Federal Reserve Board performs similarly for money. Should we not emulate the best features of these to provide continuity of planning for overall Living Design? Regulatory commissions, which are not in the

Constitution, have had powers delegated to them by Congress. These commissions are sometimes accused of being captive to their constituencies; at other times, they are criticized for not being responsive enough to the needs of their constituencies. This in itself indicates a stability that removes much of the necessity for solution by crisis which would otherwise occur.

More recently, we have heard much about technological assessment. (This has been discussed in our own councils in AAAS.) We do need a body with responsibility for the analysis and assessment of large-scale public technological systems, to draw attention to the long-range potential hazards and by-products of such developments before they are completed, and to indicate safeguards. This is a very important part of long-range planning, but it is only a part of it. Also, recently we have seen established in the National Science Foundation the RANN program, Research Applied to National Needs. This, too, is potentially a good step forward. We have seen a bipartisan recognition of the environmental challenges in the establishment of the Council for Environmental Quality. We now hear about new initiatives which are essentially new looks and hopefully imaginative plans for the old pressing problems of our nation. This, too, is part of the long-range planning. All of these good efforts need to have a group with permanence and continuity to make best use of their efforts looking toward the long-term future, a permanent United States Planning Board.

To avoid duplication of the on-going tactical work for living of the existing government agencies, this board should build on what *has* been done or what *is* being done, to what *hasn't* been done and what *should* be tried, so that the directions of current immediate necessary programs might be fitted into the long-term design.

We should set up a permanent United States Planning Board now to formulate long-range directions for our society. Otherwise the future serious realities will be lost in the noise of immediacies and solutions by crises. New initiatives, technological assessment, and research applied to national needs can then be meshed with the preservation of environment, of beauty, and of the texture of cultures in long-range living design.

Examples of the kinds of long-range plans needed spring to everyone's mind: housing involving new technology, as we have mentioned, including the long-term plans to couple cities to the open land, and possible decentralization of cities; personal transport so that people may have a choice other than just the automobile; plans for the long-term provision of transportation systems in cities and alternatives to continued highway building but both without curtailing the mobility of people; true health services (to be distinguished from our present "sickness services") involving nutrition and education of the young from the very earliest years so that they may bank their health and thus decrease the need for sickness services in later life; energy and productivity with energy thrift, recycling, and reconversion of natural resources; and rejuvenation of the mature industries and the marketing of our "new commodities," air and water.

This board should have a continuity comparable to that of the Supreme Court or at least the Federal Reserve Board. The board must be able thereby to say the hard things that have to be said in relation to the future that others in government are often not in a position to say. Historically, Congress has left planning to the Executive branch of government, which through its departments and administrations and commissions has accomplished the short-range planning. Short-range planning tactics for living are appropriately in the hands of the Executive branch. But long-range planning, the strategy of living, should be set up to have greater detachment and continuity while still being responsible to the Executive and Congress. This board would not remove the prerogatives of existing agencies. Neither would it federalize the private long-range thinking that goes on in industry, business, universities, and other institutions. It would use all of these and provide a pathway to national policy where they could be woven into the long-range plans for man on earth.

While one thinks naturally of the parallel with the Supreme Court, this permanent planning board would probably not need a constitutional amendment to give it its status. It would be funded by Congress so that no removal of Congress' control of appropriations would be involved.

The board should represent not only economics, industry, and natural and social sciences, but, equally importantly, the arts, architecture, and the humanities.

Only by ensuring a continuity of long-term planning in our government can we hope to build toward the harmony of a bountiful economy with a beautiful environment.

The guideline would be that of preserving and multiplying choices for people. To the old statement "to govern is to choose" we may add that to govern well is to provide people with the opportunity to choose.