CHAPTER ONE

The Development of a Society Can Never Be Subject to Rational Human Control

> Adonde un bien se concierta
> hay un mal que lo desvía;
> mas el bien viene y no acierta,
> y el mal acierta y porfía.
>
> —Diego Hurtado de Mendoza
> (1503–1575)[1]

> The wider the scope of my reflection on the present and the past, the more am I impressed by their mockery of human plans in every transaction.
>
> —Tacitus[2]

I. In specific contexts in which abundant empirical evidence is available, fairly reliable short-term prediction and control of a society's behavior may be possible. For example, economists can predict some of the immediate consequences for a modern industrial society of a rise or a fall in the interest rates. Hence, by raising or lowering interest rates they can manipulate such variables as the levels of inflation and of unemployment.[3] Indirect consequences are harder to predict, and prediction of the consequences of more elaborate financial manipulations is largely guesswork. That's why the economic policies of the U.S. government are subject to so much controversy: No one knows for certain what the consequences of those policies really are.

Outside of contexts in which abundant empirical evidence is available, or when longer-term effects are at issue, successful prediction—and therefore successful management of a society's development—is far more difficult. In fact, failure is the norm.

• During the first half of the second century BC, sumptuary laws (laws intended to limit conspicuous consumption) were enacted in an effort to forestall the incipient decadence of Roman society. As is usual with sumptuary laws, these failed to have the desired effect, and the decay of Roman mores continued unchecked.[4] By the early first century BC, Rome had become politically unstable. With the help of soldiers under his command, Lucius Cornelius Sulla seized control of the city, physically exterminated the opposition, and carried out a comprehensive program of reform that was intended to restore stable government. But Sulla's intervention only made the situation worse, because he had killed off the "defenders of lawful government" and had filled the Senate with unscrupulous men "whose tradition was the opposite of that sense of mission and public service that had animated the best of the aristocracy."[5] Consequently the Roman political system continued to unravel, and by the middle of the first century BC Rome's traditional republican government was essentially defunct.

• In Italy during the 9th century AD certain kings promulgated laws intended to limit the oppression and exploitation of peasants by the aristocracy. "The laws proved futile, however, and aristocratic landowning and political dominance continued to grow."[6]

• Simón Bolívar was the principal leader of the revolutions through which Spain's American colonies achieved their independence. He had hoped and expected to establish stable and "enlightened" government throughout Spanish America, but he made so little progress toward that objective that he wrote in bitterness shortly before his death in 1830: "He who serves a revolution plows the sea." Bolívar went on to predict that Spanish America would "infallibly fall into the hands of the unrestrained multitude to pass afterward to those of... petty tyrants of all races and colors... [We will be] devoured by all crimes and extinguished by ferocity [so that] the Europeans will not deign to conquer us... ."[7] Allowing for a good deal of exaggeration attributable to the emotion under which Bolívar wrote, this prediction held (roughly) true for a century and a half after his death. But notice that Bolívar did not arrive at this prediction until too late; and that it was a very general prediction that asserted nothing specific.

• In the United States during the late 19th century there were

worker-housing projects sponsored by a number of individual philanthropists and housing reformers. Their objective was to show that

> efforts to improve the living conditions of workers could be combined with... profits of 5 percent annually. ...
>
> Reformers believed that the model dwellings would set a standard that other landlords would be forced to meet... mostly because of the workings of competition. Unfortunately, this solution to the housing problem did not take hold.... The great mass of urban workers... were crowded into... tenements that operated solely for profit.[8]

It is not apparent that there has been any progress over the centuries in the capacity of humans to guide the development of their societies. Relatively recent (post-1950) efforts in this direction may seem superficially to be more sophisticated than those of earlier times, but they do not appear to be more successful.

- The social reform programs of the mid-1960s in the United States, spearheaded by President Lyndon Johnson, revealed that beliefs about the causes and cures of such social problems as crime, drug abuse, poverty, and slums had little validity. For example, according to one disappointed reformer:

> Once upon a time we thought that if we could only get our problem families out of those dreadful slums, then papa would stop taking dope, mama would stop chasing around, and junior would stop carrying a knife. Well, we've got them in a nice new apartment with modern kitchens and a recreation center. And they're the same bunch of bastards they always were.[9]

This doesn't mean that all of the reform programs were total failures, but the general level of success was so low as to indicate that the reformers did not understand the workings of society well enough to know what should be done to solve the social problems that they addressed. Where they achieved some modest level of success they probably did so mainly through luck.[10]

One could go on and on citing examples like the foregoing ones. One could also cite many examples of efforts to control the development of societies in which the immediate goals of the efforts have been achieved. But in such cases the longer-term consequences for society as a whole have not been what the reformers or revolutionaries have expected or desired.[11]

• The legislation of the Athenian statesman Solon (6th century BC) was intended to abolish hektemorage (roughly equivalent to serfdom) in Attica while allowing the aristocracy to retain most of its wealth and privilege. In this respect the legislation was successful. But it also had unexpected consequences that Solon surely would not have approved. The liberation of the "serfs" resulted in a labor shortage that led the Athenians to purchase or capture numerous slaves from outside Attica, so that Athens was transformed into a slave society. Another indirect consequence of Solon's legislation was the Peisistratid "tyranny" (populist dictatorship) that ruled Athens during a substantial part of the 6th century BC.[12]

• Otto von Bismarck, one of the most brilliant statesmen in European history, had an impressive list of successes to his credit. Among other things:

—He achieved the unification of Germany in 1867–1871.

—He engineered the Franco-Prussian war of 1870–71, but his successful efforts for peace thereafter earned him the respect of European leaders.

—He successfully promoted the industrialization of Germany.

—By such means he won for the monarchy the support of the middle class.

—Thus Bismarck achieved his most important objective: He prevented (temporarily) the democratization of Germany.

—Though Bismarck was forced to resign in 1890, the political structure he had established for Germany lasted until 1918, when it was brought down by the German defeat in World War I.[13]

Notwithstanding his remarkable successes Bismarck felt that he had failed, and in 1898 he died an embittered old man.[14] Clearly, Germany was not going the way he had intended. Probably it was the resumption of Germany's slow drift toward democratization that angered him most. But his bitterness would have been deeper if he had foreseen the future. One can only speculate as to what the history of Germany might have been after 1890 if Bismarck hadn't led the country up to that date, but it is certain that he did not succeed in putting Germany on a course leading to results of which he would have approved; for Bismarck would have been horrified by the disastrous war of 1914–18, by Germany's defeat in it, and above all by the subsequent rise of Adolf Hitler.

• In the United States, reformers' zeal led to the enactment in 1919 of "Prohibition" (prohibition of the manufacture, sale, or transportation

of alcoholic beverages) as a constitutional amendment. Prohibition was partly successful in achieving its immediate objective, for it did decrease the alcohol consumption of the "lower" classes and reduce the incidence of alcohol-related diseases and deaths; it moreover "eradicated the saloon." On the other hand, it provided criminal gangs with opportunities to make huge profits through the smuggling and/or the illicit manufacture of alcoholic drinks; thus Prohibition greatly promoted the growth of organized crime. In addition, it tended to corrupt otherwise respectable people who were tempted to purchase the illegal beverages. It became clear that Prohibition was a serious mistake, and it was repealed through another constitutional amendment in 1933.[15]

• The so-called "Green Revolution" of the latter part of the 20th century—the introduction of new farming technologies and of recently developed, highly productive varieties of grain—was supposed to alleviate hunger in the Third World by providing more abundant harvests. It did indeed provide more abundant harvests. But: "[A]lthough the 'Green Revolution' seems to have been a success as far as the national total cereal production figures are concerned, a look at it from the perspective of communities and individual humans indicates that the problems have far outweighed the successes... ."[16] In some parts of the world the consequences of the Green Revolution have been nothing short of catastrophic. For example, in the Punjab (a region lying partly in India and partly in Pakistan), the Green Revolution has ruined "thousands of hectares of [formerly] productive land," and has led to severe lowering of the water table, contamination of the water with pesticides and fertilizers, numerous cases of cancer (probably due to the contaminated water), and many suicides. "'The green revolution has brought us only downfall,' says Jarnail Singh.... 'It ruined our soil, our environment, our water table. Used to be we had fairs in villages where people would come together and have fun. Now we gather in medical centers.'"[17]

From other parts of the world as well come reports of negative consequences, of varying degrees of severity, that have followed the Green Revolution. These consequences include economic, behavioral, and medical effects in addition to environmental damage (e.g., desertification).[18]

• In 1953, U.S. President Eisenhower announced an "Atoms for Peace" program according to which the nations of the world were supposed to pool nuclear information and materials under the auspices of an international agency. In 1957 the International Atomic Energy Agency

was established to promote the peaceful uses of atomic energy, and in 1968 the United Nations General Assembly approved a "non-proliferation" treaty under which signatories agreed not to develop nuclear weapons and in return were given nuclear technology that they were supposed to use only for peaceful purposes.[19]The people involved in this effort should have known enough history to realize that nations generally abide by treaties only as long as they consider it in their own (usually short-term) interest to do so, which commonly is not very long. But apparently the assumption was that the nations receiving nuclear technology would be so grateful, and so happy cooperating in its peaceful application, that they would forever put aside the aspirations for power and the bitter rivalries that throughout history had led to the development of increasingly destructive weapons.

This idea seems to have originated with scientists like Robert Oppenheimer and Niels Bohr who had helped to create the first atomic bomb.[20] That physicists would come up with something so naïve was only to be expected, since specialists in the physical sciences almost always are grossly obtuse about human affairs. It seems surprising, however, that experienced politicians would act upon such an idea. But then, politicians often do things for propaganda purposes and not because they really believe in them.

The "Atoms for Peace" idea worked fine—for a while. Some 140 nations signed the non-proliferation treaty in 1968 (others later),[21] and nuclear technology was spread around the world. Iran, in the early 1970s, was one of the countries that received nuclear technology from the U.S.[22] And the nations receiving such technology didn't try to use it to develop nuclear weapons. Not *immediately*, anyway. Of course, we know what has happened since then. "[H]ard-nosed politicians and diplomats [e.g., Henry Kissinger]...argue that proliferation of nuclear weapons is fast approaching a 'tipping point' beyond which it will be impossible to check their spread." These "veterans of America's cold-war security establishment with impeccable credentials as believers in nuclear deterrence" now claim that such weapons "ha[ve] become a source of intolerable risk."[23] And there is the inconvenient fact that the problem of safe disposal of radioactive waste from the *peaceful* uses of nuclear energy still has not been solved.[24]

The "Atoms for Peace" fiasco suggests that humans' capacity to control the development of their societies not only has failed to progress, but has actually retrogressed. Neither Solon nor Bismarck would have supported anything as stupid as "Atoms for Peace."

II. There are good reasons why humans' capacity to control the development of their societies has failed to progress. In order to control the development of a society you would have to be able to predict how the society would react to any given action you might take, and such predictions have generally proven to be highly unreliable. Human societies are complex systems—technologically advanced societies are most decidedly complex—and prediction of the behavior of complex systems presents difficulties that are not contingent on the present state of our knowledge or our level of technological development.

> [U]nintended consequences [are] a well-known problem with the design and use of technology.... The cause of many [unintended consequences] seems clear: The systems involved are complex, involving interaction among and feedback between many parts. Any changes to such a system will cascade in ways that are difficult to predict; this is especially true when human actions are involved.[25]

Problems in economics can give us some idea of how impossibly difficult it would be to predict or control the behavior of a system as complex as that of a modern human society. It is convincingly argued that a modern economy can never be rationally planned to maximize efficiency, because the task of carrying out such planning would be too overwhelmingly complex.[26] Calculation of a rational system of prices for the U.S. economy alone would require manipulation of a conservatively estimated 6×10^{13} (sixty trillion!) simultaneous equations.[27] That takes into account only the economic factors involved in establishing prices and leaves out the innumerable psychological, sociological, political, etc., factors that continuously interact with the economy.

Even if we make the wildly improbable assumption that the behavior of our society could be predicted through the manipulation of, say, a million trillion simultaneous equations and that sufficient computing power to conduct such manipulation were available, collection of the data necessary for insertion of the appropriate numbers into the equations would be impracticable,[28] especially since the data would have to meet impossibly high standards of precision if the predictions were expected to remain valid over any considerable interval of time. Edward Lorenz, a meteorologist, was the first to call widespread attention to the fact that even the most minute inaccuracy in the data provided can totally invalidate a

prediction about the behavior of a complex system. This fact came to be called the "butterfly effect" because in 1972, at a meeting of the American Association for the Advancement of Science, Lorenz gave a talk that he titled "Predictability: Does the Flap of a Butterfly's Wings in Brazil Set Off a Tornado in Texas?"[29] Lorenz's work is said to have been the inspiration for the development of what is called "chaos theory"[30]—the butterfly effect being an example of "chaotic" behavior.

Chaotic behavior is not limited to complex systems; in fact, some surprisingly simple systems can behave chaotically.[31] The *Encyclopaedia Britannica* illustrates this with a purely mathematical example. Let A and x_0 be any two given numbers with $0<A<4$ and $0<x_0<1$, and let a sequence of numbers be generated according to the formula $x_{n+1}=Ax_n(1-x_n)$. For certain values of A, e.g., A=3.7, the sequence behaves chaotically: In order to bring about a *linear* increase in the number of terms of the sequence that one can predict to a reasonable approximation, one needs to achieve an *exponential* improvement in the accuracy of one's estimate of x_0. In other words, in order to predict the nth term of the sequence, one needs to know the value of x_0 with an error not exceeding 10^{-kn}, k a constant.[32] This is characteristic of chaotic systems generally: Any small extension of the range of prediction requires an exponential improvement in the accuracy of the data.

> [A]ll chaotic systems share the property that every extra place of decimals in one's knowledge of the starting point only pushes the horizon [of predictability] a small distance away. In practical terms, the horizon of predictability is an impassable barrier. ... [O]nce it becomes clear how many systems are sufficiently nonlinear to be considered for chaos, it has to be recognized that prediction may be limited to short stretches set by the horizon of predictability. Full comprehension... must frequently remain a tentative process... with frequent recourse to observation and experiment in the event that prediction and reality have diverged too far.[33]

It should be noted that the Heisenberg Uncertainty Principle sets an absolute limit to the precision of data used for the prediction of physical phenomena. This principle, which implies that certain events involving subatomic particles are unpredictable, is inferred mathematically from other known laws of physics; hence, successful prediction at the subatomic level would entail violations of the laws of physics. If a prediction about the

behavior of a macroscopic system requires data so precise that their accuracy can be disturbed by events at the subatomic level, then no reliable prediction is possible. Hence, for a chaotic physical system, there is a point beyond which the horizon of predictability can never be extended.

Of course, the behavior of a human society is not in every respect chaotic; there are empirically observable historical trends that can last for centuries or millennia. But it is wildly improbable that a modern technological society could be free of all chaotic subsystems whose behavior is capable of affecting the society as a whole, so it is safe to assume that the development of a modern society is necessarily chaotic in at least some respects and therefore unpredictable.

This doesn't mean that no predictions at all are possible. In reference to weather forecasting the *Britannica* writes:

> It is highly probable that atmospheric movements... are in a state of chaos. If so, there can be little hope of extending indefinitely the range of weather forecasting except in the most general terms. There are clearly certain features of climate, such as annual cycles of temperature and rainfall, which are exempt from the ravages of chaos. Other large-scale processes may still allow long-range prediction, but the more detail one asks for in a forecast, the sooner it will lose its validity.[34]

Much the same can be said of the behavior of human society (though human society is far more complex even than the weather). In some contexts, reasonably reliable and specific short-term predictions can be made, as we noted above in reference to the relationship between interest rates, inflation, and unemployment. Long-term predictions of an imprecise and nonspecific character are often possible; we've already mentioned Bolívar's correct prediction of the failure of stable and "enlightened" government in Spanish America. (Here it is well to note that predictions that something will *not* work can generally be made with greater confidence than predictions that something *will* work.[35]) But reliable long-term predictions that are at all specific can seldom be made.

There are exceptions. Moore's Law makes a specific prediction about the rate of growth of computing power, and as of 2012 the law has held true for some fifty years.[36] But Moore's Law is not an inference derived from an understanding of society, it is simply a description of an empirically

observed trend, and no one knows how long the trend will continue. The law may have predictable consequences for many areas of technology, but no one knows in any specific way how all this technology will interact with society as a whole. Though Moore's Law and other empirically observed trends may play a useful role in attempts to foresee the future, it remains true that any effort to understand the development of our society must (to borrow the *Britannica's* phrases) "remain a tentative process... with frequent recourse to observation and experiment... ."

But just in case someone declines to assume that our society includes any important chaotic components, let's suppose for the sake of argument that the development of society could in principle be predicted through the solution of some stupendous system of simultaneous equations and that the necessary numerical data at the required level of precision could actually be collected. No one will claim that the computing power required to solve such a system of equations is currently available. But let's assume that the unimaginably vast computing power predicted by Ray Kurzweil[37] will become a reality for some future society, and let's suppose that such a quantity of computing power would be capable of handling the enormous complexity of the *present* society and predicting its development over some substantial interval of time. It does not follow that a future society of that kind would have sufficient computing power to predict its *own* development, for such a society necessarily would be incomparably more complex than the present one: The complexity of a society will grow right along with its computing power, because the society's computational devices are part of the society.

There are in fact certain paradoxes involved in the notion of a system that predicts its own behavior. These are reminiscent of Russell's Paradox in set theory[38] and of the paradoxes that arise when one allows a statement to talk about itself (e.g., consider the statement, "This statement is false"). When a system makes a prediction about its own behavior, that prediction may itself change the behavior of the system, and the change in the behavior of the system may invalidate the prediction. Of course, not every statement that talks about itself is paradoxical. For example, the statement, "This statement is in the English language" makes perfectly good sense. Similarly, many predictions that a system may make about itself will not be self-invalidating; they may even cause the system to behave in such a way as to fulfill the prediction.[39] But it is too much to hope for that a society's predictions about itself will *never* be (unexpectedly) self-invalidating.

A society's ability to predict its own behavior moreover would seem to require something like complete self-knowledge, and here too one runs into paradoxes. We need not discuss these here; some thought should suffice to convince the reader that any attempt to envision a system having complete self-knowledge will encounter difficulties.

Thus, from several points of view—past and present experience, complexity, chaos theory, and logical difficulties (paradoxes)—it is clear that no society can accurately predict its own behavior over any considerable span of time. Consequently, no society can be consistently successful in planning its own future in the long term.

This conclusion is in no way unusual, surprising, or original. Astute observers of history have known for a long time that a society can't plan its own future. Thus Thurston writes: "[N]o government has ever been able physically to manage the total existence of a country, ... or to foresee all the complications that would ensue from a decision made at the center."[40]

Heilbroner and Singer write: "Technology made America a 'middle-class' nation. This process was not, of course, the outcome of anyone's decision. Like much of the economic history we have traced, it followed from the blind workings of the market mechanism."[41]

Norbert Elias wrote: "[T]he actual course of... historical change as a whole is intended and planned by no-one."[42] And: "Civilization... is set in motion blindly, and kept in motion by the autonomous dynamics of a web of relationships... ."[43]

III. The expected answer to the foregoing will be: Even granting that the behavior of a society is unpredictable in the long term, it may nevertheless be possible to steer a society rationally by means of continual short-term interventions. To take an analogy, if we let a car without a driver roll down a rugged, irregular hillside, the only prediction we can make is that the car will not follow any predetermined course but will bounce around erratically. However, if the car has a driver, he may be able to steer it so as to avoid the worst bumps and make it roll instead through relatively smooth places. With a good deal of luck he may even be able to make the car arrive approximately at a preselected point at the foot of the hill. For these purposes the driver only needs to be able to predict very roughly how far the car will veer to the right or to the left when he turns the steering wheel. If the car veers too far or not far enough, he can correct with another turn of the wheel.

Perhaps something similar could be done with an entire society. It is conceivable that a combination of empirical studies with increasingly sophisticated theory may eventually make possible fairly reliable short-term predictions of the way a society will react to any given change—just as fairly reliable short-term weather forecasting has become possible. Perhaps, then, a society might be successfully steered by means of frequent, intelligent interventions in such a way that undesirable outcomes could usually be avoided and some desirable outcomes achieved. The steering process would not have to be infallible; errors could be corrected through further interventions. Just possibly, one might even hope to succeed in steering a society so that it would arrive in the long run at something approximating one's conception of a good society.

But this proposal too runs into difficulties of a fundamental kind. The first problem is: Who decides what outcomes are desirable or undesirable, or what kind of "good" society should be our long-term goal? There is never anything resembling general agreement on the answers to such questions. Friedrich Engels wrote in 1890:

> History is made in such a way that the final result always arises from the conflicts among many individual wills, each of which is made into what it is by a multitude of special conditions of life; thus there are innumerable intersecting forces, an infinite collection of parallelograms of forces, and from them emerges a resultant—the historical event—which from another point of view can be regarded as the product of one power that, as a whole, operates unconsciously and without volition. For what each individual wants runs up against the opposition of every other, and what comes out of it all is something that no one wanted.[44]

Norbert Elias, who was not a Marxist, made a very similar remark:

> [F]rom the interweaving of countless individual interests and intentions—whether tending in the same direction or in divergent and hostile directions—something comes into being that was planned and intended by none of these individuals, yet has emerged nevertheless from their intentions and actions.[45]

Even in those rare cases in which almost everyone agrees on a policy, effective implementation of the policy may be prevented by what is called the "problem of the commons." The problem of the commons consists in the fact that it may be to everyone's advantage that everyone should act in a certain way, yet it may be to the advantage of each individual to act in a contrary way.[46] For example, in modern society it is to everyone's advantage that everyone should pay a portion of his income to support the functions of government. Yet it is to the advantage of each individual to keep all his income for himself, and that's why hardly anyone pays taxes voluntarily, or pays more than he has to.

The answer to the foregoing arguments will be that political institutions exist precisely in order to resolve such problems: The concrete decisions made in the process of governing a society are not the resultant of conflicts among the innumerable individual wills of the population at large; instead, a small number of political leaders are formally empowered (through elections or otherwise) to make necessary decisions for everyone, and to enact laws that compensate for the problem of the commons by compelling individuals to do what is required for the common welfare (for example, laws that compel payment of taxes). Since the top political leaders are relatively few in number, it is not unreasonable to hope that they can resolve their differences well enough to steer the development of a society rationally.

Actually, experience shows that when the top political leaders number more than, say, half a dozen or so, it must seriously be doubted whether they can ever resolve their differences well enough to be able to govern in a consistently rational way. But even where no conflicts exist among the top leaders, the real power of such leaders is very much less than the power that is formally assigned to them. Consequently, their ability to steer the development of their society rationally is extremely limited at best.

When this writer was in the Sacramento County Main Jail in 1996–98, he had some interesting conversations with the jail administrator, Lieutenant Dan Lewis. In the course of one such conversation, on December 31, 1996, Lewis complained that it was not easy to get some of his officers to follow his orders, and he described the problems that a person in a position of formal power faces when he tries to exert that power to make his organization do what he wants it to do. If the leader takes measures that are resented by too many of the people under his command, he will meet with so much resistance that his organization will be paralyzed.[47]

It's not only jail administrators whose power is far more limited than it appears to an outsider. Julius Caesar reportedly said, "The higher our station, the less is our freedom of action."[48] According to an English author of the 17th century: "Men in great place (saith one) are thrice servants; servants of the sovereign, or state; servants of fame; and servants of business. So as they have no freedom, neither in their persons, nor in their actions, nor in their times."[49] U.S. President Abraham Lincoln wrote: "I claim not to have controlled events, but confess plainly that events have controlled me."[50]

While F.W. de Klerk was President of South Africa, Nelson Mandela asked him why he did not prevent acts of violence that in some cases were being carried out with the collusion of the police. De Klerk replied, "Mr. Mandela, when you join me [as a member of the government] you will realise I do not have the power which you think I have."[51] It's possible that de Klerk was pleading powerlessness as an excuse for tolerating violence that in reality he might have been able to prevent. Nevertheless, when Mandela himself became President, he "quickly realized, as de Klerk had warned him, that a President had less power than he appeared to. He could rule effectively only through his colleagues and civil servants, who had to be patiently persuaded... ."[52]

In line with this, a thorough student of the American presidency, Clinton Rossiter, has explained how severely the power of the President of the United States is limited, not only by public opinion and by the power of Congress, but also by conflicts with members of his own administration who, in theory, are totally under his command.[53] Rossiter refers to "the trials undergone by [Presidents] Truman and Eisenhower in persuading certain chiefs of staff, whose official lives depend entirely on the President's pleasure, to shape their acts and speeches to the policies of the administration."[54] One of our most powerful presidents, Franklin D. Roosevelt, complained:

> The Treasury is so large and far-flung and ingrained in its practices that I find it is almost impossible to get the actions and results I want... . But the Treasury is not to be compared with the State Department. You should go through the experience of trying to get any changes in the thinking, policy and action of the career diplomats and then you'd know what a real problem was. But the Treasury and the State Department put together are nothing compared with the Na-a-vy. The admirals are really something to cope with—and I

> should know. To change anything in the Na-a-vy is like punching a feather bed. You punch it with your right and you punch it with your left until you are finally exhausted, and then you find the damn bed just as it was before you started punching.[55]

Roosevelt's capable successor in the presidency, Harry S. Truman, said:

> [P]eople talk about the powers of a President, all the powers that a Chief Executive has, and what he can do. Let me tell you something—from experience!
>
> The President may have a great many powers given to him by the Constitution and may have certain powers under certain laws which are given to him by the Congress of the United States; but the principal power that the President has is to bring people in and try to persuade them to do what they ought to do without persuasion. That's what I spend most of my time doing. That's what the powers of the President amount to.[56]

Thus, concentration of formal power in the hands of a few top leaders by no means liberates decision-making from Engels's "conflicts among many individual wills." Some people may be surprised to learn that this is true even in a society governed by a single, theoretically absolute ruler.

- From 200 BC to 1911 AD, all Chinese dynasties were headed by an emperor who "was the state's sole legislator, ultimate executive authority, and highest judge. His pronouncements were, quite literally, the law, and he alone was not bound by his own laws."[57] The emperor was supposed to be restrained by "Confucian norms and the values perpetuated by the scholar-official elite,"[58] but in the absence of an explicit codification or any mechanism for enforcement, these restraints were effective against the emperor only to the extent that some of his subjects were brave enough to challenge him on their own initiative, though the emperor, "if he insisted, would prevail."[59]

More important, therefore, were the practical limitations to which the emperor was subject. "As the head of a vast governmental apparatus... he was... forced to delegate his powers to others who conducted the routine operations of government.... Institutions inherited from previous dynasties were the main vehicles through which he delegated political responsibilities," for "in seeking alternatives to that immediate past, one had no models

outside of China to draw upon."[60] Needless to say, the actual power wielded by an emperor depended on the energy and ability of the individual who occupied the office at any given time,[61] but it seems clear that that power was in every case far less than what might naively be inferred from the fact that the emperor's word was law.

To illustrate the practical limitations on the emperor's power with a concrete example, in 1069 AD the emperor Shenzong (Shen-tsung), having recognized the brilliance of the political thinker Wang Anshi (An-shih), appointed him Vice Chief Councillor in charge of administration and gave him full power to implement his ideas in the emperor's name.[62] Wang based his reforms on thorough study, but both he and the emperor failed to take account of the bitter opposition that the new policies would arouse among those whose private interests were threatened by them.[63] "Even in the short run, the cost of the divisive factionalism that the reforms generated had disastrous effects."[64] Opposition to Wang was so intense that he resigned permanently in 1076, and during the eight years following Shenzong's death in 1085 most of the reforms were rescinded or drastically revised.[65] Under two subsequent emperors, Zhezong (Che-tsung; reigned in effect, circa 1093–1100) and Huizong (Hui-tsung; reigned 1100–1126), some of the reforms were restored, but "Wang's own former associates were gone, and his policies became nothing more than an instrument in bitter political warfare."[66] "[A]lthough Emperor Huizong's reign saw some of the reform measures reinstated, the atmosphere at his court was not one of high-minded commitment,"[67] but was characterized by "debased political behavior."[68] "Leading officials engaged in corrupt practices," and the rapacity of the emperor's agents "aroused serious revolts of people who in desperation took up arms against them."[69] The fall of the Northern Song (Sung) Dynasty in 1126–27 marked the final demise of whatever was left of Wang's reforms.[70]

• Norbert Elias makes clear that the "absolute" monarchs of the "Age of Absolutism" in Europe were not so absolute as they seemed.[71] For example, Louis XIV of France is generally seen as the archetype of the "absolute" monarch; he could probably have had any individual's head chopped off at will. But by no means could he use his power freely:

> The vast human network that Louis XIV ruled ha[d] its own momentum and its own centre of gravity which he had to respect. It cost

immense effort and self-control to preserve the balance of people and groups and, by playing on the tensions, to steer the whole.[72]

Elias might have added that Louis XIV could "steer" his realm only within certain narrow limits. Elias himself refers elsewhere to "the realization that even the most absolute government is helpless in the face of the dynamisms of social development... ."[73]

• The theoretically absolute emperor Joseph II ruled Austria from 1780 to 1790 and instituted major reforms of a "progressive" (i.e., modernizing) character. But:

"By 1787 resistance to Joseph and his government was intensifying. ...Resistance simmered in the Austrian Netherlands... .

"[By 1789]... The war [against the Turks] caused an outpouring of popular agitation against his foreign policy, the people of the Austrian Netherlands rose in outright revolution, and reports of trouble in Galicia increased. ...

"Faced with these difficulties, Joseph revoked many of the reforms that he had enacted earlier. ...

"...[Joseph II] tried to do too much too quickly and so died a deeply disappointed man."[74]

Especially to be noted is the fact that Joseph II failed even though most of his reforms were modernizing ones; that is, they merely attempted to accelerate Austria's movement in obedience to a powerful pre-existing trend in European history.

Revolutionary dictators of the 20th century, such as Hitler and Stalin, were probably more powerful than traditional "absolute" monarchs, because the revolutionary character of their regimes had done away with many of the traditional, formal or informal social structures and customary restraints that had curbed the "legitimate" monarchs' exercise of their power. But even the revolutionary dictators' power was in practice far less than absolute.

• During the 1930s, when the Hitler regime was rearming Germany in preparation for anticipated warfare, resistance by the working class "kept the government from curtailing the production of consumers' goods, although civilian output interfered seriously with arms production."[75]

It is said that, from 1938, resistance to the regime included some ten attempts to kill Hitler or otherwise remove him from power.[76] The most important of these efforts was initiated in 1943 by a conspiracy of civilian

dignitaries and military officers, who on July 20, 1944 tried to blow the Führer up with a bomb, after which they planned to seize control of the government. The assassination attempt was nearly successful, and it was only through luck that Hitler escaped with his life.[77] It appears that many of the conspirators were motivated not only by the fact that Hitler had gotten them into a losing war, but also by disgust at the atrocities that Germans, under Nazi leadership, were committing against Jews, Slavs, and other groups.[78]

- In the Soviet Union between 1934 and 1941, the Stalin regime was unable to regulate its own labor force, for the "demand for labor created a situation that overrode... the efforts of the regime to control labor through legislation."[79] The government naturally wanted a stable work force in which workers would remain at their jobs as long as they were needed, but in practice they "continued to change jobs at a high rate."[80] Laws were evaded or simply ignored, and "hardly slowed down the movement of workers."[81]

More significantly, the Terror of the middle to late 1930s was not a calculated and effective measure undertaken by Stalin to crush resistance to his rule. Instead, a frightened dictator initiated a process that rapidly spiraled out of his control. "Stalin was a man initiating and reacting to developments, not the cold mastermind of a plot to subdue the party and the nation." "It now appears that Stalin and his close associates, having helped create a tense and ugly atmosphere, nonetheless repeatedly reacted [during the Terror] to events they had not planned or foreseen." "An atmosphere of panic had set in reminiscent of the European witch-hunts... ." "Stalin seems to have become steadily more worried as the purges uncovered alleged spies and Trotskyites. Finally he struck at them, almost incoherently. [¶] During 1937 and 1938 events spun out of... control." "[T]he police fabricated cases, tortured people not targeted in Stalin's directives, and became a power unto themselves." "Terror was producing avoidance of responsibility, which was dysfunctional. Whatever the goal at the top, events were again out of control." "[Stalin] reacted, and over-reacted, to events. ... He was sitting at the peak of a pyramid of lies and incomplete information... ." "The evidence is now strong that [Stalin] did not plan the Terror."[82]

Quite apart from any resistance by subordinates or other "conflicts among individual wills" within a system, purely technical factors narrowly limit the options open even to a leader whose power over his system is theoretically absolute.

• In Frank Norris's immortal novel, *The Octopus*—about wheat farmers whose livelihood is destroyed by railroad rate increases—the protagonist, Presley, confronts the apparently ruthless businessman Shelgrim, President of the railroad. But Shelgrim tells him:

"'You are dealing with forces, young man, when you speak of wheat and the railroads, not with men. ... Men have only little to do with the whole business. ... Blame conditions, not men.'

"'But—but', faltered Presley, 'You are the head, you control the road.'

"'...Control the road! ... I can go into bankruptcy if you like. But otherwise, if I run my road as a business proposition, I can do nothing. I can *not* control it.'"[83]

The Octopus is a work of fiction, but it does truthfully represent, in dramatized form, the economic realities of the era in which Norris wrote (about the end of the 19th and the beginning of the 20th century). At that time, "railway labor and material costs" had increased, and "many American railroads, already struggling to stay alive economically, could not afford rate reductions." State railroad commissions "seeking... ways of establishing fair, 'scientific' rates" found that "there was no such thing as 'scientific' rate making. They discovered that it was extraordinarily difficult to define the 'public interest' or to take the rate question 'out of politics.' Setting rates meant assigning economic priorities, and someone—shipper, carrier, consumer—inevitably got hurt."[84] So it's likely that a railroad like Shelgrim's would indeed have gone bankrupt if it had tried to set rates in such a way as to treat everyone "fairly" and humanely.

It is probably true in general that the ruthless behavior of business enterprises is more often compelled by economic realities than voluntarily chosen by a rapacious management.

• In the 1830s, at an early stage of the U.S. industrial revolution, the textile manufacturers of Massachusetts treated their employees benevolently. Nowadays their system would no doubt be decried as "paternalistic," but in material terms the workers could consider themselves fortunate, for working conditions and housing were very good by the standards of the time. But during the 1840s the situation of the workers began to deteriorate. Wages were reduced, hours of work increased, and greater effort was demanded of the workers; and this was the result not of employers' greed but of market conditions that grew out of economic competition.[85] "As business became nationwide... the competition of different manufacturing

areas meant that prices and wages were no longer determined by local conditions. They fluctuated as a consequence of economic changes wholly beyond the control of the employers or workers immediately concerned."[86]

• A recent (2012) article by Adam Davidson discusses some of the reasons behind the problem of unemployment in the U.S. Taking as an example a company he has personally investigated, Davidson writes: "It's tempting to look to the owners of Standard Motor Products and ask them to help [unskilled workers]: to cut costs a little less relentlessly, take slightly lower profits, and maybe even help solve America's jobs crisis in some small way." Davidson then goes on to explain why a company like Standard Motor Products would not be able to survive in the face of competition if it did not cut costs relentlessly and, therefore, replace human workers with machines whenever it was profitable to do so.[87] Here again we see that "[t]he businessman... [is] only the agent of economic forces and developments beyond his control."[88]

In the last two examples the options open to leaders of organizations were limited not by technical factors alone, but by these in conjunction with competition from outside the organization. But even independently of external competition and of any "conflict of wills" within a system, technical factors by themselves severely limit the choices available to the system's leaders. Not even dictators can escape these limitations.

• In the *Encyclopaedia Britannica* article on Spain we find: "For almost 20 years after the [Spanish Civil War], the [Franco regime] followed a policy of... national economic self-sufficiency.... Spain's policies of economic self-sufficiency were a failure, and by the late 1950s the country was on the verge of economic collapse."[89]

Unwilling to rely solely on the foregoing brief passage for twenty years of Spanish economic history, this writer consulted a Spanish correspondent, who sent him copies of pages from relevant historical works.[90] It turned out that the *Britannica's* account—perhaps unavoidably in view of its brevity—was oversimplified to the point of being seriously misleading. Among other things, it isn't clear to what extent Spain's policy of self-sufficiency was voluntarily chosen and to what extent it was forced on the country, first by the conditions prevailing during World War II and later by the Western democracies' hostility to the authoritarian regime of Franco. Much of this history is beyond the understanding of those of us who have no specialized knowledge of economics, but one thing does emerge clearly: Quite apart from any external competition or internal conflict, economic reality

imposes narrow limits on what even an authoritarian regime can do with a nation's economy. A dictator cannot run an economy the way a general runs an army—by giving orders from above—because the economy won't follow orders.[91] In other words, not even a powerful dictator like Francisco Franco can overrule the laws of economics.

Nor can idealistic zeal overcome those laws.

• In the years following the Cuban Revolution of 1956–59, U.S. media propaganda portrayed Fidel Castro as motivated by a lust for power, but actually Castro started out with generalized humanitarian and democratic goals.[92] Once he had overthrown the Batista government, he found that, despite the immense power conferred on him by his personal charisma,[93] the options open to him were extremely limited. Circumstances forced him to choose between democracy and the deep social reforms that he envisioned; he couldn't have both. Since his basic goals were his social ones he had to abandon democracy, become a dictator, and Stalinize and militarize Cuban society.[94]

There can be no doubt about the idealistic zeal of the Cuban revolutionaries,[95] and Castro was as powerful as any charismatic dictator could ever be.[96] Even so, the revolutionary regime was unable to control the development of Cuban society: Castro admitted that he had failed to curb the bureaucratic tendencies of Cuba's administrative apparatus.[97] Notwithstanding the regime's strong ideological opposition to racism, "the drive to promote... blacks and mixed race Cubans to leadership positions within the government and Party" was only partly successful, as Castro himself acknowledged.[98] In fact, Cuban efforts to combat racism do not seem to have been any more successful than those of the United States.[99] The Castro regime achieved no more than minimal success in its attempt to free the Cuban economy from its almost total dependence on sugar and to industrialize the country.[100] To survive at all economically, the regime was forced to abandon its attempt to build "socialism" (as conceived by Cuba's idealistic leaders) within a short period. It was found necessary instead to make ideologically painful compromises with economic reality,[101] and even with these compromises the Cuban economy has remained no more than barely viable.[102]

A contributing factor in Cuba's economic failure was the embargo imposed by the United States: U.S. firms were forbidden to trade with Cuba. But this factor was not decisive, and not as important as admirers of the Castro regime liked to think. Cuba could trade with most of the

economically important countries of the world other than the U.S., and was even able to trade indirectly with major U.S. corporations by dealing with their subsidiaries in other countries.[103] The embargo was far less important than Cuba's inability to free itself from its excessive dependence on sugar or even to run its sugar industry efficiently.[104] Another factor in Cuba's economic failure was a lack of cooperation within Cuban society—Engels's "conflicts among many individual wills." There were absenteeism, passive resistance to production quotas, and "stolid peasant resistance."[105] "Individualistic" tendencies led to pilfering, waste, and even to major criminal activity.[106] In addition, there were conflicts within the Cuban power-structure.[107] Almost certainly, however, the decisive factor in Cuba's failure has been the Castro regime's refusal to comply with the technical requirements for economic success: The regime compromised its ideology only as far as was necessary for bare survival, and declined to accept those elements of the free market and of capitalism that might have made vigorous development possible. That this factor was decisive is shown by the fact that purely socialist economies have failed all over the world.[108]

IV. There is yet another—and critically important—reason why a society cannot "steer" itself in the manner suggested at the beginning of Part III of this chapter: Every complex, large-scale society is subject to internal developments generated by "natural selection" operating on systems that exist within the society. This factor is discussed at length in Chapter Two; here we will only sketch the argument in the briefest possible terms.

Through a process analogous to biological evolution there arise, within any complex, large-scale society, self-preserving or self-reproducing systems large and small (including, for example, business enterprises, political parties or movements, open or covert social networks such as networks of corrupt officials) that struggle to survive and propagate themselves. Because power is a cardinal tool for survival, these systems compete for power.

Biological organisms, evolving through natural selection, eventually invade every niche in which biological survival is possible at all, and, whatever measures may be taken to suppress them, some organisms will find ways of surviving nonetheless. Within any complex, large-scale society, a similar process will produce self-propagating systems that will invade every corner and circumvent all attempts to suppress them. These systems will compete for power without regard to the objectives of any government (or other entity) that may try to steer the society. Our

argument—admittedly impossible at present to prove conclusively—is that these self-propagating systems will constitute uncontrollable forces that will render futile in the long run all efforts to steer the society rationally. For details, see Chapter Two.

V. Notwithstanding all the arguments we've reviewed in the present chapter up to this point, let's make the unrealistic assumption that techniques for manipulating the internal dynamics of a society will some day be developed to such a degree that a single, all-powerful leader (we'll be charitable and call him a philosopher-king[109] rather than a dictator)—or a group of leaders small enough (< 6?) to be free of "conflicts among individual wills" within the group—will be able to steer a society as suggested at the beginning of Part III, above.

The notion of authoritarian rule by a single leader or a small group of leaders is not as far-fetched as it may appear to the denizens of modern, liberal democracies. Many people in the world already live under the authority of one man or a few, and when the technological society gets itself into sufficiently serious trouble, as it is likely to do in the coming decades, even the denizens of liberal democracies will begin looking for solutions that today seem out of the question. During the Great Depression of the 1930s, many Americans—mainstream people, not kooks out on the fringes—felt disillusioned with democracy[110] and advocated rule by a dictator or an oligarchy (a "supercouncil" or a "directorate").[111] Many admired Mussolini.[112] During the same period, many Britons admired Hitler's Germany. "Lloyd George's reaction to Hitler was typical: 'If only we had a man of his supreme quality in England today,' he said."[113]

Returning, then, to our hypothetical dictator, or philosopher-king as we've decided to call him, we'll assume, however implausibly, that he will somehow be able to overcome the problems of complexity, of the conflicts of many individual wills, of resistance by subordinates, and of the competitive, power-seeking groups or systems that will evolve within any complex, large-scale society. Even under this unreal assumption we will still run into fundamental difficulties.

The first problem is: Who is going to choose the philosopher-king and how will they put him into power? Given the vast disparities of goals and values ("conflicts among individual wills") in any large-scale society, it is hardly likely that the rule of any one philosopher-king could be consistent with the goals and values of a majority of the population, or even with the

goals and values of a majority of any elite stratum (the intellectuals, say, or scientists, or rich people)—except to the extent that the philosopher-king, once in power, might use propaganda or other techniques of human engineering to bring the values of the majority into line with his own. If the realities of practical politics are taken into account, it seems that anyone who might actually become a philosopher-king either would have to be a compromise candidate, a bland fellow whose chief concern would be to avoid offending anyone, or else would have to be the ruthless leader of an aggressive faction that drives its way to power. In the latter case he might be an unscrupulous person intent only on attaining power for himself (a Hitler), or he might be a sincere fanatic convinced of the righteousness of his cause (a Lenin), but either way he would stop at nothing to achieve his goals.

Thus, the citizen who might find the idea of a philosopher-king attractive should bear in mind that he himself would not select the philosopher-king, and that any philosopher-king who might come into power would probably not be the kind that he imagines or hopes for.

A further problem is that of selecting a successor when the philosopher-king dies. Each philosopher-king will have to be able to preselect reliably a successor whose goals and values are virtually identical to his own; for, otherwise, the first philosopher-king will steer the society in one direction, the second philosopher-king will steer the society in a somewhat different direction, the third philosopher-king will steer it in yet another direction, and so forth. The result will be that the development of the society in the long term will wander at random, rather than being steered in any consistent direction or in accord with any consistent policy as to what constitute desirable or undesirable outcomes.

Historically, in absolute monarchies of any kind—the Roman Empire makes a convenient example—it has proven impossible even to ensure the succession of rulers who are reasonably competent and conscientious. Capable, conscientious rulers have alternated with those who have been irresponsible, corrupt, vicious or incompetent. As for a long, unbroken succession of rulers, each of whom not only is competent and conscientious but also has goals and values closely approximating those of his predecessor—you can forget it. All of these arguments, by the way, apply not only to philosopher-kings but also to philosopher-oligarchs—ruling groups small enough so that Engels's "conflicts among many individual wills" do not come into play.

All the same, let's assume that it would somehow be possible to ensure the succession of a long line of philosopher-kings all of whom would govern in accord with a single, permanently stable system of values. In that event... but hold on... let's pause and take stock of the assumptions we've been making. We're assuming, among other things, that the problems of complexity, chaos, and the resistance of subordinates, also the purely technical factors that limit the options open to leaders, as well as the competitive, power-seeking groups that evolve within a society under the influence of natural selection, can all be overcome to such an extent that an all-powerful leader will be able to govern the society rationally; we're assuming that the "conflicts among many individual wills" within the society can be resolved well enough so that it will be possible to make a rational choice of leader; we're assuming that means will be found to put the chosen leader into a position of absolute power and to guarantee forever the succession of competent and conscientious leaders who will govern in accord with some stable and permanent system of values. And if the hypothetical possibility of steering a society rationally is to afford any comfort to the reader, he will have to assume that the system of values according to which the society is steered will be one that is at least marginally acceptable to himself—which is a sufficiently daring assumption.

It's now clear that we have wandered into the realm of fantasy. It is impossible to prove with mathematical certainty that the development of a society can never be guided rationally over any significant interval of time, but the series of assumptions that we've had to make in order to entertain the possibility of rational guidance is so wildly improbable that for practical purposes we can safely assume that the development of societies will forever remain beyond rational human control.[114]

VI. It's likely that the chief criticism to be leveled at this chapter will be that the writer has expended a great deal of ink and paper to prove what "everyone" already knows. Unfortunately, however, not everyone does know that the development of societies can never be subject to rational human control; and even many who would agree with that proposition as an abstract principle fail to apply the principle in concrete cases. Again and again we find seemingly intelligent people proposing elaborate schemes for solving society's problems, completely oblivious to the fact that such schemes never, never, never are carried out successfully. In a particularly

fuddled excursion into fantasy written several decades ago, the noted technology critic Ivan Illich asserted that "society must be reconstructed to enlarge the contribution of autonomous individuals and primary groups to the total effectiveness of a new system of production designed to satisfy the human needs which it also determines," and that a "convivial society should be designed to allow all its members the most autonomous action by means of tools least controlled by others"[115]—as if a society could be consciously and rationally "reconstructed" or "designed." Other egregious examples of this sort of folly were provided by Arne Naess[116] and Chellis Glendinning[117] in 1989 and 1990, respectively; these are discussed in Part IV of Chapter Three of the present work.

Right down to the present (2013), people who should know better have continued to ignore the fact that the development of societies can never be rationally controlled. Thus, we often find technophiles making such absurd statements as: "humanity is in charge of its own fate"; "[we will] take charge of our own evolution"; or, "people [will] seize control of the evolutionary process."[118] The technophiles want to "guide research so that technology improve[s] society"; they have created a "Singularity University" and a "Singularity Institute" that are supposed to "shape the advances and help society cope with the ramifications" of technological progress, and "make sure... that artificial intelligence... is friendly" to humans.[119]

Of course, the technophiles won't be able to "shape the advances" of technology or make sure that they "improve society" and are friendly to humans. Technological advances will be "shaped" in the long run by unpredictable and uncontrollable power-struggles among rival groups that will develop and apply technology for the sole purpose of gaining advantages over their competitors. See Chapter Two of this book.

It's not likely that the majority of technophiles fully believe in this drivel about "shaping the advances" of technology to "improve society." In practice, Singularity University serves mainly to promote the interests of technology-oriented businessmen,[120] while the fantasies about "improving society" function as propaganda that helps to forestall public resistance to radical technological innovation. But such propaganda is effective only because many laymen are naïve enough to take the fantasies seriously.

Whatever may be the motives behind the technophiles' schemes for "improving society," other such schemes unquestionably are sincere. For recent examples, see the books by Jeremy Rifkin (2011)[121] and Bill Ivey (2012).[122] There are other examples that superficially look more sophisticated

than the proposals of Rifkin and Ivey but are equally impossible to carry out in practice. In a book published in 2011, Nicholas Ashford and Ralph P. Hall[123] "offer a unified, transdisciplinary approach for achieving sustainable development in industrialized nations. ... The authors argue for the design of multipurpose solutions to the sustainability challenge that integrate economics, employment, technology, environment, industrial development, national and international law, trade, finance, and public and worker health and safety."[124] Ashford and Hall do not intend their book to be merely an abstract speculation like Plato's *Republic*[125] or Thomas More's *Utopia*; they imagine themselves to be offering a practical program.[126]

In another example (2011), Naomi Klein proposes massive, elaborate, worldwide "planning"[127] that is supposed to bring global warming under control,[128] help with many of our other environmental problems,[129] and at the same time bring us "real democracy,"[130] "rein in"[131] the corporations, alleviate unemployment,[132] reduce wasteful consumption in rich countries[133] while allowing poor countries to continue their economic growth,[134] foster "interdependence rather than hyper-individualism, reciprocity rather than dominance and cooperation rather than hierarchy,"[135] "elegantly weav[e] all these struggles into a coherent narrative about how to protect life on earth,"[136] and overall promote a "progressive" agenda[137] so as to create a "healthy, just world."[138]

One is tempted to ask whether the schemes concocted by people like Ashford, Hall, and Klein are meant as an elaborate joke of some sort; but no, the intentions of these authors are quite serious. How can they possibly believe that schemes like theirs will ever be carried out in the real world? Are they totally devoid of any practical sense about human affairs? Maybe. But a more likely explanation is unwittingly offered by Naomi Klein herself: "[I]t is always easier to deny reality than to watch your worldview get shattered... ."[139] The worldview of most members of the upper middle class, including most intellectuals, is deeply dependent on the existence of a thoroughly organized, culturally "advanced," large-scale society characterized by a high level of social order. It would be extremely difficult psychologically for such people to recognize that the only way to get off the road to disaster that we are now on would be through a total collapse of organized society and therefore a descent into chaos. So they cling to any scheme, however unrealistic, that promises to preserve the society on which their lives and their worldview are dependent; and one suspects that the threat to their worldview is more important to them than the threat to their lives.

CHAPTER TWO

Why the Technological System Will Destroy Itself

> We were recently entertained by a naïve fable of the happy arrival of the 'end of history,' of the overflowing triumph of an all-democratic bliss; the ultimate global arrangement had supposedly been attained. But we all see and sense that something very different is coming, something new, and perhaps quite stern.
>
> —Aleksandr Solzhenitsyn[1]

> Power is in nature the essential measure of right.
>
> —Ralph Waldo Emerson[2]

I. Most of the arguments set forth elsewhere in this book are reasonably solid, but in the present chapter we go out on a limb both in making assumptions and in drawing inferences from them. We think our assumptions and inferences contain at least as much truth as they need to contain for the purpose of reaching certain probable conclusions about the future of human society, but we acknowledge that rational disagreement with our reasoning is possible. Two things, however, can be definitely asserted: first, that our assumptions and inferences are reasonably accurate as applied to the development up to the present time of large-scale, complex societies; second, that anyone who wants to understand the likely future development of modern society will have to give careful attention to problems of the kind that are raised by the arguments of this chapter.

Though we focus here on the processes of competition and natural selection[3] as they operate in complex societies, it is important to avoid confusing our viewpoint with the (now largely defunct) philosophy known as "Social Darwinism." Social Darwinism didn't merely call attention to natural selection as a factor in the development of societies; it also assumed that the winners in the contest of "survival of the fittest" were better, more desirable human beings than the losers were:

> [T]he competitive struggle of business was viewed as a contest in which the survivors were the 'fittest'—not merely as businessmen, but as champions of civilization itself. Hence businessmen transformed their sense of material superiority into a sense of moral and intellectual superiority. ... Social Darwinism became a means of excusing as well as explaining the competitive process from which some emerged with power and some were ground into poverty.[4]

Here our purpose is merely to describe the role that natural selection plays in the development of societies. We do not mean to suggest any favorable value-judgment concerning the winners in the struggle for power.

II. This chapter deals with self-propagating systems. By a self-propagating system (self-prop system for short) we mean a system that tends to promote its own survival and propagation. A system may propagate itself in either or both of two ways: The system may indefinitely increase its own size and/or power, or it may give rise to new systems that possess some of its own attributes.

The most obvious examples of self-propagating systems are biological organisms. *Groups* of biological organisms can also constitute self-prop systems; e.g., wolf packs or hives of honeybees. Particularly important for our purposes are self-prop systems that consist of groups of human beings. For example, nations, corporations, labor unions, churches, and political parties; also some groups that are not clearly delimited and lack formal organization, such as schools of thought, social networks, and subcultures. Just as wolf-packs and beehives are self-propagating without any conscious intention on the part of wolves or bees to propagate their packs or their hives, there is no reason why a human group cannot be self-propagating independently of any intention on the part of the individuals who comprise the group.

If A and B are systems of any kind (self-propagating or not), and if A is a functioning component of B, then we will call A a *subsystem* of B, and we will call B a *supersystem* of A. For example, in human hunting-and-gathering societies, nuclear families[5] belong to bands, and bands often are organized into tribes. Nuclear families, bands, and tribes are all self-prop systems. The nuclear family is a subsystem of the band, the band is a subsystem of the tribe, the tribe is a supersystem of each band that belongs to it, and each band is a supersystem of every nuclear family that belongs to that band. It is also true that each nuclear family is a subsystem of the tribe and that

the tribe is a supersystem of every nuclear family that belongs to a band that belongs to the tribe.

The principle of natural selection is operative not only in biology, but in any environment in which self-propagating systems are present. The principle can be stated roughly as follows:

Those self-propagating systems having the traits that best suit them to survive and propagate themselves tend to survive and propagate themselves better than other self-propagating systems.

This of course is an obvious tautology, so it tells us nothing new. But it can serve to call our attention to factors that we might otherwise overlook.

We are about to advance several propositions that are not tautologies. We can't prove these propositions, but they are intuitively plausible and they seem consistent with the observable behavior of self-propagating systems as represented by biological organisms and human (formal or informal) organizations. In short, we believe these propositions to be true, or as close to the truth as they need to be for present purposes.

Proposition 1. In any environment that is sufficiently rich, self-propagating systems will arise, and natural selection will lead to the evolution of self-propagating systems having increasingly complex, subtle, and sophisticated means of surviving and propagating themselves.

It needs to be emphasized that natural selection doesn't merely act in simple ways, as by making the legs of deer longer so that they can run faster or giving arctic mammals thicker coats of fur so that they can stay warm. Natural selection can also lead to the development of complex structures such as the human eye or heart, and to systems of far greater complexity that still are not fully understood, such as the human immune system or nervous system. We maintain that natural selection can lead to equally complex and subtle developments in self-prop systems consisting of human groups.

Natural selection operates relative to particular periods of time. Let's start at some given point in time that we can call Time Zero. Those self-prop systems that are most likely to survive (or have surviving progeny) at five years from Time Zero are those that are best suited to survive and propagate themselves (in competition[6] with other self-prop systems) during the five-year period following Time Zero. These will not necessarily be the same as those self-prop systems that, in the absence of competition during the five-year period, would be best suited to survive and propagate

themselves during the thirty years following Time Zero. Similarly, those systems best suited to survive competition during the first thirty years following Time Zero are not necessarily those that, in the absence of competition during the thirty-year period, would be best suited to survive and propagate themselves for two hundred years. And so forth.

For example, suppose a forested region is occupied by a number of small, rival kingdoms. Those kingdoms that clear the most land for agricultural use can plant more crops and therefore can support a larger population than other kingdoms. This gives them a military advantage over their rivals. If any kingdom restrains itself from excessive forest-clearance out of concern for the long-term consequences, then that kingdom places itself at a military disadvantage and is eliminated by the more powerful kingdoms. Thus the region comes to be dominated by kingdoms that cut down their forests recklessly. The resulting deforestation leads eventually to ecological disaster and therefore to the collapse of all the kingdoms. Here a trait that is advantageous or even indispensable for a kingdom's short-term survival—recklessness in cutting trees—leads in the long term to the demise of the same kingdom.[7]

This example illustrates the fact that, where a self-prop system exercises foresight,[8] in the sense that concern for its own long-term survival and propagation leads it to place limitations on its efforts for short-term survival and propagation, the system puts itself at a competitive disadvantage relative to those self-prop systems that pursue short-term survival and propagation without restraint. This leads us to

Proposition 2. In the short term, natural selection favors self-propagating systems that pursue their own short-term advantage with little or no regard for long-term consequences.

A corollary to Proposition 2 is

Proposition 3. Self-propagating subsystems of a given supersystem tend to become dependent on the supersystem and on the specific conditions that prevail within the supersystem.

This means that between the supersystem and its self-prop subsystems, there tends to develop a relationship of such a nature that, in the event of the destruction of the supersystem or of any drastic acceleration of

changes in the conditions prevailing within the supersystem, the subsystems can neither survive nor propagate themselves.

A self-prop system with sufficient foresight would make provision for its own or its descendants' survival in the event of the collapse or destabilization of the supersystem. But as long as the supersystem exists and remains more or less stable, natural selection favors those subsystems that take fullest advantage of the opportunities available within the supersystem, and disfavors those subsystems that "waste" some of their resources in preparing themselves to survive the eventual destabilization of the supersystem. Under these conditions, self-prop systems will tend very strongly to become incapable of surviving the destabilization of any supersystem to which they belong.

Like the other propositions put forward in this chapter, Proposition 3 has to be applied with a dose of common sense. If the supersystem in question is weak and loosely organized, or if it has no more than a modest effect on the conditions in which its subsystems exist, the subsystems may not become strongly dependent on the supersystem. Among hunter-gatherers in some (not all) environments, a nuclear family would be able to survive and propagate itself independently of the band to which it belongs. Because tribes of hunter-gatherers are loosely organized it seems certain that in most cases a hunting-and-gathering band would be able to survive independently of the tribe to which it belongs. Many labor unions might be able to survive the demise of a confederation of labor unions such as the AFL-CIO, because such an event might not fundamentally affect the conditions under which labor unions have to function. But labor unions could not survive the demise of modern industrial society, or even the demise merely of the legal and constitutional framework that makes it possible for labor unions as we know them to operate. Nor would many present-day business enterprises survive without modern industrial society. Domestic sheep, if deprived of human protection, would soon be killed off by predators. And so forth.

Clearly a system cannot be effectively organized for its own survival and propagation unless the different parts of the system can promptly communicate with one another and lend aid to one another. In order to operate effectively throughout a given geographical region, a self-prop system must be able to receive prompt information from, and take prompt action within, every part of the region.[9] Consequently,

Proposition 4. Problems of transportation and communication impose a limit on the size of the geographical region over which a self-prop system can extend its operations.

Human experience suggests:

Proposition 5. The most important and the only consistent limit on the size of the geographical regions over which self-propagating human groups extend their operations is the limit imposed by the available means of transportation and communication. In other words, while not all self-propagating human groups tend to extend their operations over a region of maximum size, natural selection tends to produce *some* self-propagating human groups that operate over regions approaching the maximum size allowed by the available means of transportation and communication.

Propositions 4 and 5 can be seen operating in human history. Primitive bands or tribes usually have territories that they "own," but these are relatively small because human feet are the only means of transportation available to these societies. However, primitives who have numerous horses and live in open country over which horses can travel freely, like the Plains Indians of North America, can hold much larger territories. Pre-industrial civilizations built empires that extended over vast distances, but these empires actively created, if they did not already have, relatively rapid means of transportation and communication.[10] Such empires grew to a certain geographical size, after which they stopped growing and, in many cases, became unstable; that is, they tended to break up into smaller political units. Though the hypothesis would be difficult to prove conclusively, it is at least highly plausible that these empires stopped growing and became unstable because they were at the limit of what was possible with the existing means of transportation and communication.

Today there is quick transportation and almost instant communication between any two parts of the world. Hence,

Proposition 6. In modern times, natural selection tends to produce some self-propagating human groups whose operations span the entire globe. Moreover, even if human beings are some day replaced by machines or other entities, natural selection will still tend to produce some self-propagating systems whose operations span the entire globe.

Current experience strongly confirms this proposition: We see global "superpowers," global corporations, global political movements, global religions, global criminal networks. Proposition 6, we argue, is not dependent on any particular traits of human beings but only on the general properties of self-prop systems, so there is no reason to doubt that the proposition will remain true if and when humans are replaced by other entities: As long as rapid, worldwide transportation and communication remain available, natural selection will tend to produce or maintain self-prop systems whose operations span the entire globe.

Let's refer to such systems as *global* self-prop systems. Instant worldwide communications are still a relatively new phenomenon and their full consequences have yet to be developed; in the future we can expect global self-prop systems to play an even more important role than they do today.

Proposition 7. Where (as today) problems of transportation and communication do not constitute effective limitations on the size of the geographical regions over which self-propagating systems operate, natural selection tends to create a world in which power is mostly concentrated in the possession of a relatively small number of global self-propagating systems.

This proposition too is suggested by human experience. But it's easy to see why the proposition should be true independently of anything specifically human: Among global self-prop systems, natural selection will favor those that have the greatest power; global or other large-scale self-prop systems that are weaker will tend to be eliminated or subjugated. Small-scale self-prop systems that are too numerous or too subtle to be noticed individually by the dominant global self-prop systems may retain more or less autonomy, but each of them will have influence only within some very limited sphere. It may be answered that a coalition of small-scale self-prop systems could challenge the global self-prop systems, but if small-scale self-prop systems organize themselves into a coalition having worldwide influence, then the coalition will itself be a global self-prop system.

We can speak of the "world-system," meaning all things that exist on Earth, together with the functional relations among them. The world-system probably should not be regarded as a self-prop system, but whether it is or not is irrelevant for present purposes.

To summarize, then, the world-system is approaching a condition in which it will be dominated by a relatively small number of extremely powerful global self-prop systems. These global systems will compete for power—as they must do in order to have any chance of survival—and they will compete for power *in the short term*, with little or no regard for long-term consequences (Proposition 2). Under these conditions, intuition tells us that desperate competition among the global self-prop systems will tear the world-system apart.

Let's try to formulate this intuition more clearly. For some hundreds of millions of years the terrestrial environment has had some degree of stability, in the sense that conditions on Earth, though variable, have remained within limits that have allowed the evolution of complex life-forms such as fishes, amphibians, reptiles, birds, and mammals. In the immediate future, all self-prop systems on this planet, including self-propagating human groups and any purely machine-based systems derived from them, will have evolved while conditions have remained within these limits, or at most within somewhat wider ones. By Proposition 3, the Earth's self-prop systems will have become dependent for their survival on the fact that conditions have remained within these limits. Large-scale self-prop human groups, as well as any purely machine-based self-prop systems, will be dependent also on conditions of more recent origin relating to the way the world-system is organized; for example, conditions relating to economic relationships. The rapidity with which these conditions change must remain within certain limits, else the self-prop systems will not survive.

This doesn't mean that all of the world's self-prop systems will die if future conditions, or the rapidity with which they change, slightly exceed some of these limits, but it does mean that if conditions go far enough beyond the limits many self-prop systems are likely to die, and if conditions ever vary wildly enough outside the limits, then, with near certainty, all of the world's more complex self-prop systems will die without progeny.

With several self-prop systems of global reach, armed with the colossal might of modern technology and competing for immediate power while exercising no restraint from concern for long-term consequences, it is extremely difficult to imagine that conditions on this planet will not be pushed far outside all earlier limits and batted around so erratically that for any of the Earth's more complex self-prop systems, including complex biological organisms, the chances of survival will approach zero.

Notice that the crucial new factor here is the availability of rapid, worldwide transportation and communication, as a consequence of which there exist global self-prop systems. There is another way of seeing that this situation will lead to radical disruption of the world-system. Students of industrial accidents know that a system is most likely to suffer a catastrophic breakdown when (i) the system is highly complex (meaning that small disruptions can produce unpredictable consequences), and (ii) tightly coupled (meaning that a breakdown in one part of the system spreads quickly to other parts).[11] The world-system has been highly complex for a long time. What is new is that the world-system is now tightly coupled. This is a result of the availability of rapid, worldwide transportation and communication, which makes it possible for a breakdown in any one part of the world-system to spread to all other parts. As technology progresses and globalization grows more pervasive, the world-system becomes ever more complex and more tightly coupled, so that a catastrophic breakdown has to be expected sooner or later.

It will perhaps be argued that destructive competition among global self-prop systems is not inevitable: A single global self-prop system might succeed in eliminating all of its competitors and thereafter dominate the world alone; or, because global self-prop systems would be relatively few in number, they could come to an agreement among themselves whereby they would refrain from all dangerous or destructive competition. However, while it is easy to talk about such an agreement, it is vastly more difficult actually to conclude one and enforce it. Just look: The world's leading powers today have not been able to agree on the elimination of war or of nuclear weapons, or on the limitation of emissions of carbon dioxide.

But let's be optimistic and assume that the world has come under the domination of a single, unified system, which may consist of a single global self-prop system victorious over all its rivals, or may be a composite of several global self-prop systems that have bound themselves together through an agreement that eliminates all destructive competition among them. The resulting "world peace" will be unstable for three separate reasons.

First, the world-system will still be highly complex and tightly coupled. Students of these matters recommend designing into industrial systems such safety features as "decoupling," that is, the introduction of "barriers" that prevent malfunctions in one part of a system from spreading to other parts.[12] Such measures may be feasible, at least in theory, in

any relatively limited subsystem of the world-system, such as a chemical factory, a nuclear power-plant, or a banking system, though Perrow[13] is not optimistic that even these limited systems will ever be consistently redesigned throughout our society to minimize the risk of breakdowns within the individual systems. In regard to the world-system as a whole, we noted above that it grows ever more complex and more tightly coupled. To reverse this process and "decouple" the world-system would require the design, implementation, and enforcement of an elaborate plan that would regulate in detail the political and economic development of the entire world. For reasons explained at length in Chapter One of this book, no such plan will ever be carried out successfully.

Second, prior to the arrival of "world peace" and for the sake of their own survival and propagation, the self-prop subsystems of a given global self-prop system (their supersystem) will have put aside, or at least moderated, their mutual conflicts in order to present a united front against any immediate external threats or challenges to the supersystem (which are also threats or challenges to themselves). In fact, the supersystem would never have been successful enough to become a global self-prop system if competition among its most powerful self-prop subsystems had not been moderated.

But once a global self-prop system has eliminated its competitors, or has entered into an agreement that frees it from dangerous competition from other global self-prop systems, there will no longer be any *immediate* external threat to induce unity or a moderation of conflict among the self-prop subsystems of the global self-prop system. In view of Proposition 2—which tells us that self-prop systems will compete with little regard for long-term consequences—unrestrained and therefore destructive competition will break out among the most powerful self-prop subsystems of the global self-prop system in question.[14]

Benjamin Franklin pointed out that "the great affairs of the world, the wars, revolutions, etc. are carried on and effected by parties." Each of the "parties," according to Franklin, is pursuing its own collective advantage, but "as soon as a party has gained its general point"—and therefore, presumably, no longer faces immediate conflict with an external adversary—"each member becomes intent upon his particular interest, which, thwarting others, breaks that party into divisions and occasions... confusion."[15]

History does generally confirm that when large human groups are not held together by any immediate external challenge, they tend strongly

to break up into factions that compete against one another with little regard for long-term consequences.[16] What we are arguing here is that this does not apply only to human groups, but expresses a tendency of self-propagating systems in general as they develop under the influence of natural selection. Thus, the tendency is independent of any flaws of character peculiar to human beings, and the tendency will persist even if humans are "cured" of their purported defects or (as many technophiles envision) are replaced by intelligent machines.

Third, let's nevertheless assume that the most powerful self-prop subsystems of the global self-prop systems will not begin to compete destructively when the external challenges to their supersystems have been removed. There yet remains another reason why the "world peace" that we've postulated will be unstable.

By Proposition 1, within the "peaceful" world-system new self-prop systems will arise that, under the influence of natural selection, will evolve increasingly subtle and sophisticated ways of evading recognition—or, once they are recognized, evading suppression—by the dominant global self-prop systems. By the same process that led to the evolution of global self-prop systems in the first place, new self-prop systems of greater and greater power will develop until some are powerful enough to challenge the existing global self-prop systems, whereupon destructive competition on a global scale will resume.

For the sake of clarity we have described the process in simplified form, as if a world-system relatively free of dangerous competition would *first* be established and afterward would be undone by new self-prop systems that would arise. But it's more likely that new self-prop systems will be arising all along to challenge the existing global self-prop systems, and will prevent the hypothesized "world peace" from ever being consolidated in the first place. In fact, we can see this happening before our eyes.[17] The most crudely obvious of the (relatively) new self-prop systems are those that challenge law and order head on, such as terrorist networks and hackers' groups,[18] as well as frankly criminal enterprises[19] that make no pretense of idealistic motives. Drug cartels have disrupted the normal course of political life in Mexico;[20] terrorists did the same in the United States with the attack of September 11, 2001, and they are continuing to do so, much more drastically, in countries like Iraq. Self-prop systems of the purely lawless type even have the potential to take control of important nations, as drug cartels arguably have come close to doing in Kenya.[21] Political "machines"

are not necessarily to be classified as criminal enterprises, but they ordinarily are more or less corrupt and tainted with illegal activity,[22] and they do challenge, or even take over, the "legitimate" structure of government.

Probably more significant for the present and the near future are emerging self-prop systems that use entirely legal methods, or at least keep their use of illegal methods to the minimum necessary for their purposes, and justify those methods with a claim, not totally outrageous, that their actions are necessary for the fulfillment of some widely accepted ideal such as "democracy," "social justice," "prosperity," "morality," or religious principles. In Israel, the ultra-orthodox sect—strictly legal—has become surprisingly powerful and seriously threatens to subvert the values and objectives of the hitherto secular state.[23] The great corporations, as we know them today, are a relatively recent (and perfectly legal) development; in the U.S. they date only from the latter half of the 19th century.[24] New corporations are continually being formed, and some grow powerful enough to challenge the older enterprises. During the last several decades many corporations have become international, and their power has begun to rival that of nation-states.[25]

A subordinate system that a government creates for its own purposes can turn into a self-prop system in its own right, and may even become dominant over the government. Thus, bureaucracies commonly are concerned more with their own power and security than with the fulfillment of their public responsibilities.[26] "[E]very... bureaucracy develops a tendency to preserve itself, to fatten itself parasitically. It also develops a tendency to become a power in and of itself, autonomous, over which governments lose all real control."[27] A nation's military establishment often acquires a considerable degree of autonomy and then supplants the government as the dominant political force in the country. Nowadays the undisguised military coup seems less popular than it once was, and politically sophisticated generals prefer to exercise their power behind the scenes while allowing a facade of civilian government to function. When the generals find it necessary to intervene overtly they claim to be acting in favor of "democracy" or some such ideal. This type of military dominance can be seen today in Pakistan and Egypt.[28]

Two competing, entirely legal self-prop systems that have arisen in the U.S. during the last few decades are the politically correct left and the dogmatic right (not to be confused with the liberals and conservatives of earlier times in America). This book is not the place to speculate about the

outcome of the struggle between these two forces; suffice it to say that in the long run their bitter conflict may do more to prevent the establishment of a lastingly peaceful world order than all the bombs of Al Qaeda and all the murders of the Mexican drug gangs.

People who find it difficult to face harsh realities will hope for a way to design and construct a world-system in which the processes that lead to destructive competition will not occur. But in Chapter One we've explained why no such project can ever be successfully carried out in practice. It may be objected that a mammal (or other complex biological organism) is a self-prop system that is a composite of millions of other self-prop systems, namely, the cells of its own body. Yet (unless and until the animal gets cancer) no destructive competition arises among cells or groups of cells within the animal's body. Instead, all the cells loyally serve the interests of the animal as a whole. Moreover, no external threat to the animal is necessary to keep the cells faithful to their duty. There is (it may be argued) no reason why the world-system could not be as well organized as the body of a mammal, so that no destructive competition would arise among its self-prop subsystems.

But the body of a mammal is a product of hundreds of millions of years of evolution through natural selection. This means that it has been created through a process of trial and error involving many millions of successive trials. If we suppose the duration of a generation to be a period of time Δ, those members of the first generation that contributed to the second generation by producing offspring were only those that passed the test of selection over time Δ. Those lineages[29] that survived to the third generation were only those that passed the test of selection over time 2Δ. Those lineages that survived to the fourth generation were only those that passed the test of selection over time 3Δ. And so forth. Those lineages that survived to the Nth generation were only those that passed the test of selection over the time-interval $(N-1)\Delta$ as well as the test of selection over every shorter time-interval. Though the foregoing explanation is grossly simplified, it shows that in order to have survived up to the present, a lineage of organisms has to have passed the test of selection many millions of times and over all time-intervals, short, medium, and long. To put it another way, the lineage has had to pass through a series of many millions of filters, each of which has allowed the passage only of those lineages that were "fittest" (in the Darwinian sense) to survive over time-intervals of widely varying length. It is only through this process that the body of a mammal has evolved, with its incredibly subtle and complex mechanisms

that promote the survival of the animal's lineage at short, medium, and long term. These mechanisms include those that prevent destructive competition among cells or groups of cells within the animal's body.

Also highly important is the large number of individuals in each generation of a biological organism. A species that has had a close brush with extinction may at some point have been reduced to a few thousand individuals, but any mammalian species, through almost all of its evolutionary history since its first appearance as a multi-celled organism, has had millions of individuals in each generation from among which the "fittest" have been selected.

But once self-propagating systems have attained global scale, two crucial differences emerge. The first difference is in the number of individuals from among which the "fittest" are selected. Self-prop systems sufficiently big and powerful to be plausible contenders for global dominance will probably number in the dozens, or possibly in the hundreds; they certainly will not number in the millions. With so few individuals from among which to select the "fittest," it seems safe to say that the process of natural selection will be inefficient in promoting the fitness for survival of the dominant global self-prop systems.[30] It should also be noted that among biological organisms, species that consist of a relatively small number of large individuals are more vulnerable to extinction than species that consist of a large number of small individuals.[31] Though the analogy between biological organisms and self-propagating systems of human beings is far from perfect, still the prospect for viability of a world-system based on the dominance of a few global self-prop systems does not look encouraging.

The second difference is that in the absence of rapid, worldwide transportation and communication, the breakdown or the destructive action of a small-scale self-prop system has only local repercussions. Outside the limited zone where such a self-prop system has been active there will be other self-prop systems among which the process of evolution through natural selection will continue. But where rapid, worldwide transportation and communication have led to the emergence of global self-prop systems, the breakdown or the destructive action of any one such system can shake the whole world-system. Consequently, in the process of trial and error that is evolution through natural selection, it is highly probable that after only a relatively small number of "trials" resulting in "errors," the world-system will break down or will be so severely disrupted that none of the world's

larger or more complex self-prop systems will be able to survive. Thus, for such self-prop systems, the trial-and-error process comes to an end; evolution through natural selection cannot continue long enough to create global self-prop systems possessing the subtle and sophisticated mechanisms that prevent destructive internal competition within complex biological organisms.

Meanwhile, fierce competition among global self-prop systems will have led to such drastic and rapid alterations in the Earth's climate, the composition of its atmosphere, the chemistry of its oceans, and so forth, that the effect on the biosphere will be *devastating*. In Part IV of the present chapter we will carry this line of inquiry further: We will argue that if the development of the technological world-system is allowed to proceed to its logical conclusion, then in all probability the Earth will be left a dead planet—a planet on which nothing will remain alive except, maybe, some of the simplest organisms—certain bacteria, algae, etc.—that are capable of surviving under extreme conditions.

* * *

The theory we've outlined here provides a plausible explanation for the so-called Fermi Paradox. It is believed that there should be numerous planets on which technologically advanced civilizations have evolved, and which are not so remote from us that we could not by this time have detected their radio transmissions. The Fermi Paradox consists in the fact that our astronomers have never yet been able to detect any radio signals that seem to have originated from an intelligent extraterrestrial source.[32]

According to Ray Kurzweil, one common explanation of the Fermi Paradox is "that a civilization may obliterate itself once it reaches radio capability." Kurzweil continues: "This explanation might be acceptable if we were talking about only a few such civilizations, but [if such civilizations have been numerous], it is not credible to believe that every one of them destroyed itself."[33] Kurzweil would be right if the self-destruction of a civilization were merely a matter of chance. But there is nothing implausible about the foregoing explanation of the Fermi Paradox if there is a process common to all technologically advanced civilizations that consistently leads them to self-destruction. Here we've been arguing that there *is* such a process.

III. Our discussion of self-propagating systems merely describes in general and abstract terms what we see going on all around us in concrete form: Organizations, movements, ideologies are locked in an unremitting struggle for power. Those that fail to compete successfully are eliminated or subjugated.[34] The struggle is almost exclusively for power in the short term;[35] the competitors show scant concern even for their own long-term survival,[36] let alone for the welfare of the human race or of the biosphere. That's why nuclear weapons have not been banned, emissions of carbon dioxide have not been reduced to a safe level, the Earth's resources are being exploited at an utterly reckless rate, and no limitation has been placed on the development of powerful but dangerous technologies.

The purpose of describing the process in general and abstract terms, as we've done here, is to show that what is happening to our world is not accidental; it is not the result of some chance conjunction of historical circumstances or of some flaw of character peculiar to human beings. Given the nature of self-propagating systems in general, the destructive process that we see today is made inevitable by a combination of two factors: the colossal power of modern technology and the availability of rapid transportation and communication between any two parts of the world.

Recognition of this may help us to avoid wasting time on naïve efforts to solve our current problems. For example, on efforts to teach people to conserve energy and resources. Such efforts accomplish nothing whatever.

It seems amazing that those who advocate energy conservation haven't noticed what happens: As soon as some energy is freed up by conservation, the technological world-system gobbles it up and demands more. No matter how much energy is provided, the system always expands rapidly until it is using all available energy, and then it demands still more. The same is true of other resources. The technological world-system infallibly expands until it reaches a limit imposed by an insufficiency of resources, and then it tries to push beyond that limit regardless of consequences.

This is explained by the theory of self-propagating systems: Those organizations (or other self-prop systems) that least allow respect for the environment to interfere with their pursuit of power here and now, tend to acquire more power than those that limit their pursuit of power from concern about what will happen to our environment fifty years from now, or even ten years. (Proposition 2.) Thus, through a process of natural selection, the world comes to be dominated by organizations that make maximum

possible use of all available resources to augment their own power without regard to long-term consequences.

Environmental do-gooders may answer that if the public has been persuaded to take environmental concerns seriously it will be disadvantageous in terms of natural selection for an organization to abuse the environment, because citizens can offer resistance to environmentally reckless organizations. For example, people might refuse to buy products manufactured by companies that are environmentally destructive. However, human behavior and human attitudes can be manipulated. Environmental damage can be shielded, up to a point, from public scrutiny; with the help of public-relations firms, a corporation can persuade people that it is environmentally responsible; advertising and marketing techniques can give people such an itch to possess a corporation's products that few individuals will refuse to buy them from concern for the environment; computer games, electronic social networking, and other mechanisms of escape keep people absorbed in hedonistic pursuits so that they don't have time for environmental worries. More importantly, people are made to see themselves as utterly dependent on the products and services provided by the corporations. Because people have to earn money to buy the products and services on which they are dependent, they need jobs. Economic growth is necessary for the creation of jobs, therefore people accept environmental damage when it is portrayed as a price that must be paid for economic growth. Nationalism too is brought into play both by corporations and by governments. Citizens are made to feel that outside forces are threatening: "The Chinese will get ahead of us if we don't increase our rate of economic growth. Al Qaeda will blow us up if we don't improve our technology and our weaponry fast enough."

These are some of the tools that organizations use to counter environmentalists' efforts to arouse public concern; similar tools can help to blunt other forms of resistance to the organizations' pursuit of power. The organizations that are most successful in blunting public resistance to their pursuit of power tend to increase their power more rapidly than organizations that are less successful in blunting public resistance. Thus, through a process of natural selection, there evolve organizations that possess more and more sophisticated and effective means of blunting public resistance to their power-seeking activities, whatever the degree of environmental damage involved. Because such organizations have great wealth at their disposal, environmentalists do not have the resources to compete with them in the propaganda war.[37]

This is the reason, or an important part of the reason,[38] why attempts to teach people to be environmentally responsible have done so little to slow the destruction of our environment. And again—note well—the process we've described is not contingent on any accidental set of circumstances or on any defect in human character. Given the availability of advanced technology, the process inevitably accompanies the action of natural selection upon self-propagating systems.

IV. People who know something about the biological past of the Earth and see what the technological system is doing to our planet speak of a "sixth mass extinction," which they think is now in progress. Apparently they envision something like the extinction event at the end of the Cretaceous period, when the dinosaurs died out: They assume that many kinds of complex organisms will survive, and the species that become extinct will be replaced by complex organisms of a different kind, just as the dinosaurs were replaced by mammals.[39] Here we argue that this (relatively) comforting assumption is unjustified, because the extinction event that has now begun is of a fundamentally different kind than all of the previous mass extinctions that have occurred on this planet.

So far as is known, each previous mass extinction has resulted from the arrival of some one major disruptive factor, or at most perhaps two or three such factors.[40] Thus, it is widely believed that the dinosaurs were wiped out by the impact of an asteroid that kicked up colossal clouds of dust. These obstructed the light of the Sun, cooling the planet and interfering with photosynthesis.[41] Presumably, mammals were better able to survive under these conditions than the dinosaurs were. There are paleontologists who argue that some species of dinosaurs survived for as long as a million years after the impact of the asteroid, hence, that the asteroid alone was not enough to account for all the extinctions that occurred at the end of the Cretaceous. The dinosaurs, they maintain, must have been finished off by some other factor—perhaps a prolonged period of unusual volcanic activity that continued to darken the atmosphere.[42] In any case, no one claims that more than a very few such factors—all of them simple, blind forces—were involved in the extinction of the dinosaurs or in other, previous mass extinctions.

In contrast to these earlier events, the extinction event that is now under way is not the work of a single blind force or even of two or three or ten such forces. Instead, it is the work of a multiplicity of intelligent, living

forces. These are human organizations, self-prop systems that assiduously pursue their own short-term advantage without scruple and without concern for long-term consequences. In doing so they leave no stone unturned, no possibility untested, no avenue unexplored in their unremitting drive for power.

This can be compared to what happens in biology: In the course of evolution organisms develop means of exploiting every opportunity, utilizing every resource, and invading every corner where life is possible at all. Scientists have been surprised to discover living organisms surviving, and in some cases even thriving, in locations where there seemingly is nothing on which they could support themselves. There are communities of bacteria, worms, molluscs, and crustaceans that flourish near hydrothermal vents so deep in the ocean that no sunlight whatever can reach them and the downward drift of nutrients from the surface is entirely inadequate. Some of these creatures actually use hydrogen sulfide—to most organisms a deadly poison—as a source of energy.[43] Elsewhere there are bacteria that live a hundred feet beneath the seafloor in an environment almost completely devoid of nutrients.[44] Other bacteria nourish themselves on nothing more than "bare rock and water" at depths of up to 1.7 miles beneath the surface of the continents.[45] Everyone knows that there are organisms called parasites that find a home within other organisms, but many people may be surprised to learn that there are parasites that live in or on other parasites; in fact, there are parasites of parasites of parasites of parasites.[46] (One recalls the lines of Samuel Butler: "All great fleas have little fleas to bite 'em, and these have smaller still, and so ad infinitum."[47])

Needless to say, there do exist limits to the conditions under which life can survive. E.g., it has been questioned whether there can ever be a "general mechanism by which any conventional protein could be made stable and functional at temperatures above 100° C."[48] Yet some organisms do live at temperatures as high as 113° C., though none is known to survive and reproduce at a higher temperature.[49]

Like biological organisms, the world's leading human self-prop systems exploit every opportunity, utilize every resource, and invade every corner where they can find anything that will be of use to them in their endless search for power. And as technology advances, more and more of what formerly seemed useless turns out to be useful after all, so that more and more resources are extracted, more and more corners are invaded, and more and more destructive consequences follow. For example:

When humans made no use of metals other than iron meteorites, or nuggets of gold or copper that might be found by chance, the only mining activity consisted in the digging-out of rocks such as flint or obsidian that were used to make tools. But once people learned to utilize metals on a large scale the destructive effects of mining became evident. Certainly by the 16th century, and probably much earlier, it was clearly recognized that mining poisoned streams and rivers and ruined the countryside where it occurred.[50] But in those days mining affected only a few districts where there were known deposits of relatively high-grade ore, and people who lived elsewhere probably never gave a thought to the damage caused by the extraction of metals. In recent times, however, more sophisticated means of detecting deposits of valuable minerals have been devised,[51] as well as methods for utilizing low-grade ores that formerly were left undisturbed because the extraction of metal from them was too difficult to be profitable.[52] As a result of these developments mining activities have continually invaded new areas, and severe environmental damage has followed.[53] It is said that the water flowing out of many old mining sites is so heavily contaminated that it will have to be treated "forever" to remove the toxic metals.[54] Of course, it won't be treated forever, and when the treatment stops, rivers will be irremediably poisoned.

Mining activities are invading still other areas because new uses have been found for elements that several decades ago had few if any practical applications. Most of the "rare earth" elements were of limited utility before the middle of the 20th century, but they are now considered indispensable for many purposes.[55] The rare earth neodymium, for example, is needed in large quantities for the lightweight permanent magnets used in wind turbines.[56] Unfortunately, most deposits of rare earths contain radioactive thorium, hence the mining of these metals generates radioactive waste.[57]

In quantitative terms, at least, uranium was of little importance prior to the development of atomic weapons and nuclear power-plants; it is now mined on a large scale. Relatively small amounts of arsenic were no doubt sufficient for medical applications and for the manufacture of rat poison and artists' pigments, but today the element is used in large quantities, e.g., to harden lead alloys and as a wood preservative. Fence posts treated with cupric arsenate are extremely common in the western United States[58]—there must be many millions of them. These posts last far longer than untreated ones, but they are not indestructible. They will eventually disintegrate, and when they do the arsenic they contain will spread through

our environment. Large-scale mining and utilization of other toxic and/or carcinogenic elements such as mercury, lead, and cadmium are likewise spreading them everywhere. Cleanup efforts are so puny in relation to the magnitude of the problem that they are little better than a joke.

The extraction and processing of other resources have followed similar trajectories. Petroleum, long known as a substance that seeped from the ground in places, originally had few uses. But during the 19th century it was discovered that kerosene, distilled from petroleum, could be burned for illumination in lamps, and for that purpose was superior to whale oil. As a result of this discovery the first "oil well" was drilled in Pennsylvania in 1859, and drilling elsewhere soon followed. The petroleum industry at that time was based mainly on kerosene; there was little demand for other petroleum products, such as natural gas and gasoline. But natural gas later came to be used on a large scale for heating, cooking, and illumination, and after the advent of the gasoline-powered automobile around the beginning of the 20th century the petroleum industry won a position of central importance in the economy of the industrialized world. From that time on, new uses for petroleum products have continually been discovered. In addition, processes have been developed for transforming hydrocarbons so that formerly useless petroleum distillates can be turned into useful products, and oil deposits that, because of their undesirable characteristics (e.g., high sulfur content), might not have been worth extracting, can now be made valuable.[59]

Oil companies have come up with ever more sophisticated methods for locating petroleum deposits, and this is one of the reasons why estimates of "known oil reserves" keep increasing. But the estimates also increase because previously inaccessible petroleum is made accessible by new technologies that make it profitable to extract petroleum (including natural gas) from ever more difficult sources. Drillers penetrate deeper and deeper into the Earth's crust, and are even able to drill horizontally; "fracking" (hydraulic fracturing) releases new reserves of oil, and especially gas, from shale rock; techniques are under development for utilizing the vast deposits of methane hydrate found on the ocean floor.[60] As a result of all these technical advances more and more of the Earth's surface is raped by the petroleum industry, and for humans who get in the way it's just tough luck. Fracking, for example, is not a benign technique;[61] at least one woman who was affected by it felt that her life had been ruined.[62]

Anyone who thinks the technological world-system is ever going to stop burning fossil fuels (while any are left) is dreaming.[63] But whether or not the system ever renounces such fuels, other destructive sources of energy will be utilized. Nuclear power-plants generate radioactive waste; no provably safe way of disposing of such waste has yet been indentified,[64] and the world's leading self-prop systems aren't even trying very hard to find a permanent home for the accumulating radioactive garbage.[65] Of course, the self-prop systems need energy for the maintenance of their power here and now, whereas radioactive waste represents only a danger for the future and, as we've emphasized, natural selection favors self-prop systems that compete for power in the present with little regard for long-term consequences. So nuclear power-plants continue to be built, while the problem of dealing with their burned-out fuel is largely neglected. In fact, the problem of nuclear waste is on track to become totally unmanageable because, instead of a few of the big, old-style reactors, numerous small ones ("mini-nukes") will soon be built,[66] so that every little town can have its own nuclear power-plant.[67] With the big, old-style reactors at least the radioactive wastes have been concentrated at a relatively small number of sites, but with numerous mini-nukes scattered over the world radioactive wastes will be everywhere. One would have to be extraordinarily naïve, or else gifted with a remarkable capacity for self-deception, to believe that each little two-bit burg is going to handle its nuclear waste responsibly. In practice, much of the radioactive material will escape into the environment.

"Green" energy sources aren't going to wean the system from its dependence on fossil fuels and nuclear power. But even if they did, green energy sources don't look so green when one examines them closely. "There's no free lunch when it comes to meeting our energy needs," says the director of the Natural Resources Defense Council's land program. "To get energy, we need to do things that will have impacts."[68]

The construction of wind farms entails the creation of radioactive waste because, as noted earlier, the lightweight permanent magnets in wind turbines require the rare-earth element neodymium. In addition, wind farms kill numerous birds, which fly into the "propellers" of the turbines.[69] Large numbers of new wind-farms are planned in the U.S., China, and presumably other countries as well,[70] and a likely result will be the extermination of many species of birds. "Shawn Smallwood, a Davis, Calif. ecologist and researcher [said:] 'Just the sheer numbers of turbines we're talking about—we're going to be killing so many raptors until there are no

more raptors in my opinion.'"[71] Raptors play an important role in controlling rodent populations, so when the raptors are gone more pesticides will have to be used to kill rodents.

The United States has been developing a military robot called the EATR that relies on green energy inasmuch as it "fuels itself by eating whatever biomass"—a renewable resource—"it finds around it."[72] But you can imagine the devastation that would result from a war fought by armies of robots that gobble for fuel whatever biomass they find. And if the biomass-gobbling technology is ever adapted to civilian use, it will endanger every living thing that can be used to satisfy the system's always ravenous appetite for energy.

But solar energy is harmless, right? Well, not quite, for solar panels compete with biological organisms for the light of the Sun. Let's recall what we pointed out earlier, that the technological system invariably expands until it is using all available energy, and then it demands more. If fossil fuels and nuclear power aren't going to satisfy the system's ever-growing demand for energy,[73] then solar panels will be placed wherever sunlight can be collected. This means, inter alia, that solar panels will progressively invade the habitats of living things, depriving them of sunlight and therefore killing most of them. This is not speculation—the process has already begun. There are plans "to create huge solar energy plants in the deserts of California, Arizona, Nevada and elsewhere in the West. ... The open deserts are prime habitat for threatened plants and animals... ."[74] According to Janine Blaeloch, executive director of the Western Lands Project, "These [solar energy] plants will introduce a huge amount of damage to our public land and habitat."[75] And remember, the system's appetite for energy is insatiable: In all probability, the development of solar energy will expand until there is no habitat left for living organisms other than the domesticated crops that the system grows to satisfy its own needs.

But there is much more to be taken into account. Notwithstanding the folly of Ray Kurzweil's fantasies of a future technological utopia, he is absolutely right about some things. He quite correctly points out that in thinking about the future most people make two errors: (i) They "consider the transformations that will result from a single trend [or from several specified trends that are already evident] in today's world as if nothing else will change."[76] And (ii) they "intuitively assume that the current rate of progress will continue for future periods," neglecting the unending *acceleration* of technological development.[77] In order to avoid falling into these

errors ourselves, we have to remember that the assaults on the terrestrial environment that are known and observable *now* will not in future be the only ones. Just as the use of petroleum distillates in internal combustion engines was undreamed of before 1860 at the earliest,[78] just as the use of uranium as fuel was undreamed of before the discovery of nuclear fission in 1938–39,[79] just as most uses of the rare earths were undreamed of until recent decades, so there will be future uses of resources, future ways of exploiting the environment, future corners for the technological system to invade that at present are still undreamed of. In attempting to estimate the coming damage to our environment, we can't just project into the future the effects of currently known causes of environmental harm; we have to assume that new causes of environmental harm, which no one today can even imagine, will emerge in the future. Moreover, we have to remember that the growth of technology, and with it the exacerbation of the harm that technology does to our environment, will accelerate ever more rapidly over the coming decades. All this being taken into consideration we have to conclude that, in all probability, little or nothing on our planet will much longer remain free of gross disruption by the technological system.

Most people take our atmosphere for granted, as if Providence had decreed once and for all that air should consist of 78% nitrogen, 21% oxygen, and 1% other gasses. In reality our atmosphere in its present form was created, and is still maintained, through the action of living things.[80] Originally the atmosphere contained far more carbon dioxide than it does today,[81] and we may wonder why the greenhouse effect didn't make the Earth too hot for life ever to begin. The answer, presumably, is that the Sun at that time radiated much less energy than it does now.[82] In any case, it was the biosphere that took the excess carbon dioxide out of the air:

> As primitive bacteria and cyanobacteria had, through photosynthesis or related life processes, captured atmospheric carbon, depositing it on the seafloor, carbon was removed from the atmosphere. ...
>
> Cyanobacteria also were the first organisms to utilize water as a source of electrons and hydrogen in the photosynthetic process. Free oxygen was released as a result of this reaction and began to accumulate in the atmosphere, allowing oxygen-dependent life-forms to evolve.[83]

Biological processes also affect the amount of methane in the atmosphere,[84] and let's remember that methane has a far more powerful effect in promoting global warming than carbon dioxide does.[85] On the other hand, some experts claim that 3.7 billion years ago certain microbes generated large quantities of methane that, instead of warming the planet, *cooled* it by creating clouds that reflected sunlight back into space. Supposedly, the Earth narrowly escaped becoming too cold for the survival of life.[86] However that may be, it's evident that a really radical disruption of the biosphere could cause an atmospheric disaster: a lack of oxygen, a concentration of toxic gasses such as methane or ammonia, a deficiency or an excess of carbon dioxide that would make our planet too cold or too hot to support life.

At present, the most imminent danger seems to be the possible overheating of the Earth through an excess in the atmosphere of carbon dioxide and perhaps methane.[87] Just how hot might the Earth get if humans continue to burn fossil fuels? About 56 million years ago there was a massive increase in the amount of carbon dioxide in our atmosphere, estimated to be roughly equal to the amount that would be added now if humans burned off "all the Earth's reserves of coal, oil, and natural gas."[88] The result was a radical change in the terrestrial environment, including a 9° F (5° C) rise in average temperatures[89] and the flooding of substantial parts of the continents.[90] There weren't any mass extinctions,[91] but this should give us no sense of security about the future of the biosphere, because we can't assume that the effect of adding a given amount of carbon dioxide to the atmosphere today will be the same as what it was 56 million years ago.[92]

The carbon dioxide added to the atmosphere 56 million years ago was probably added relatively slowly, over thousands of years.[93] If humans now burn off all petroleum reserves they undoubtedly will do so in a small fraction of that time, hence living organisms will have little opportunity to adapt to their changed environment. Moreover, the presumed equivalence of the amount of carbon dioxide being released today with what was released 56 million years ago is based on an estimate of the Earth's fossil-fuel reserves that almost certainly is far too low, for new and unexpected deposits of oil and natural gas are continually being discovered and estimates of the reserves are correspondingly raised. Account must also be taken of other ways in which humans add carbon dioxide to the atmosphere. For example, vast quantities of limestone are "burned" to make lime and

Portland cement: $CaCO_3 \rightarrow CaO + CO_2$. It's not clear how much of the carbon dioxide (CO_2) is eventually recaptured by the lime (CaO) or how long that takes.

But even if the Earth warms no more than it did 56 million years ago, the consequences will be unacceptable to the powerful classes in our society. The world's dominant self-prop systems will therefore resort to "geo-engineering," that is, to a system of artificial manipulation of the atmosphere designed to keep temperatures within acceptable limits.[94] The implementation of geo-engineering will entail immediate, desperate risks,[95] and even if no immediate disaster ensues the eventual consequences very likely will be catastrophic.[96]

All this relates merely to the greenhouse effect. To it we have to add numerous other factors that tend to disrupt the biosphere. As we've seen, living organisms will be progressively robbed of sunlight by continual expansion of the system's solar-energy installations. There will be no limit to the contamination of our environment with radioactive waste, with toxic elements such as lead, arsenic, mercury, and cadmium,[97] and with a variety of poisonous chemical compounds.[98] There will be oil spills from time to time, since the safety measures taken by the petroleum industry are never quite sufficient,[99] and in some parts of the world the industry doesn't even make any serious effort to prevent spills.[100] The phasing-out of chlorofluorocarbons is supposed to allow the ozone layer, which protects living organisms from the Sun's ultraviolet radiation, to recover from the damage it has already suffered, but the recovery (if indeed it occurs) will take decades,[101] and meanwhile the damage that ultraviolet radiation does to the biosphere has to be taken into account.

The foregoing effects of the technological system's activities have long been recognized as harmful, but there can be little doubt that many effects not recognized as harmful today will turn out to be harmful tomorrow, for this has often happened in the past.[102] "It has been estimated that the modern sediment loads of the rivers draining into the Atlantic Ocean may be four to five times greater than the prehistoric rates because of the effects of human activity."[103] How, in the long run, will this affect life in the ocean? Does anyone know? Genes from genetically engineered organisms can, and almost certainly will, be passed to wild plants or animals.[104] What will be the ultimate consequences for the biosphere of this "genetic pollution?" No one knows. Even if these and other effects turn out to be harmless when considered separately and individually, all of the "harmless" effects of the

system's activities taken together will surely bring about major alterations in the biosphere.

Here we've done no more than scratch the surface. A full assessment of the ways in which the functioning of the technological world-system currently threatens to disrupt the biosphere would require a vast amount of research, and the results would fill several volumes. Will all of these factors add up to a disruption of the biosphere sufficient to prevent it from performing its function in maintaining the present composition of our atmosphere? It's anybody's guess. But that's not all: Let's not forget that the technological system is still in its infancy in comparison with what it will become over the next several decades. At a rapidly accelerating pace and in ways that no one has yet imagined, we can expect the world's leading self-prop systems to find more and more opportunities to exploit, more and more resources to extract, more and more corners to invade, until little or nothing on this planet is left free of technological intervention—intervention that will be carried out in a mad quest for immediate increments of power and without regard to long-term consequences. In the opinion of this writer, there is a strong probability that if the biosphere is not destroyed outright it will at least be rendered incapable of maintaining any reasonable approximation to the present composition of our atmosphere, without which none of the more complex forms of life on this planet will be able to survive.

One plausible outcome might be that the Earth will end up like the planet Venus:

> It has been suggested that the climate of the Earth could be ultimately unstable. Addition of gasses capable of trapping heat could accelerate the release of H_2O and raise the temperature to a point where the oceans would evaporate.... Some believe that such changes may have occurred on Venus.... Venus is a striking example of the importance of the greenhouse effect. Its atmosphere contains a large concentration of CO_2 [= carbon dioxide].... [T]he Venusian surface temperature is much hotter than the Earth's—about 780° K [507° C or 944° F]—in spite of the fact that Venus absorbs less energy from the Sun because of its ubiquitous cloud cover... ."[105]

To sum up the thesis of this part of the present chapter: If the development of the technological world-system is allowed to proceed to its logical conclusion, it will in all probability leave the Earth uninhabitable for all of

the more complex forms of life as we know them today. This admittedly remains unproven; it represents the author's personal opinion. But the facts and arguments offered here are enough at least to show that the opinion can be entertained as a plausible hypothesis, and that it would be rash to assume without further proof that the denouement we are facing will be no worse than earlier extinction events in the Earth's history.

What can be taken as a near certainty is that—*if* the development of the technological system is allowed to proceed to its logical conclusion—the outcome for the biosphere will be thoroughly devastating; if it isn't worse than the extinction event at the end of the Cretaceous when the dinosaurs disappeared, it can't be much better; if any humans are left alive, they will be very few; and the technological system itself will be dead.

But note the reservation in the foregoing statement: "*if* the development of the technological system is allowed to proceed to its logical conclusion," The author has occasionally been asked: "If the system is going to destroy itself anyway, then why bother to overthrow it?" The answer, of course, is that if the technological system were eliminated *now* a great deal could still be saved. The longer the system is allowed to continue its development, the worse will be the outcome for the biosphere and for the human race, and the greater will be the risk that the Earth will be left a dead planet.[106]

V. *The techies' wet-dreams.* There is a current of thought that appears to be carrying many technophiles out of the realm of science and into that of science fiction.[107] For convenience, let's refer to those who ride this current as "the techies." The current runs through several channels; not all techies think alike. What they have in common is that they take highly speculative ideas about the future of technology as near certainties, and on that basis predict the arrival within the next few decades of a kind of technological utopia. Some of the techies' fantasies are astonishingly grandiose. For example, Ray Kurzweil believes that "[w]ithin a matter of centuries, human intelligence will have re-engineered and saturated all the matter in the universe."[108] The writing of Kevin Kelly, another techie, is often so vague as to border on the meaningless, but he *seems* to say much the same thing that Kurzweil does about human conquest of the universe: "The universe is mostly empty because it is waiting to be filled with the products of life and the technium. . . ."[109] "The technium" is Kelly's name for the technological world-system that humans have created here on Earth.[110]

Most versions of the technological utopia include immortality (at least for techies) among their other marvels. The immortality to which the techies believe themselves destined is conceived in any one of three forms:

(i) the indefinite preservation of the living human body as it exists today;[111]

(ii) the merging of humans with machines and the indefinite survival of the resulting man-machine hybrids;[112]

(iii) the "uploading" of minds from human brains into robots or computers, after which the uploaded minds are to live forever within the machines.[113]

Of course, if the technological world-system is going to collapse in the not-too-distant future, as we've argued it must, then no one is going to achieve immortality in any form. But even assuming that we're wrong and that the technological world-system will survive indefinitely, the techies' dream of an unlimited life-span is still illusory. We need not doubt that it will be technically feasible in the future to keep a human body, or a man-machine hybrid, alive indefinitely. It is seriously to be doubted that it will ever be feasible to "upload" a human brain into electronic form with sufficient accuracy so that the uploaded entity can reasonably be regarded as a functioning duplicate of the original brain. Nevertheless, we will assume in what follows that each of the solutions (i), (ii), and (iii) will become technically feasible at some time within the next several decades.

It is an index of the techies' self-deception that they habitually assume that anything they consider desirable will actually be done when it becomes technically feasible. Of course, there are lots of wonderful things that already are and for a long time have been technically feasible, but don't get done. Intelligent people have said again and again: "How easily men could make things much better than they are—if they only all tried together!"[114] But people never do "all try together," because the principle of natural selection guarantees that self-prop systems will act mainly for their own survival and propagation in competition with other self-prop systems, and will not sacrifice competitive advantages for the achievement of philanthropic goals.[115]

Because immortality, as the techies conceive it, will be technically feasible, the techies take it for granted that some system to which they belong can and will keep them alive indefinitely, or provide them with what they need to keep themselves alive. Today it would no doubt be technically feasible to provide everyone in the world with everything that he or she

needs in the way of food, clothing, shelter, protection from violence, and what by present standards is considered adequate medical care—if only all of the world's more important self-propagating systems would devote themselves unreservedly to that task. But that never happens, because the self-prop systems are occupied primarily with the endless struggle for power and therefore act philanthropically only when it is to their advantage to do so. That's why billions of people in the world today suffer from malnutrition, or are exposed to violence, or lack what is considered adequate medical care.

In view of all this, it is patently absurd to suppose that the technological world-system is ever going to provide seven billion human beings with everything they need to stay alive indefinitely. If the projected immortality were possible at all, it could only be for some tiny subset of the seven billion—an elite minority. Some techies acknowledge this.[116] One has to suspect that a great many more recognize it but refrain from acknowledging it openly, for it is obviously imprudent to tell the public that immortality will be for an elite minority only and that ordinary people will be left out.

The techies of course assume that they themselves will be included in the elite minority that supposedly will be kept alive indefinitely. What they find convenient to overlook is that self-prop systems, in the long run, will take care of human beings—even members of the elite—only to the extent that it is to the systems' advantage to take care of them. When they are no longer useful to the dominant self-prop systems, humans—elite or not—will be eliminated. In order to survive, humans not only will have to be useful; they will have to be more useful in relation to the cost of maintaining them—in other words, they will have to provide a better cost-versus-benefit balance—than any non-human substitutes. This is a tall order, for humans are far more costly to maintain than machines are.[117]

It will be answered that many self-prop systems—governments, corporations, labor unions, etc.—do take care of numerous individuals who are utterly useless to them: old people, people with severe mental or physical disabilities, even criminals serving life sentences. But this is only because the systems in question still need the services of the majority of people in order to function. Humans have been endowed by evolution with feelings of compassion, because hunting-and-gathering bands thrive best when their members show consideration for one another and help one another.[118] As long as self-prop systems still need people, it would be to the systems' disadvantage to offend the compassionate feelings of the useful majority through ruthless treatment of the useless minority. More important

than compassion, however, is the self-interest of human individuals: People would bitterly resent any system to which they belonged if they believed that when they grew old, or if they became disabled, they would be thrown on the trash-heap.

But when *all* people have become useless, self-prop systems will find no advantage in taking care of anyone. The techies themselves insist that machines will soon surpass humans in intelligence.[119] When that happens, people will be superfluous and natural selection will favor systems that eliminate them—if not abruptly, then in a series of stages so that the risk of rebellion will be minimized.

Even though the technological world-system still needs large numbers of people for the present, there are now more superfluous humans than there have been in the past because technology has replaced people in many jobs and is making inroads even into occupations formerly thought to require human intelligence.[120] Consequently, under the pressure of economic competition, the world's dominant self-prop systems are already allowing a certain degree of callousness to creep into their treatment of superfluous individuals. In the United States and Europe, pensions and other benefits for retired, disabled, unemployed, and other unproductive persons are being substantially reduced;[121] at least in the U.S., poverty is increasing;[122] and these facts may well indicate the general trend of the future, though there will doubtless be ups and downs.

It's important to understand that in order to make people superfluous, machines will not have to surpass them in general intelligence but only in certain specialized kinds of intelligence. For example, the machines will not have to create or understand art, music, or literature, they will not need the ability to carry on an intelligent, non-technical conversation (the "Turing test"[123]), they will not have to exercise tact or understand human nature, because these skills will have no application if humans are to be eliminated anyway. To make humans superfluous, the machines will only need to outperform them in making the technical decisions that have to be made for the purpose of promoting the short-term survival and propagation of the dominant self-prop systems. So, even without going as far as the techies themselves do in assuming intelligence on the part of future machines, we still have to conclude that humans will become obsolete. Immortality in the form (i)—the indefinite preservation of the human body as it exits today—is highly improbable.

The techies of course will argue that even if the human body and brain as we know them become obsolete, immortality in the form (ii) can still be achieved: Man-machine hybrids will permanently retain their usefulness, because by linking themselves with ever-more-powerful machines human beings (or what is left of them) will be able to remain competitive with pure machines.[124]

But man-machine hybrids will retain a biological component derived from human beings only as long as the human-derived biological component remains useful. When purely artificial components become available that provide a better cost-versus-benefit balance than human-derived biological components do, the latter will be discarded and the man-machine hybrids will lose their human aspect to become wholly artificial.[125] Even if the human-derived biological components are retained they will be purged, step by step, of the human qualities that detract from their usefulness. The self-prop systems to which the man-machine hybrids belong will have no need for such human weaknesses as love, compassion, ethical feelings, esthetic appreciation, or desire for freedom. Human emotions in general will get in the way of the self-prop systems' utilization of the man-machine hybrids, so if the latter are to remain competitive they will have to be altered to remove their human emotions and replace these with other motivating forces. In short, even in the unlikely event that some biological remnants of the human race are preserved in the form of man-machine hybrids, these will be transformed into something totally alien to human beings as we know them today.

The same applies to the hypothesized survival of human minds in "uploaded" form inside machines. The uploaded minds will not be tolerated indefinitely unless they remain useful (that is, more useful than any substitutes not derived from human beings), and in order to remain useful they will have to be transformed until they no longer have anything in common with the human minds that exist today.

Some techies may consider this acceptable. But their dream of immortality is illusory nonetheless. Competition for survival among entities derived from human beings (whether man-machine hybrids, purely artificial entities evolved from such hybrids, or human minds uploaded into machines), as well as competition between human-derived entities and those machines or other entities that are not derived from human beings, will lead to the elimination of all but some minute percentage of all the entities involved. This has nothing to do with any specific traits of human

beings or of their machines; it is a general principle of evolution through natural selection. Look at biological evolution: Of all the species that have ever existed on Earth, only some tiny percentage have direct descendants that are still alive today.[126] On the basis of this principle alone, and even discounting everything else we've said in this chapter, the chances that any given techie will survive indefinitely are minute.

The techies may answer that even if almost all biological species are eliminated *eventually*, many species survive for thousands or millions of years, so maybe techies too can survive for thousands or millions of years. But when large, rapid changes occur in the environment of biological species, both the rate of appearance of new species and the rate of extinction of existing species are greatly increased.[127] Technological progress constantly accelerates, and techies like Ray Kurzweil insist that it will soon become virtually explosive;[128] consequently, changes come more and more rapidly, everything happens faster and faster, competition among self-prop systems becomes more and more intense, and as the process gathers speed the losers in the struggle for survival will be eliminated ever more quickly. So, on the basis of the techies' own beliefs about the exponential acceleration of technological development, it's safe to say that the life-expectancies of human-derived entities, such as man-machine hybrids and human minds uploaded into machines, will actually be quite short. The seven-hundred-year or thousand-year life-span to which some techies aspire[129] is nothing but a pipe-dream.

Singularity University, which we discussed in Part VI of Chapter One of this book, purportedly was created to help technophiles "guide research" and "shape the advances" so that technology would "improve society." We pointed out that Singularity University served in practice to promote the interests of technology-orientated businessmen, and we expressed doubt that the majority of technophiles fully believed in the drivel about "shaping the advances" to "improve society." It does seem, however, that *the techies*—the subset of the technophiles that we specified at the beginning of this Part V of the present chapter—are entirely sincere in their belief that organizations like Singularity University[130] will help them to "shape the advances" of technology and keep the technological society on the road to a utopian future. A utopian future will have to exclude the competitive processes that would deprive the techies of their thousand-year life-span. But we showed in Chapter One that the development of our society can never be subject to rational control: The techies won't be able to "shape

the advances" of technology, guide the course of technological progress, or exclude the intense competition that will eliminate nearly all techies in short order.

In view of everything we've said up to this point, and in view moreover of the fact that the techies' vision of the future is based on pure speculation and is unsupported by evidence,[131] one has to ask how they can believe in that vision. Some techies, e.g., Kurzweil, do concede a slight degree of uncertainty as to whether their expectations for the future will be realized,[132] but this seems to be no more than a sop that they throw to the skeptics, something they have to concede in order to avoid making themselves too obviously ridiculous in the eyes of rational people. Despite their pro forma admission of uncertainty, it's clear that most techies confidently expect to live for many centuries, if not forever, in a world that will be in some vaguely defined sense a utopia.[133] Thus Kurzweil states flatly: "We will be able to live as long as we want... ."[134] He adds no qualifiers—no "probably," no "if things turn out as expected." His whole book reveals a man intoxicated with a vision of the future in which, as an immortal machine, he will participate in the conquest of the universe. In fact, Kurzweil and other techies are living in a fantasy world.

The techies' belief-system can best be explained as a religious phenomenon,[135] to which we may give the name "Technianity." It's true that Technianity at this point is not strictly speaking a religion, because it has not yet developed anything resembling a uniform body of doctrine; the techies' beliefs are widely varied.[136] In this respect Technianity probably resembles the inceptive stages of many other religions. Nevertheless, Technianity already has the earmarks of an apocalyptic and millenarian cult: In most versions it anticipates a cataclysmic event, the Singularity,[137] which is the point at which technological progress is supposed to become so rapid as to resemble an explosion. This is analogous to the Judgment Day[138] of Christian mythology or the Revolution of Marxist mythology. The cataclysmic event is supposed to be followed by the arrival of techno-utopia (analogous to the Kingdom of God or the Worker's Paradise). Technianity has a favored minority—the Elect—consisting of the techies (equivalent to the True Believers of Christianity or the Proletariat of the Marxists[139]). The Elect of Technianity, like that of Christianity, is destined to Eternal Life; though this element is missing from Marxism.[140]

Historically, millenarian cults have tended to emerge at "times of great social change or crisis."[141] This suggests that the techies' beliefs reflect

not a genuine confidence in technology, but rather their own anxieties about the future of the technological society—anxieties from which they try to escape by creating a quasi-religious myth.