Visions of a Sustainable World

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This meeting is one of a series devoted to exploring whether and how the Santa Fe Institute, the World Resources Institute, the Brookings Institution, the J.D. and C. T. MacArthur Foundation, and other organizations and individuals around the world can contribute to a better understanding of the central and most complex problem facing the human race, the achievement of a sustainable existence on this planet.

Many of you have heard most of these remarks before, but I am repeating them for the benefit of new arrivals – and I apologize to the rest of you for the partial duplication. Also, much of what I say will be obvious and even belaboring the obvious over and over, but maybe that is not such a grave crime in this situation, where most people insist on turning away from the obvious.

Unfortunately, sustainability has become a cliché during the last year or two, and people talk of *"sustainable development"* when what they mean is the same kind of development they were always envisioning, with the word sustainable thrown in to make it more acceptable.

What do we really mean by it? What kind of future are we envisaging for global society when we speak of sustainability, tempering our hopes with some dose of reality?

Surely we do not mean stagnation, with no improvement in the life of the hungry or the oppressed. But neither do we mean continued and growing abuse of the environment as population increases, as one tries to raise the standard of living of the poor, and as the wealthy exert an enormous per capita environmental impact.

In negative terms, we certainly mean the avoidance of global catastrophe, including catastrophic war, all-encompassing tyranny, or disastrous degradation of the biosphere.

We do often weather lesser disasters if our society is resilient, robust. Such disasters will continue to occur and to demand that resilience or robustness.

Human society must continue to learn from its mistakes, to be adaptable. Indeed, in some respects, it needs to be come more adaptable. Wholly new reserves of foresight, intelligence, and especially capacity for alteration of habits will be required if we are to achieve a future condition in which encroachment on the environment is not progressive, population is stabilized, most of the existing population has a modest degree of prosperity compared to its expectations (which come from looking at the more fortunate), government is not overwhelmingly oppressive, and catastrophic global war is not a thinkable event.

I would call such a situation a sustainable world: not static, but with growth in quality rather than quantity. Can we envisage such a world emerging by the middle of the next century?

We are discussing the possibility that human society on a global scale can become self-regulating to a much greater extent than it is now, so as to bring under control, without widespread tyranny:

--population growth,
--consumption of resources on a non-sustainable basis, exerting growing pressure on the environment
--extreme poverty, as well as the gross inequalities in wealth that make restraint in consumption politically difficult (*although competition, tempered with cooperation, is, of course, healthy and productive*),
--and especially what we many call "generalized tribalism," in its more destructive form.

All of these involve the partial renunciation or sublimation or transformation of traditional appetites – to outbreed, out-consume, or conquer rivals and especially rival tribes (in the larger sense).

We are not sure to what extent to regard these appetites as hard-wired (as a result of biological evolution and genetics), as culturally determined, or as the result of rational calculation of costs and benefits (but perhaps ignoring the subtleties of externalities, the

social rate of discount, etc., in other words, costs that are concealed because distributed or in the future and benefits that are concealed because of lack of imagination).

Notice that I place emphasis on appetites and not only on technical means.

In Western intellectual and managerial circles, which are highly Apollonian, there is a great deal of emphasis on the *means* by which undesirable effects may occur, leading to a preoccupation with contraceptives, arms control, emissions controls, and so forth. Naturally, we must consider those issues, including especially future technological developments, but we must not neglect the underlying tendencies.

At the Santa Fe Institute, we devote much of our attention to complex adaptive systems, including biological evolution on earth (and corresponding processes that must exist elsewhere in the universe); individual learning and thinking in animals, including humans; human cultural evolution; and computers that are programmed to evolve new strategies, say for playing games. In all of these, the system records its experience of the world and how that world reacts to its behavior, not in a "look-up table" but in a highly compressed model or schema. In the presence of contemporary information from the environment, that schema unfolds to give actual behavior in the real world and that behavior, in a feedback loop, affects the viability of the schema, which can vary and which is in competition with other schemata.

For biological evolution, the schema is the DNA, which unfolds in the presence of further environmental signals to give an individual, and the ability of that individual to produce offspring affects the viability of that pattern of DNA and ones like it.

In the scientific enterprise, the schema is a theory, which unfolds under the conditions of a particular problem to give a solution that is compared with observation, and that comparison gives a feedback loop that affects in an obvious way the viability of the theory in its competition with other theories.

Here the adaptation is rather efficient. The schema must be persistent, robust, to be useful. But the variation and competition must nevertheless allow for fairly rapid change – evolution, learning, adaptation.

Often the adaptation is less efficient. Consider human beings learning how to interact with each other. At an early age, they form "person schemata" based on relationships with parents and siblings, nursemaids, and so forth. Later on, these schemata are drawn on in relationships with other people. Often, in what is called neurotic behavior, there are persistent patterns of repeated maladaptive behavior – schemata that do not change even though they fail to work very well.

For societies, the cultural DNA can consist of myths, traditions, institutions etc., which in particular external circumstances result in certain kinds of societal behavior and a feedback loop that affects the viability, in competition with variants, of the schemata.

But again the adaptations may not be very efficient, even to the point where the society may disappear!

Our tendencies to generalized tribalism, to rapid procreation, and to wasteful exploitation of the environment may once have been adaptive, but in a world of destructive weapons and huge planetary changes, they are no longer so.

Like neuroses, these tendencies may be highly resistant to cure.

Historians tend to be impatient with people who claim "This is a unique period in history" – that has been claimed about so many eras. Still, our time is special in two well-defined and closely related ways:

1) The human race has attained the technical capability of altering the biosphere through effects of order one – it is notorious that a full-scale thermonuclear war would wipe out a large fraction of life on the planet, and by our procreation and our economic activities we are altering the global climate and exterminating large numbers of the species that share the biosphere with us. Our destructive effect was greater in the past actually than is usually admitted – for example, deforestation by the axe and by goats and sheep, followed by erosion and dessication – even the possible contribution of the tiny numbers of ice-age people in North America to the extinction of the North American ice-age megafauna – nevertheless today's potential for damage concerns the entire biosphere in ways that are unprecedented.

2) The rising curves of world population and natural resource depletion cannot go on rising steeply forever; they must soon pass through *inflection points*, as emphasized so strongly by Jonas Salk. The twenty-first century is a crucial time (in the original sense of a cross-road) for the human race and the planet.

Will those curves flatten out as a result of human foresight and progress toward a sustainable world or will they turn over as a result of the traditional scourges of war, famine, and pestilence? If they do flatten out, will it be at levels that permit a reasonable quality of human life, including a measure of freedom, and the persistence of a large measure of biological diversity, or at levels that correspond, if there is a sustainable society at all, to a grey world of scarcity, pollution, and regimentation, with plants and animals restricted to a few species that co-exist easily with mankind?

We can look at the progressive development of the means and the scale of military competition in a similar way. Will we allow large-scale thoroughly destructive wars actually to break out, or will we use intelligence and foresight to limit and redirect competition, top damp down conflict, and to balance competition with cooperation? Will we learn, *or have we perhaps already learned*, to manage our differences short of catastrophic war?

There is a general trend in human history toward aggregation into larger and larger societies, and today that is taking the form of the development of regional associations and specialized transnational institutions, including world institutions. Despite the near-universality of the United Nations and a number of successes scored by various of its organs, there is no sign at this time of the development of a world government. Indeed, many of the transnational institutions are private and some are informal. Others are autonomous organizations that administer international treaties, etc.

It is helpful to adopt a positive attitude and besides laying out the directions in which global catastrophe can occur, pay careful attention to the many institutions and practices, formal and informal, local, and regional, but *especially highly transnational or global*, that already exist and that channel competition into sustainable patterns and temper it with cooperation.

Some are more important than others, some more effective than others, but they are all of some significance.

Air Travel System
International Postal Union
Convention on Broadcasting Frequencies
Convention on Chemical Weapons
Interpol
Migratory Bird Treaties
CITES
PUPAP, ICSU, World Congresses of Mathematics, Astronomy, Anthropology, Psychiatry, etc.
PEN
International Communities of musicians, dancers, etc.
Financial institutions such as World Bank, IMF, etc.
Multinational corporations, including McDonald's
English as an international language
UN Agencies: WHO-OM, UNEP, UNDP, UNPP, UNICEF, etc.
Red Cross, Red Crescent, Red Shield of David.

Gradually, more and more, we are beginning to come to grips, on a global or a highly transnational basis, with some of the problems of management of the biosphere and our activities in it.

The recent willingness of the Soviet Union and China to play a role in making world institutions and practices work is extremely encouraging. It results in the probability of near-universality for numerous activities for which there was little hope of near-universality before.

All of these institutions confront the problem of *unity in diversity* (which is discussed in detail in the Aspen Institute paper that many of you have read).

As the process of aggregation into larger units continues, will human foresight result in peaceful change with a considerable degree of individual freedom, or will aggregation involve a large measure of conquest and tyranny as it often did in the past?

It is important that a study of global sustainability not concentrate exclusively on the demographic and environmental and associated economic issues that have suddenly become so fashionable with the waning of the cold war, but explore the military, diplomatic, and political domains where very important dangers and opportunities still lie and which are in very strong interaction with the other issues.

Discussions at the World Resources Institute about global sustainability have crystallized, as we shall hear from Gus Speth, around the idea of a set of transitions that must take place early in the next century if human society is to approach sustainability:

1) the demographic transition to roughly stable populations across the world;

2) the technological transition to a situation where the environmental impact per person and per unit of conventional material prosperity is reduced as much as possible;

3) the economic transition to a world in which serious attempts are made to charge real costs, so that there are incentives for the world economy to be based on nature's "income" rather than depletion of its "capital";

4) the social transition to a broader sharing of that income, with the generation of relatively nondestructive employment for the poor families of the world;

5) the institutional transition to a situation in which global cooperation to solve planetary problems is facilitated and in which the various aspects of policy are integrated with one another, in recognition of their actual interdependence; and

6) the informational transition to a world in which scientific research, education, and the perfection of indicators permit large numbers of people to understand the nature of the challenges they face.

The key to understanding more about these needed transitions (and a few others) is to treat the various subjects as strongly interconnected. In discussing any complex nonlinear dynamical system, one cannot expect to pick out various aspects in advance, study them separately, and then be able to describe the behavior of the system by putting together the separate pieces. It is essential to take a crude look at the whole picture, taking into account, as much as possible, the strong interactions among the various parts.

In most academic and bureaucratic circles, prestige attached to doing careful studies of rather narrow aspects of the human condition, and attempts, necessarily crude ones, to study the broad picture are not taken seriously. The Santa Fe Institute, devoted to the

study of complex nonlinear systems, particularly adaptive ones, necessarily emphasizes the importance of approximate study of a whole system.

In order to investigate the conditions for the needed transitions, taken as a whole, one would try, for example, to understand what are the requirements for relative and absolute timing, and how those requirements might be met, given the interactions among the various domains. One would try to explore the sensitivity of the various transitions to unexpected events and trends of global significance.

Perhaps most difficult of all, one would try to understand the role of ideology (and its delicate interplay with political, economic, and social changes), as well as the role of technology. Will a changing conception of the good life make it easier for the wealthier human societies to moderate their extravagant consumption of resources and for the poorer societies to seek paths of truly sustainable development that do not attempt to emulate that extravagance? Can growth in quality rather than quantity be validated as a meaningful goal?

What about generalized tribalism in all its many forms (nationalism, religious divisions, ethnic rivalries)? Will it yield, on the whole, to the compelling need for concerted action on global problems or will it obstruct cooperation to the point of catastrophe? As remarked above, the current popularity of environmental issues should not blind us to the continuing importance of political, diplomatic, and military questions for the sustainability of human society.

Despite the diversity of interests of the Santa Fe Institute family, it is hard to see how SFI could undertake a serious study of this overarching subject by itself. It will be necessary to work in concert with other institutions, presumably including "think tanks" concerned with the world environment as well as with other world problems. We must therefore think about the possibilities for forming partnerships among institutions with complementary and mutually supportive agendas. We are fortunate in having high-level representatives here from WRI and Brookings, as well as from some other non-academic institutions, and a strong delegation from Stanford. We should now find ways of involving suitable individuals and institutions from other parts of the world.

Our subject may be divided roughly into three parts, chronologically. We can sketch alternative visions of a world well on its way to sustainability in the mid-21st century, crude notions of paths that could lead there through the indicated transitions, and present-day forces and trends in society that could, if encouraged, contribute significantly to the probability that the human race will follow such paths.

For the hypothetical futures, one may try to estimate world population and its distribution, the distribution of income levels, and the requirements placed on technology to achieve such levels sustainably, and to speculate about the nature of the societal mechanisms for alleviating extreme poverty in a sustainable manner, the nature of governance on a large and a small scale in such a world, and the character of ideological trends that would be compatible with such a world.

For the present, we may want to look at the trends in transnational organizations, environmental and population agendas, economic thinking and practice, technological change, and political and ideological development that seem to need encouragement and imaginative transformation, and to see how these fit together into a set of principles. It is important that in doing so we bear in mind the kinds of lessons in practical aspects of governance that Jim McNeill shared with us and that he communicated so well to the Brundtland Commission.

Probably the most important contribution that our alliance of organizations can make is to work on understanding better the dynamics of the *transitions* themselves, their relative timing, the strong interaction among them, and the sensitivity to perturbations, especially by unforeseen events, thus perhaps arriving at some sense that there *emerge* some dominant issues or variables from the complex pattern of phase transitions that are facing the planet.

I should like, finally to repeat the warning that I gave at an earlier meeting. Global modeling is being tried, here and there, and has not so far been very successful. (We need, of course, to familiarize ourselves with what has already been done.) An early attempt, in the Forrester and Meadows report to the Club of Rome, went far to discredit the whole approach. The reason is not that it was very highly oversimplified, that the answer depended on a few assumed numerical parameters the variation of which was insufficiently explored, and so forth. The reason was that it was put forward as if it meant something, when it was only a preliminary warm-up exercise and as such it was not crazy at all. We have to be terribly careful not to make fools of ourselves and of others who might attempt to same kind of ambitious but necessary task. The key is in how the various exercises are presented to the world -- the *disclaimers* have to be an integral part of every communication, built in so carefully that even the press cannot ignore them.

Brookings and WRI have to think of their credibility in the policy community, SFI in the world of science and scholarship, foundations like the MacArthur Foundation in the realm of at least moderately responsible philanthropy, and yet if we do get together to carry out studies of this all-embracing kind, we must be bold in our thinking and not afraid to try out ideas that seem at first to be unacceptable or absurd – we must, therefore, exercise great care in how our far-ranging speculations are presented to the public.