Preface

This book is dedicated to Dr. Jens Junghans, who for many years has been concerned with the problem of industrial society's totally unsustainable relationship with nature. I am fortunate to have had frequent opportunities to discuss this issue with Dr. Junghans, and I am convinced of it's importance. With his permission, I am using some of his ideas in this book, and adding a few of my own.

To a large extent, this book is a history of the relationship between humankind and the natural world, and to a lesser extent it attempts to predict the long-term consequences of our flawed relationship with nature. In other words, a study of human folly in the past and present is used as a springboard for making predictions about the future problems.

It is notoriously difficult to make correct predictions about the distant future. In modern human society, the breakneck speed of scientific discovery and technological innovation makes long-term predictions especially difficult. Furthermore, people tend to care only about those things that will occur only during their own lifetimes. For these reasons, among others, most economists do not look more than a few decades into the future.

Nevertheless, I believe that the distant future of the balance or unbalance between humankind and nature has a great importance. Certainly, if we look far enough ahead, it will be beyond our own lifetimes, but we have a great responsibility to our descendants.

Looking at the very distant future simplifies some issues. For example, one can argue about the size of reserves of coal, oil and metals, but it is certain that in the very long run, such non-renewable resources will become rare and extremely expensive.

Viewed on a time scale of many thousands of years rather than tens or hundreds, global population growth and fossil fuel use appear in an ex-

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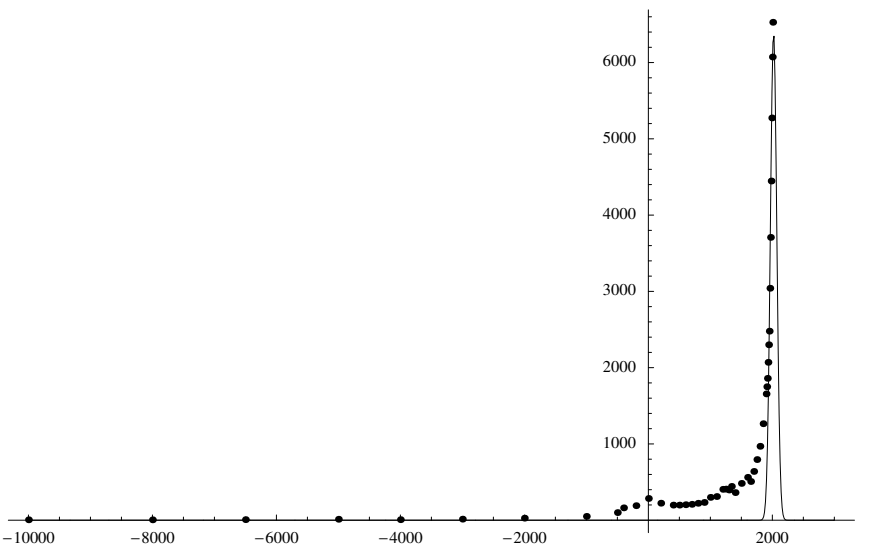
tremely clear and dramatic perspective. Forty thousand years ago, at the time when human cultural development began to accelerate, there were at most only 4-5 million or so members of our species on the earth. They lived as hunter-gatherers, and were not conspicuously different from other animals. Then, suddenly, a series of cultural achievements allowed humans to increase enormously in numbers and to populate all parts of the earth. The invention of agriculture was followed by the inventions of writing, paper, and printing. Knowledge, giving humans mastery over the natural world, began to accumulate with astonishing rapidity. New advances in technique allowed further growth in population.



This figure shows the estimated human population as a function of time during the last 12,000 years. The dots are the US Census Bureau's population estimates in millions, while the solid curve shows the approximate time-dependence of fossil fuel use. When they are plotted together, the sudden, explosive growth of human population, and the spike-like graph of fossil fuel use, are seen to be simultaneous (and causally connected).

Plotted on an evolutionary timescale, human population growth appears as an extraordinarily abrupt upward surge. On the same time scale, a graph of fossil fuel use is a tall, narrow spike, rising from zero to a high value, and then falling to nothing again, all in the space of a few centuries. Looking at the figure above, we can infer that fossil fuel use has been one of the causes of the explosive upsurge of global population.

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One can calculate from the size of coal, oil and natural gas reserves that the era of fossil fuel use will end within a few hundred years. Must the graph of human population also fall abruptly at the same time? This is one of the questions that we will address.

The Industrial Revolution (when both fossil fuel use and explosive population growth began in earnest) was the result of the rapid accumulation of human knowledge following the invention of printing with movable type. In Europe, the rise of science in the 17th and 18th centuries produced a period of great optimism. The Utopian predictions of the Marquis de Condorcet, William Godwin and Adam Smith (Chapter 1) are typical of this period. In the early 19th century, however, the realities of persistent poverty led Thomas Robert Malthus and David Ricardo (Chapter 2) to a much darker picture of the human condition - so dark, in fact, that it led Thomas Carlyle to call economics "the Dismal Science".

Since the time of Adam Smith, industrial society has thundered forward under the banner of unrestricted economic growth that Smith was the first to raise. Today, however, as we approach limits to growth imposed by the exhaustion of non-renewable resources and by the finite carrying capacity of the global environment, we should perhaps listen also to the warning voice of Malthus. He pointed out that throughout almost all of human history, the growth of population has been held in check by strong forces. These are sometimes preventative checks, such as late marriage, moral restraint or contraception (which he called "vice"); but when the preventative checks fail, the grim Malthusian forces - famine, disease and war - come into play.

The successes of science and technology have allowed dramatic growth of both population and economic activity during the last few centuries, but the limits to both types of growth are rapidly approaching. It is therefore relevant to ask what level of global population and what level of economic activity can be comfortably sustained in the distant future.

A stable future world must necessarily be a war-free world, since weapons are likely to become even more destructive in the future than they are today. A world war fought with such weapons would destroy civilization. Thus our descendants will also be faced with the great task of abolishing the institution of war. They will not only need to stabilize and eventually reduce global population and economic activity; they will also need to develop political and ethical maturity to match their scientific progress.

In arguing against the optimistic Utopia of William Godwin, Malthus says, "The great error under which Mr. Godwin labours throughout his

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whole work is the attributing of almost all of the vices and misery that prevail in civil society to human institutions. Political regulations and established administration of property are, with him, the fruitful sources of all evil, the hotbeds of all the crimes that degrade mankind. Were this really the true state of the case, it would not seem a completely hopeless task to remove evil completely from the world; and reason seems to be the proper and adequate instrument for effecting so great a purpose. But the truth is, that although human institutions appear to be, and often are, the obvious and obtrusive causes of much misery in human society, they are, in reality, light and superficial in comparison with those deeper-seated causes of evil which result from the laws of nature and the passions of mankind."

In the passage just quoted, Malthus is talking about population growth: The passions of mankind drive us to excessive reproduction, while the laws of nature limit our food supply. Hence the poverty and misery that we observe in many parts of the world. However, his words could equally well be applied to the problem of war: The laws of nature make nuclear weapons possible, and the passions of mankind drive us to use them.

Thus we are faced with the question of whether human reason can lead us to a stable and happy world in the distant future, or whether the laws of nature and the passions of mankind will make impossible all of the future Utopias that one can visualize.

At the time when Malthus was writing, Darwin's theory of evolution had not yet appeared, but today, with our knowledge of evolutionary theory, we must ask how "the passions of mankind" (i.e. human emotional nature) can be so counterproductive. At first sight, one would think that evolutionary forces would make humans well-adapted their environment and way of life in much the same way that swallows are adapted to catching gnats or storks adapted to a diet of frogs. The answer to this seeming paradox lies in the extreme slowness of genetic evolution compared with the rapidity of human cultural evolution.

Before cultural evolution began to revolutionize the lifestyle of our species, the "passions of mankind" were undoubtedly necessary for the survival of our remote ancestors. However, the rapid and constantly accelerating rate of cultural evolution has changed the conditions of human life beyond recognition during the last forty thousand years. Genetically we are very similar to our hunter-gatherer ancestors, but their world has been replaced by a world of quantum theory, space travel, gene splicing and information technology. Thus human emotions, which have remained relatively unchanged, are often inappropriate for our present way of life. In

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the future, the problem of anachronistic emotions is certain to become even more acute. This book will discuss the educational measures that will be needed to overwrite the destructive passions of mankind.

If we carefully examine cultural evolution, we can see that it has two parts, one of which changes more quickly than the other. The extremely rapidly-moving part is science and technology. Our political and social institutions change more slowly, although their progress is still very rapid compared with genetic change. Because of the different rates of change of these two facets of cultural evolution, our political and social institutions often fail to harmonize with the innovations of science and technology. For example, in a world of thermonuclear weapons, the absolutely sovereign nation-state has become a dangerous anachronism - yet it persists because of institutional inertia. It takes quite a bit of time for laws, constitutions, schoolbooks, thought-patterns and political structures to adjust to new realities. In the meantime, technology roars ahead, with a rate of change so great that it threatens to shake society to pieces.

Thus modern human society experiences two types of tensions, both of which will probably become more acute in the future:

(1) Tensions produced by the fact that our emotions do not harmonize with our present way of life.
(2) Tensions produced by the disharmony between our technology and our social and political institutions.

How can we find the path to a stable and peaceful future society? Can we take some steps along this path today? Can industrial society achieve equilibrium and harmony with nature, as well as harmony among all the humans that inhabit the earth? Let us explore these questions together.

Acknowledgments

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