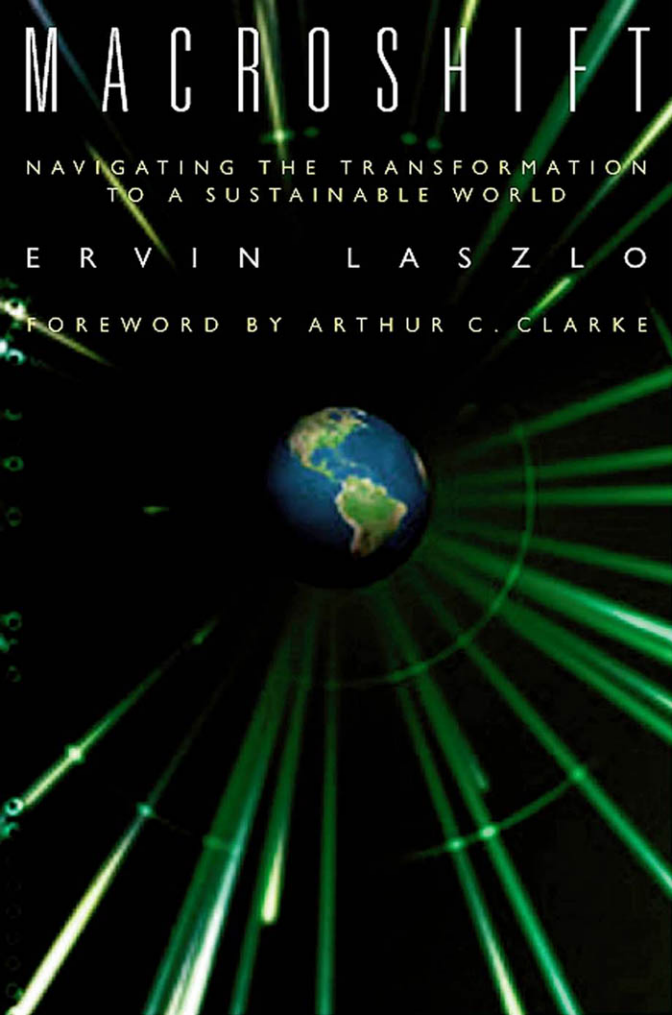
MACROSHIFT

NAVIGATING THE TRANSFORMATION TO A SUSTAINABLE WORLD

ERVIN LASZLO

FOREWORD BY ARTHUR C. CLARKE



An Excerpt From

Macroshift:
Navigating The Transformation To A Sustainable World

by Ervin Laszlo

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Foreword by Arthur C. Clarke

Anyone who attempts to write about the future should take warning from all the failures of the past. Even in the restricted field of technology, which is the only one where any kind of forecasting is possible, success has been very limited. And in geopolitical matters, it has been virtually nonexistent: did anyone predict the events of the last decade in Europe? So in this book, Ervin Laszlo, scientist, and founder and president of the Club of Budapest, makes a vital point: the future is not to be forecast, but created. What we do today will decide the shape of things tomorrow. Especially the way we perceive the challenges that await us, and the vision we develop for coping with them. His book furnishes essential guidelines for creating a positive scenario for our common future: for the new thinking and acting that this calls for.

I leave until later Laszlo's ideas, insights and injunctions—I begin by addressing the questions of engineering hardware, the area closest to my interests. Here, too, some of the warnings issued by Laszlo are relevant: for example, against obeying the technological imperative. Not all things that can be produced should, evidently, actually be produced. But there are many fascinating things that we can, and probably will, produce, and these deserve to be thought about.

The past record of technological forecasting is not encouraging. The failures of people to forecast the developments that awaited them fall into two categories: the hopelessly pessimistic and the overly optimistic. This may be because our logical processes are linear, whereas the real world obeys nonlinear processes, often with

exponential laws. Thus we tend to exaggerate what can be done in the short run but hopelessly underestimate ultimate possibilities. Here are some of my favorite examples of this phenomenon.

When the news of Alexander Graham Bell's invention reached Britain, the Engineer-in-Chief of the Post Office exclaimed loftily: "The Americans have need of the telephone—but we do not. We have plenty of messenger boys." That is what I call a failure of imagination. Here, in contrast, is a failure of nerve, based on the same example. When the mayor of a certain American city heard about the telephone, he was wildly enthusiastic. "I can see the time," he exclaimed, "when every city will have one." What would he have thought, could he have known that one day many individuals would have half a dozen. . . .

Quite recently I came across another example of a comic failure, by a man determined not to be outguessed by the future. Around the end of the last century, the president of the Carriage Builders Association of Great Britain lectured his fellows on the subject of the newly invented motor car. "Anyone would be a fool," he said, "who denied that the motor car has an important future. But he would be an even bigger fool if he suggested that it would have any impact on the horse and carriage trade."

However, I cannot leave the subject of technological prediction without quoting from Norman Augustine, CEO of Martin Marietta and author of the wise and witty Augustine's Laws. He recently pointed to what he called "Coolidge's revenge," due around 2020. Apparently, when Calvin's administration was presented with an estimate of some $25,000 for the purchase of a dozen airplanes, the President asked testily, "Why can't they buy one—and let the aviators take turns flying it?" Well, Norm has calculated that, extrapolating the present rising cost of aircraft and electronics, in the twenty-first century the U.S. budget will indeed be able to afford just one airplane!

As everyone knows, we are now in the midst of one of the greatest technological revolutions in history, and if the bifurcations in the area of economy, ecology, and politics outlined in this report are

adequately managed, the end will be nowhere in sight. Who could have imagined that something the size of a fingernail, constructed by technology inconceivable only a few decades ago, could change the face of commerce, industry, and everyday human life? Although we science fiction writers assumed that computers would play an important role in the future (Hi there, HAL!), nobody dreamed that one day the world population of computers would exceed that of human beings.

We are now approaching a time, for better or for worse, when we will be able to do anything that does not defy the laws of physics—and, especially after reading this report's review of the insights from the new physics, it may well turn out that we don't know those laws as well as we thought.

Obviously, many things are possible, but not all are desirable, *vide* the argument over human cloning, which I am not competent to discuss (though I suspect it will be taken for granted by our grandchildren, and they will wonder what all the fuss was about). I will stick to the engineering sciences, and here are some of my guesses in this area.

1. Discovery of revolutionary new power sources, possibly based on zero-point energy or quantum fluctuations. The zero-point field of the quantum vacuum, as Laszlo points out, emerges as one of the most crucial elements of the universe, and it may hold a number of surprises in the near future. This series of developments started a decade ago with the "Cold Fusion" caper and has now extended to quantum field physics. I am 99 percent sure that the end of the fossil fuel/nuclear age is now in sight, with awesome political and economic consequences—as well as some very desirable ones, such as ending the current threat of global warming and pollution.

2. Development of super-strength materials (e.g., carbon nanotubes) which will impact transportation, building construction—and especially space travel, by reducing the structural mass of space vehicles to a fraction of its present value.

This may lead to the construction of "space elevators" and orbital towers (see *3001: The Final Odyssey* for details). However, I am concerned about the danger of collision with the multitude of satellites below geostationary orbit; they may have to be banned. In any case, they will be unnecessary when we have permanent structures reaching thousands of kilometers out into space.

3. A "Space Drive," long the dream of science fiction writers—something to replace the noisy, inefficient, and downright dangerous rocket. There are a number of hints in rather far-out physics as to how such a device might operate, and I am happy to see that some scientists are working on them. When they are perfected, they will open up the Solar System, as sailing ships opened up this planet during the First Millennium.

4. Contact/detection of extraterrestrials: no one can predict when this will happen, but I would be surprised if it does not occur during the next few decades, as our technologies in this direction are developing rapidly. The recent excitement over putative Mars microbes indicates the interest this subject arouses in the public mind. Unfortunately, it has been confused with UFO and alien abduction nonsense—part of the pathology of the usual "millennium myths."

5. This is the Bad News. We now realize (especially after Shoemaker-Levy's spectacular impact on Jupiter) that we live in a dangerous neighborhood. Ask the dinosaurs, if you can find one. Although the statistics are being vigorously disputed, few would deny that—next Wednesday, or a thousand years hence—a Near Earth Object (comet or asteroid) will cause catastrophic damage somewhere on this planet. The very least we should do is to initiate a survey of potentially dangerous NEOs, and Project SPACEGUARD (which I suggested in *Rendezvous with Rama* more than twenty years ago) is being established to promote this. What we should do if we see a Big Dumb Rock heading this way is a question that already has dozens of answers; some day, we will have to choose one of them.

At this point, perhaps I should obey Shelley's injunction:

> Cease—drain not to its dregs the urn
> Of bitter prophecy!

Yet, although prophecy is no doubt the most convenient way to cope with the future, it is not the only way. J. D. Bernal's *The World, the Flesh and the Devil*, one of the best books on foreseeing the future ever written, opens with the striking phrase: "There are two futures, the future of Desire and the future of Fate, and man's reason has never learnt to separate them." The future of Fate will not be disclosed until it unfolds, but reason, as exposed in this book, tells us that the future of Desire can be crucial to its unfolding. To quote another British poet, Robert Bridges, successful living depends upon the "masterful administration of the unforeseen." Such administration is now, in the midst of the civilizational change Laszlo calls "macroshift," important as never before. We must catch up with the world our technological genius has created—update the way we perceive it, the way we value it, and the way we act in it. Fortunately this is not a mere theoretical exercise, for the outcome of a macroshift is sensitive to changes in our perceptions and behaviors.

It is here, at the critical chaos-leap of the macroshift that the Future of Fate and the Future of Desire intersect—where desire, transformed into the masterful administration of the unforeseen, makes for a selection between a scenario of breakdown and a scenario of breakthrough. I leave the reader with this report of the Club of Budapest to see how the seeming paradox between unforeseeability and conscious choice can be resolved—how today's macroshift can be purposively and effectively navigated.

It is just as well that the real future has to be created and not just foreseen—for if we could know it, what would be the point of living?

Preface

In the opening years of the twenty-first century we are launched on a process of profound and irreversible transformation. The problems and crises we have been experiencing in recent years are driving past the tolerance threshold of nationally based industrial societies toward a borderless world where information is the key resource and communication the key to making use of it.

This process is more profound than the much discussed globalization of local, regional, and national economies through technology, finance, communication, and trade. Today's transformation is not just economic, it is a *civilizational* process. It is part of a long-term evolutionary trend that drives toward the progressive integration of different groups, economies, societies, and cultures in systems that embrace ever more people and ever larger territories. This process has now reached the limits of the planet; it is "globalizing." Economic globalization is part of it—but only a part.

The message of this book is that ours is an era of total-range evolutionary transformation that could, and ultimately will, go beyond economic globalization to pave the way toward a shift in civilization. This is an era of *macroshift*: a shift that is all-embracing, rapid, and irreversible, extending to the far corners of the globe and involving practically all aspects of life. It is driven by technology, but the stresses and conflicts it creates do not have purely technological solutions. Because of the rapid and unreflective exploitation of our technological genius, we live and act in conditions for which we are poorly prepared. Established values, vision, and behavior have become useless and even dangerous. We must update the way we perceive our world

and the way we value it so that we would change the way we act in it. This, in the final count, is the crux of the matter.

Trying to reverse a macroshift would be quixotic—a wasted effort. But this is not to say that we can sit with folded hands, waiting for the macroshift to take its course. A macroshift's unfolding is never predetermined: it is sensitive to human perceptions, values, and actions. Like a giant supertanker in turbulent waters, a macroshift cannot be simply steered, but with foresight and understanding it can be navigated. Understanding this possibility and acting on it is important, for today's macroshift harbors great promise as well as grave danger. It could lead to a more humane and sustainable civilization or to a series of crises that lead to catastrophe. If we are to avert its dangers and realize its promise, we must see this process for what it is and act purposefully to steer toward a humanly desirable outcome.

This is not utopia: it can be done. The present report aims to provide that modicum of insight and information which is the basic precondition for navigating the macroshift in ways that are both effective and ethical.

Acknowledgments

In writing this report an invaluable resource has been the materials and comments I received from friends and colleagues in recent months as well as over the years. I cannot thank everyone individually who has helped me to evolve and formulate my views, but if I am to choose a few individuals whose collaboration has been especially memorable I would name Richard Falk and Saul Mendlowitz at Princeton's Center of International Studies, Aurelio Peccei and Alexander King at the Club of Rome, Davidson Nicol and Joel Kurtzman at the United Nations Institute for Training and Research, Kinhide Mushakoji at the United Nations University, Iván Vitányi and Mária Ságі at Eurocircon, Federico Mayor at UNESCO, and Thomas Druyen, Fiona Montagu, Mária Ságі, and

Peter Ustinov at the Club of Budapest. Historian of civilization Alastair Taylor provided me with the historical and conceptual background for the evolution of worldviews from Mythos to Logos, and Alfonso ("Monty") Montuori of the California Institute of Integral Studies and Christopher Laszlo of the Innov-Ethics Group put at my disposal valuable materials on the relevance of the macroshift to business.

The enthusiasm, expertise, and unfailing dedication of the entire editorial team led by Steve Piersanti at Berrett-Koehler proved to be a further priceless resource. My heartfelt thanks go to them all, and also to my wife Carita, who gave me the time and the peace of mind to think and write in our converted farmhouse in Tuscany during that remarkably intense but exciting period when the ideas for this book found their way from sketches on the back of some envelopes to their present shape in print.

The factual basis for this report—the wide variety of "hard" data concerning the state of the world, and the "softer" but just as relevant data on the state of people's mind as they contemplate the state of the world—has been furnished by the many organizations, national and international, governmental and nongovernmental, with which it has been my good fortune to be associated over the years: first at Princeton, then at the United Nations, and currently through the Club of Budapest. Rather than listing each source individually, I take this opportunity to acknowledge my indebtedness to this precious stream of information that has not ceased to reach my hands day after day, year after year. Of course, the interpretation of this information I am giving is my own: it is based on my decades-long work in the systems and evolutionary sciences.

The scientifically inclined reader will find a detailed bibliography of the sources for my review of cutting-edge science, together with suggestions for further reading, following the Postscript.

Ervin Laszlo
Montescudaio, Pisa (Italy)
January/February 2001

Part One

World in Macroshift

We live in an era of deep-seated transformation—a shift in civilization. Its signs and manifestations are all around us. While globalization is integrating production, trade, finance, and communication, it is producing a social and ecological backlash characterized by regional unemployment, widening income gaps, and environmental degradation. The benefits of economic growth, for long the main indicator of progress, are becoming more and more concentrated. Hundreds of millions live at a higher material standard of living, but thousands of millions are pressed into abject poverty, living in shantytowns and urban ghettos in the shadows of ostentatious affluence. This is socially and politically explosive: it fuels resentment and revolt and provokes massive migration from the countryside to the cities, and from the poorer to the richer regions. In such conditions organized crime, already growing into a global enterprise, finds fertile ground with a gamut of activities ranging from information fraud to traffic in arms, drugs, and human organs.

The application of new technologies, another indicator of progress, is a two-edged sword. Nuclear power promises an unlimited supply of commercial energy, but disposal of nuclear wastes and decommissioning aging reactors pose unsolved puzzles, and the specter of nuclear meltdown, whether due to technical accident or intentional terrorism, remains unchallenged. Genetic engineering has a fabulous potential for creating virus-resistant and protein-rich plants, improved breeds of animals, vast supplies of animal proteins, and microorganisms capable of producing proteins and hormones and improving photosynthesis. But genetic engineering can also produce lethal biological weapons and pathogenic microorganisms, destroy the diversity and the balance of nature, and create abnormal—and abnormally aggressive—insects and animals.

Our information technologies could create a globally interacting yet locally diverse civilization, enabling all people to be linked whatever their culture and ethnic or national origin. But if these networks remain dominated by the power groups that brought them into being, they will serve only the narrowly focused interests of a small minority of people and marginalize the rest. If the Internet, television, and the electronic and print media become further commercialized, these media will cater to the demands of those who have the means to enter the global marketplace rather than giving voice to all people. Worse than that, the cyberspace of telecommunications could become a new medium for information warfare, intolerant cultural influences, pornography, and crime.

But the macroshift today harbors not only danger; it is also the cradle of opportunity. Our globalized technological civilization could break down in chaos and anarchy—or it could break through to a more humane and sustainable world. The choice between these possibilities will not be made by applying technological fixes or implementing strategies based on the same kind of thinking that created today's unsustainabilities. As this report will show, to master our destiny we need new thinking, new values—a new consciousness.

In this opening Part we first review the nature and dynamics of macroshifts, and then describe how they came about in history and how the one we now experience is unfolding in the contemporary world. We then outline the factors that influence its unfolding and show that they are not written in the stars but depend on the evolution of our values and behaviors. The oft-neglected value-sensitivity of macroshifts is what opens for us a real opportunity to choose our destiny—and the unprecedented responsibility to choose it wisely.

I

What Is a Macroshift?

Our future—the future of humankind—will be decided by the outcome of today's macroshift. But what is a macroshift? If our future depends on its outcome, and especially if we can do something about influencing this outcome, understanding today's macroshift is important. Indeed, it is uniquely and decisively important.

Let us begin at the beginning. The most basic question we can ask about our future is whether we can know it. Very different answers can be given to this simple question. We may shrug and say, "I don't know and don't really care—I just take one thing at a time and the future will take care of itself." Or we may say that there are no answers to this question, or at least none that we could give with any measure of confidence. Prediction, after all, is a difficult business—especially, as the saying goes, when it is about the future. But we can also say that there are reasonable and credible ways to answer questions about our future by looking at the present. Just as the present has emerged out of the past, the future is likely to follow from conditions in the present. After all, where we are going has much to do with where we have been.

Indifference and skepticism are widespread attitudes, but they are not helpful when the world is changing before our eyes. If you choose to opt out of taking real responsibility for the consequences of your actions because such consequences are said to be unforeseeable and, in any case, are none of your business, you may as well

quit reading now. But if you believe, or at least are open to the possibility, that we can say something meaningful about where we are going and, even more, that we may have a real role in deciding it, then read on.

What is it, then, that we can say with a measure of confidence about the shape of things to come? The simplest and most common answer is that the future will follow from the present and will not be radically different from it. As the French saying goes, *plus ça change, plus c'est la même chose* (the more things change, the more they are the same). After all, we are dealing with humans and human nature, and these will be pretty much the same tomorrow as they are today. A more sophisticated variant of this popular view adds that long-term ongoing processes of today will introduce some measure of change and make some difference tomorrow. These processes are typically viewed as "trends." Trends, whether local or global, micro or mega, introduce a measure of difference: as trends unfold, there are more of some things and less of others. The world is still the same, only some people are better off and others worse.

This is the view typically held by futurists, forecasters, and trend analysts in general. A good example of this is the much-publicized report of the U.S. National Intelligence Council, *Global Trends 2015: A Dialogue about the Future with Nongovernment Experts* (Washington, DC 2000). The view of the world of 2015 that emerges in this nonclassified report is based on the unfolding of key trends, catalyzed by key drivers. The seven key trends and drivers are demographics, natural resources and environment, science and technology, the global economy and globalization, national and international governance, future conflict, and the role of the United States. The way these trends unfold under the impact of their drivers can produce four different futures: a future of inclusive globalization, another future of pernicious globalization, a future of regional competition, or a post-polar world. The main deciders are the effects of globalization—they can be positive or negative—and the level and management of the world's potential for interstate and interregional conflict.

When all these factors are taken into account, we get what the experts call "the optimistic scenario." In this perspective the world of 2015 is much like today's world except that some population segments (alas, a shrinking minority) are better off and other segments (a growing majority) are less well off. The global economy will continue to grow, although its path will be rocky and marked by sustained financial volatility and a widening economic divide.

Economic growth may be undone, however, by events such as a sustained financial crisis or a prolonged disruption of energy supplies. Other "discontinuities" may occur as well. Here is a short list of possible problems from the *Global Trends 2015* report:

- violent political upheavals due to a serious deterioration of living standards in the Middle East;
- the formation of an international terrorist coalition with anti-Western aims and access to high-tech weaponry;
- a global epidemic on the scale of HIV/AIDS;
- rapidly changing weather-patterns that inflict grave damage on human health and on economies;
- the antiglobalization movement growing until it becomes a threat to Western governmental and corporate interests; the emergence of a geo-strategic alliance (possibly by Russia, China, and India) aimed at counterbalancing the United States and Western influence;
- collapse of the alliance between the United States and Europe; or
- creation of a counterforce organization that could undermine the power of the International Monetary Fund and the World Trade Organization and thus the ability of the United States to exercise global economic leadership.

With all these uncertainties and discontinuities we are far from justifying the assumption that the future will be much like the present. It is anybody's guess whether the world of 2015 will be the same

kind of world as the world we live in today—or something quite different.

> *Given the unsustainability of many trends and processes in today's world, the dynamic of development that will apply to our future is not the linear dynamic of classical extrapolation but the nonlinear chaos dynamic of complex-system evolution.*

This dilemma highlights the limits of trend-based forecasting. Trends unfold in time, but they can also break down and give rise to new trends and new processes. After all, no trend operates in an infinite environment; its unfolding has limits. These may be natural limits due to finite resources and supplies, or human and social limits due to changing structures, values, and expectations. When a major trend encounters such limits, the world has changed and a new dynamic enters into play. Extrapolating existing trends does not help us define this moment. We need to know what happens precisely when a trend breaks down. This calls for deeper insight. We must go beyond observing current trends and following their expected path. We must know something about the developmental dynamics of the system in which trends appear—and then disappear. Such knowledge is theoretical but it is cogent—and it is available. It comes from the theory of complex systems, popularly known as "chaos theory."

Given the unsustainability of many trends and processes in today's world, the dynamic of development that will apply to our future is not the linear dynamic of classical extrapolation but the nonlinear chaos dynamic of complex-system evolution. Few would deny that current trends are building toward some critical threshold—toward some of the famous (or infamous) "planetary limits" that in the 1970s and 1980s were said to be the limits to growth. Whether they are limits to growth altogether is questionable, but they are clearly limits to the kind of growth that is occurring today.

As we move toward these limits, we are approaching a period of instability. It will mark the deflection or disappearance of some of the current trends and the appearance of others. This is not unusual: systems and chaos theory tell us that the evolution of complex systems always involves alternating periods of stability and instability, continuity and discontinuity, order and chaos. We are at the threshold of a period of instability today—a period of chaos.

Evolution through Macroshifts

> *A macroshift is a bifurcation in the evolutionary dynamic of a society—in our interacting and interdependent world it is a bifurcation of human civilization in its quasi totality.*

Processes of rapid and fundamental change in complex systems are known as "bifurcations." The term, coming from the branch of physics known as nonequilibrium thermodynamics, has been popularized in chaos theory. It means that the hitherto continuous evolutionary path of a system forks off: thereafter the system evolves in a different way. Or it may not evolve at all: the system could also disappear, decomposing to its individually stable components. A macroshift is a bifurcation in the evolutionary dynamic of a society—in our interacting and interdependent world it is a bifurcation of human civilization in its quasi totality.

Of the variety of bifurcations known to systems and chaos theorists, the kind that interests us is the one called "catastrophic bifurcation." Here the system's relatively stable "point" and "periodic" attractors are joined by "chaotic" or "strange" attractors. These appear suddenly, as chaos theorists say, "out of the blue." They drive the system into a supersensitive state, the state of chaos. The chaotic state is not an unordered, random state but one where even immeasurably small fluctuations produce measurable, macroscopic effects.

These are the legendary "butterfly effects." (The story goes that if a monarch butterfly flaps its wings in California it creates a tiny air fluctuation that amplifies and amplifies and ends by creating a storm over Mongolia.)

The discovery of the butterfly effect is linked with the art of weather forecasting, having its roots in the shape assumed by the first chaotic attractor when it was discovered by U.S. meteorologist Edward Lorenz in the 1960s. When Lorenz attempted to computer-model the supersensitive evolution of the world's weather, he found a strange evolutionary path, consisting of two different trajectories joined together similarly to the wings of a butterfly. The slightest disturbance would shift the evolutionary trajectory of the world's weather from one of the wings to the other. The weather, it appears, is a system in a permanently chaotic state—a system permanently governed by chaotic attractors.

Subsequently a considerable variety of chaotic attractors have been discovered. They are applicable in some measure to all complex systems, above all to living systems. Living systems maintain themselves in the physically improbable state far from thermal and chemical equilibrium. They are remarkable systems. Living systems do not move toward equilibrium, as classical physical systems do, but maintain themselves in their improbable state by constantly replenishing the energies and matter they consume with fresh energies and matter obtained from their environment. (Physicists would say that they balance the positive entropy they produce by importing negative entropy.) In doing so the more complex variety of systems makes use of an additional factor: information. The human brain and nervous system, for example, is a complex information-processing system adapted through the mechanisms of genetic mutation and natural selection to perceive and select suitable sources of energy and matter in the organism's milieu; to enable the organism to ingest and absorb these energies; and to use them to fuel the organism's own life processes. These processes go on as long as human beings live; it makes us into open "negentropic" systems that self-maintain and self-organize in our ecological and social environment.

Humans as individual organisms are not alone in being self-maintaining and organizing open systems. The groups and systems humans form are also systems of this kind. Individuals are born, grow to maturity, and die, but the societies they form and the ecologies in which they participate continue to exist. The dynamic of complex-systems evolution applies also to these larger entities.

Human societies are complex systems made up of the relations of individually conscious humans to each other and to their environment. The presence of human mind and consciousness complicate the evolutionary dynamic of these systems. The evolution of natural systems usually can be described with differential equations that map the behavior of the systems in reference to the principal system constraints. This is not the case when it comes to human societies. Here the consciousness of the society's members influences the system's behavior, affecting the evolution of the system in a variety of unforeseen ways.

> *When a human society reaches the limits of its stability, it becomes supersensitive and is highly responsive to the smallest fluctuation. Then the system responds even to subtle changes in values, beliefs, worldviews, and aspirations.*

In periods of relative stability the consciousness of individuals does not play a decisive role in society's evolution, but in periods of chaos it does. When a human society reaches the limits of its stability, it becomes supersensitive and is highly responsive to the smallest fluctuation. Then the system responds even to subtle changes in values, beliefs, worldviews, and aspirations.

A macroshift is a process of societal evolution in which encounter with the system's limits of stability initiates a bifurcation: an era of transformation. This is an era of unprecedented freedom to decide the system's future. The outcome of the "chaos leap" of a bifurcation is initially undecided. Selection from among a range of possible alternatives is ultimately decided by the nature of the

"fluctuations" that occur either within that system or in its surroundings. In human societies these fluctuations can be consciously governed. As consumers and clients, as taxpayers and voters, and as public opinion holders, we create the kinds of fluctuations that will decide the outcome of our society's macroshift. If we are aware of this power in our hands, and if we have the will and the wisdom to make use of it, we can become conscious agents of our society's bifurcation—that is, masters of our own destiny.

Four Phases of a Macroshift

1. The Trigger Phase

Innovations in "hard" technologies (tools, machines, operational systems) bring about greater efficiency in the manipulation of nature for human ends.

2. The Transformation Phase

Hard technology innovations irreversibly change social and environmental relations and bring about, successively,

- a higher level of resource production,
- faster growth of population,
- greater societal complexity, and
- a growing impact on the social and the natural environment.

3. The Critical (or "Chaos") Phase

Changed social and environmental relations put pressure on the established culture, placing into question time-honored values and worldviews and the ethics and ambitions associated with them. Society becomes chaotic in the chaos theory sense of the term. Society does not lack order but exhibits a subtle order that is extremely sensitive to fluctuations. The evolution of the dominant culture and consciousness—the way people's values, views and ethics respond and change—determine the outcome of the system's chaos leap (the way its developmental trajectory forks off).

4 (a). The Breakdown Phase

The values, worldviews, and ethics of a critical mass of people in society is resistant to change, or changes too slowly, and the established institutions are too rigid to allow for timely transformation. Social complexity, coupled with a degenerating environment, creates unmanageable stresses. The social order is exposed to a series of crises that soon degenerate into conflict and violence.

or

4 (b). The Breakthrough Phase

The mindset of a critical mass of people evolves in time, shifting the culture of society toward a better adapted mode. As these changes take hold, the improved social order—governed by more adapted values, worldviews, and associated ethics—establishes itself. The social system stabilizes itself in its changed conditions.

The four phases of a macroshift describe the dynamic of the evolutionary process in human societies. The first phase is the trigger phase. In this phase a set of technological innovations launches the macroshift (here "technology" is understood in the broadest sense, as any tool, technique, or means whereby humans interact with each other and with nature). Of the many technological innovations that surface in society, only the ones that help people do what they want to do with greater ease and less investment of time, energy, and money are implemented. These innovations amplify the power of muscles to move and transform matter, they extend the power of the eye to see and the ear to hear, and they enlarge the power of the brain to register and compute information. As a rule, these innovations are implemented without much regard for their consequences; the innovators think only of greater efficiency and effectiveness in carrying out the tasks and projects they want to see carried out.

In the second phase of a macroshift, the transformation phase, the proliferation of new technologies goes beyond the ability of the existing structures and institutions to manage and control. Those who own the new technologies work more effectively, but in doing

so they create instability. More resources are produced, both by a more effective exploitation of the already exploited resources and by opening up new resources (for example, coal in addition to wood, then oil in addition to coal). The availability of a larger quantity and a wider variety of resources enables more people to produce and to consume. As a result, the population grows. But a larger population using more, and more kinds of, resources cannot make do with the kind of structures that served life based on simpler and more limited resources. There is a need for special skills and special purpose organizational structures. As these are developed, the complexity of society grows, together with its population and its resource base. In the absence of a suitable change in the dominant culture, social and political stability suffer.

Society grows beyond its traditional bounds, into an international and intercultural dimension. A more complex society with more people using more resources puts previously separate people not only into contact with each other but also into dependence on one another. As intercommunity trade develops, the scope of social interaction expands, and there is more intense exchange between diverse peoples and cultures. There is a corresponding pressure on society's traditional structures and relations of power. The established institutions are under stress, and new ways of living, administering communities, and doing business are required. Some people come up with the new ways and reap the benefits; others fail to come along. Social structures tend to polarize into rich and poor, powerful and marginalized segments.

Societal expansion and increased complexity have another unexpected consequence: they place a greater load on the life supporting environment. Nature suffers in unforeseen ways: forests fail to regenerate, soils are impoverished, water tables are lowered and become polluted, and the very air over densely inhabited areas becomes unhealthy.

The macroshift moves toward a successful conclusion if, and only if, a critical mass of people in society evolve their mindset: if they generate and embrace values, worldviews, and ethics that mesh with the conditions that were inadvertently spawned by the technological innovations of their predecessors.

In the third phase of the macroshift, the critical phase, society's transformation builds toward a crucial threshold. Expansion and integration combined with environmental degeneration produce unexpected consequences that disorient people and overload the administrative and control capacity of institutions. Society enters a period of social and cultural chaos, with some people holding to established values and swearing by tried and tested methods while a growing number look for alternatives.

The macroshift moves toward a successful conclusion if, and only if, a critical mass of people in society evolve their mindset. They must generate and embrace values, worldviews, and ethics that mesh with the conditions that were inadvertently spawned by the technological innovations of their predecessors. How soon and indeed whether a critical mass evolves its values, worldviews, and consciousness is not written in the stars. It depends on the creativity of the people and the flexibility of the dominant institutions. These vary from age to age, culture to culture, and society to society.

In any event, when the critical threshold of a chaos leap is breached, a fourth phase gets under way. It brings either breakdown or breakthrough. Society either restabilizes, thanks to the evolution of a more adapted mindset, or heads toward crises and breakdown.

The insight emerging from this four-phase dynamic is simple and straightforward. Macroshifts are triggered by technological innovations that destabilize the established structures and institutions of society. More adapted structures and institutions await the surfacing of a more adapted mindset in the bulk of the population. Consequently, a macroshift is a transformation of civilization in which technology is the driver and the values and consciousness of a critical mass of people the decider.

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