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Saving the environment: Science and social action

D'Andrade, Patricia, Ph.D.

City University of New York, 1993

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SAVING THE ENVIRONMENT:
SCIENCE AND SOCIAL ACTION

by
Patricia D'Andrade

A dissertation submitted to the Graduate Faculty
in Sociology in partial fulfillment of the requirements
for the degree of Doctor of Philosophy,
The City University of New York

1993

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PATRICIA D'ANDRADE

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This manuscript has been read and accepted for the Graduate Faculty in Sociology in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

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ABSTRACT

SAVING THE ENVIRONMENT: SCIENCE AND SOCIAL ACTION

by Patricia D'Andrade

Adviser: Professor Lindsey Churchill

This dissertation analyzes environmental arguments for their stance toward science. It is a sociology of knowledge investigation of arguments made primarily by environmental scientists in the United States in the 1960s and 70s.

The environmental crisis puts science in question but at the same time looks to science for information and solutions. Thus, science is a center of contention around which arguments develop and oppositions are established. Science is beginning to take the place of political thought in providing legitimating concepts for arguments intended to effect social change. Major environmental books and articles by American authors of the 1960s and 70s judge postwar science and technology from the opposed positions of "science skeptic" and "science truster."

The guiding theory for this research is from Karl

Mannheim, especially from his interpretive, cultural analysis of conservative thought, in which he uses the term "style of thought" for a coherent argument intended to persuade toward a course of social action. Thought styles develop oppositionally around a common center of contention during periods of great change; conservative and liberal thought styles developed with the rise of modern politics.

This study concludes that there is an environmental style of thought organized around questions about science in society, that its current form originated among biologists, and that it is the main argument to have introduced skepticism of science to the public.

The influence of science imparts to politics a new identity which does not accord with older political concepts. A "conceptual shift" is occurring, in Western societies, in legitimating arguments for social and political action. This shift is from arguments that rely on political-frame concepts of a just society, to arguments that rely on scientific-frame concepts of truth and factuality, and it is particularly evident in the environmental debate.

Works analyzed: Silent Spring, Science and Survival, The Population Bomb, "The Tragedy of the Commons," "The Historical Roots of Our Ecologic Crisis," Post-Scarcity Anarchism, The Closing Circle, Only One Earth, The Limits to Growth.

ACKNOWLEDGMENTS

Much more goes into a dissertation than happens at the comparatively late stages of research and writing, so I shall be roughly chronological in acknowledging those who have influenced me along the way.

My thanks to George Fischer for his initial help in acquainting me with the CUNY Sociology Department and his subsequent observations on the process of producing a dissertation. Bill Kornblum encouraged my application to the program and gave me good advice about being a student in it.

The influence of Michael Landmann on my investigations of knowledge, through his course, The Philosophical Foundations of the Social Sciences, given at The New School Graduate Faculty in 1983, is far greater than my brief experience with him would suggest. To him I owe my introduction to the great body of German social thought, and a conviction that social theory is relevant to our present condition. His own love of knowledge gave impetus to my decision to begin graduate study.

My committee allowed me the freedom of intellectual

questioning that I sought, and I thank them for their confidence in me. Stanley Aronowitz has contributed a great deal to my years of graduate study through courses, conversations, opportunities to work, general good humor, and most of all, through his intellectual grasp of sociological theory. Roz Bologh gave me detailed, thoughtful and useful criticism, not only on this dissertation, but on all the work I have done with her. My interest in the problems addressed by the dissertation began in independent study with Lindsey Churchill, who then became an unfailingly calm guide through the dissertation process, one who intuited my purpose, ignored my divagations, and never imposed his sociological understanding on mine.

Bob Alford made a thorough and concerned critique of my early efforts at framing the dissertation and set a scholarly standard which I hope I have not forgotten. Bob Horn encouraged my research for the dissertation and fed me current information on environmental activities. My thanks, too, to Pat Gorman for helping me sort through my categories while holding on to my overall design.

David Johnson's unfailing support made it all possible, and without him this work would not have been begun, let alone completed. David gave me the gift of time.

* * *

Finally, there are others, unknown to me and now gone, who helped me through this dissertation. In the course of writing it, I took up birdwatching -- as a distraction, as a way to get out of the house and away from the desk, as a way to get exercise and distance. Since I live in Manhattan, my recourse was to Central Park. My birding began in late October, went through the winter months, and began to develop into a passion in the spring. I have often been a walker in the woods and wished that I could identify what I saw and heard. I now found that learning the names and habits of one group of beings in this natural world opened up that world as having a depth and design I had previously felt but had only the smallest knowledge of. On my walks I entered a world of beauty, complexity, vitality, and spaciousness and minutiae combined.

This very different activity from writing the dissertation was sustaining and restorative. That I was able to pursue it less than half an hour's walk from my apartment, in the most densely populated part of the biggest city in the United States is a tribute to those who had the vision and determination to put a people's park the size of the Kingdom of Monaco in the center of a real-estate hungry urban island. Central Park is a magnet for migrating birds, for overwintering birds, for any bird that has somehow come to the city and is looking for lakes and streams, woods and

fields, hills and hollows. There is greater variety in its small compass than can be found in many square miles by birders in many other parts of the country. The park's layout was intentionally and cleverly designed to produce the illusion of greater distance and more space than its objective measurements indicate. It is landscaped with a variety of plants and trees that provide changing texture and color across the seasons. I feel real gratitude to the makers of this park, and I would like to express it here, approximately one hundred years after its beginnings. They had an appreciation of natural beauty, and they passed on to us both a place where that beauty could be felt and the civic value that a great city should provide such a space for all its citizens.

Not all of my forays into the park were thoroughly enjoyable. On many trips, thickets and small streams were choked with trash. Plastic bags and deflated balloons hung in ugly tatters from splendid trees unmatched in any of the unprotected woodlands of the countryside outside of New York City. Homeless people on the edge of desperation occupy the park's rustic, small, pergola-like open wooden shelters; they huddle in the arched passageways that take the park walker under the vehicular roads; they camp without shelter or fire in the Ramble, the park's most wooded and least groomed section (and the area most favored by its birds).

Muggings and gay-bashings in the part of the park I frequented were reported to me by acquaintances. Economic recession has caused cutbacks in park maintenance and cleanup, and heavy use of the park has thus subjected it to environmental degradation, destroying both wildlife habitat and places where people can find the lawns, gardens, and relief from city concrete and grime that they hope for.

The park, then, is not separate from the social world. In this way it is a metaphor for our time, when Nature itself is no longer a place apart. The natural world everywhere bears our mark and suffers a combination of overuse, neglect, and misuse. And yet it keeps on living and thrusting and burgeoning, cycling through its sequences of life, death, and new life as if it would all go on forever. Whether that forever happens is now up to us.

To all who have ever tried to speak for Nature, my appreciation.

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INTRODUCTION

Knowledge and Society:

The Case of Science and the Environment

Knowledge is so integral to society that it often functions as unnoticed background. Like the physical environment that we organize for our purposes, knowledge is something that we make and then make use of but that we only occasionally wonder about. We are aware that knowledge changes in content and quantity, but are not alert to changes in its form. The exception, in our modern society, is that we distinguish between scientific and pre-scientific knowledge. Yet even this change is widely considered to be mostly a matter of knowing more. For the sociology of knowledge, however, it is a matter of knowing differently.

Science is now central to our concepts of knowledge, and as a practice, has a powerful influence on economy and politics. Today, 'science' is achieving equal status with 'the state' as a conceptual focus for public discourse, and as a source of legitimation for action on social and political issues.

This conceptual focus is evident in sociological analysis, political debate, and philosophical argument about social change and public policy issues. These debates are directed as much toward the presence of science and technology as they are toward the presence of government and law. This is especially evident in the debate over what to do about environmental problems.

The environmental movement in the United States includes a wide variety of organizations and groups acting to defend the environment against degradation: against pollution, against overuse, destruction of ecosystem, extinction of species, elimination of wilderness, nuclear threat, global warming, and a host of other damages. The common term for the movement to preserve the environment, change our use of it, and establish ecological awareness is "environmentalism"; some activists now say that environmentalism is a failed and co-opted movement of the past, which has to be replaced by an "ecological" movement.

Despite its diversity, it can be argued that the environmental movement generally shares a view of science that is skeptical of its benefits while relying on its findings. This does not mean that the environmental movement is against science; it must depend upon science in many of its efforts to convince the world to change. What environmentalism does challenge, however, is the traditional

notion of how science should 'be' in society. Within environmental arguments is a skepticism about the benefits of science, a critique of the direction of its efforts, and sometimes the claim that it should be in service to specific societal goals.

The focus on science occurs not only in the environmental movement, but throughout society in the United States. We often think of our publicly-debated problems as political issues, but many of them are now also science issues. Much of the argument about problem issues -- environment, medical technology, nuclear power, and other areas of conflict mentioned earlier -- centers on the role of science in society. This concern is not always immediately apparent, and showing that it exists is what the following chapters are about. The orienting theory for my analysis comes from the sociology of knowledge developed by Karl Mannheim, which traces bodies of thought to their social origins, and relates different styles of argument to central social concerns.

Argument of the Dissertation

Mannheim's analysis of conservative political thought serves as a model for this study,¹ in which I argue three

main points:

1) Science -- both as practice and as knowledge -- has become central in debates over social action in the United States. The centrality of science is shown by a developing polarization over how science should 'be' in society, with those who trust science to take a direction that benefits people and planet on one side, and those who are skeptical of its uses on the other. Both sides accept the validity of scientific knowledge; it is how science is used and where it is going that is a source of division. The polarization develops because a threat exists to perceived interests, namely the threat to environment and human health (and ultimately, survivability), which comes from the power of scientific developments to harm, whether with atomic bombs or with pesticides.

2) The sociology of knowledge developed by Karl Mannheim provides a method that points to this centrality and a model for analyzing it. The arguments about science and its social, economic and political aspects develop as Mannheim said styles of thought develop, in his work on conservative thought. A style of thought

- develops in a context of large-scale, "oriented" change

- is a response to polarizing event(s)
- solves a key epistemological problem
- is motivated by a basic social intention
- requires an effective group to sustain it.

3) There is a particular response to science in arguments about the environment, a coherent environmental style of thought, which is where the critique of science, or the doubt about how it is pursued and used, is especially evident.

My argument is parallel to much of Mannheim's analysis of conservatism, by which:

1) The centrality of politics is shown in polarized arguments over the relationship of citizen and state, and over the philosophical basis of politics (i.e., over an autonomous sphere of politics, not tied to religious justification or theories of divine right). The polarization develops because of the threat to old landed interests stemming from the French Revolution and Enlightenment thought.

2) The arguments develop (as in #2, above) contextually: they are responses to polarizing events; take

epistemological positions; grow out of social intentions;
are carried by identifiable groups.

3) There is a conservative style of thought which is where the critique of the autonomous political sphere/abstract natural law/Enlightenment thought is especially evident.

In addition, I propose that the broader context of the centrality of science shown in the appearance of an environmental style of thought is a conceptual shift in how we understand and explain social action. The dominance of science as a form of knowledge leads me to believe that we are shifting from the use of a political framework of explanation for what society requires and does to a scientific framework. Science has become basic to the legitimation of social action, and politics can no longer base its arguments only on a philosophy of social contract. "Individual and science" have become as relevant to our personal and political lives as "citizen and state." This evaluation of the influence of scientific knowledge cannot be fully developed in this dissertation, but it contributes to my discussions of knowledge, worldview, and science-based argument.

Applying Mannheim

In his study of conservatism, Mannheim, while doing empirical research, also proposed "style of thought" as a category of cultural and political analysis. A style of thought is a coherent argument intended to persuade toward a course of social action. It has its roots in the social experience of a particular social group, and has a characteristic content and expression. Opposing styles of thought, representing opposed social groups, have a common center of contention. Using these and other categories, Mannheim argued that a major discourse became organized around political events and concepts in early 19th-century Germany, resulting in conservative and liberal (progressive) styles of thought which supported different social agendas.

Mannheim's analysis serves as a model for my examination of environmental arguments organized around post-World War II scientific and technological developments. Though Mannheim's analysis of conservative thought is generally considered his best empirical work, it has not been taken as an example to follow. There have been many commentaries on the theoretical aspects of Mannheim's work, but few attempts to apply his method, which is thought to provide little more than a general injunction to seek interests in arguments. This dissertation is the first

application of Mannheim's theory and method of "style of thought" since his own application of it, in the 1920s, to 19th-century conservatism.

The dissertation analyzes a subset of environmental arguments for their stance toward science, primarily those arguments made by scientists themselves. It is a sociology of knowledge investigation into the content and social context of these particular environmental arguments that developed in the United States in the 1960s and 70s.

This research attempts to identify for environmental thinking the elements that Mannheim identifies in the development of conservative thought. Mannheim is not explicit about all these elements; I have abstracted them from his analysis. Such a specification of contributing elements has not been done before. I use it experimentally as specifying the requisites for the development of any style of thought, not just conservative thought. These style-of-thought elements provide the outline for the analysis made in the dissertation.

Mannheim is credited as a founder of the sociology of knowledge, but is often criticized for failure to make it either sufficiently critical or sufficiently operational. This dissertation argues that the application of Mannheim's method for analyzing public discourse, which he did retrospectively, can be done in the present to alert us to

emerging changes in societal priorities which accompany the use of and belief in certain types of knowledge.

What the Dissertation Is and Is Not

Because the sociology of knowledge is less familiar in American sociology than the sociology of social movements, and because the empirical reference point of this study can be considered a social movement, it may help to explain what the dissertation is and what it is not.

It is not a history of the environmental movement in the United States, an attitudes survey, or a demographic survey of who environmentalists are. It is not a political study of environmental groups, or an account of where they stand on different single issues, e.g., whales, nuclear power, forests, water pollution, or global warming. It is not a score sheet of successes and failures of the environmental movement. In short, it is not a sociological or political analysis of a social movement.

It is an analysis of how arguments and intellectual positions have as their conceptual magnet a dominant concern spread across many social issues over a significant period of time -- in this case: How should science be in society? How can it balance autonomy and responsibility?

It is a sociology of knowledge -- an analysis of how the legitimacy of institutionalized science as guide to truth and action becomes an issue in various areas, the example here being environment. It is a look at a piece of the process whereby great change means an intensification of polarization in interests and ideologies.

The Organization of the Material

I begin with an introduction to the study of knowledge and to science as a distinct type of knowledge. I next propose that scientific knowledge also provides an orienting framework for us now, one that is replacing an older framework of political concepts when it comes to social action. I then discuss some organizing concepts and theoretical issues related to Mannheim's sociology of knowledge. A detailed study of Mannheim's analysis of conservative thought follows. I go on to consider what is involved in using Mannheim's work as a model for analyzing a style of thought where science is the focus of attention.

Part II reviews important environmental books by American authors of the 1960s and 70s, most of whom had scientific training. Their views of science are evaluated, and I take a brief look at some of the events that were the

social context of these environmental arguments. The conclusion relates these works to Mannheim's sociology of knowledge.

NOTES TO THE INTRODUCTION

1. Two versions of Mannheim's study are now in print: "Conservative Thought" in From Karl Mannheim, ed. Kurt H. Wolff (New York: Oxford University Press, 1971), and Conservatism, ed. David Kettler, Volker Meja, and Nico Stehr (London/Boston: Routledge & Kegan Paul, 1986). See note appended to Chapter Four.

PART ICHAPTER ONE

SCIENCE IN SOCIETY

Science as a Dominant Form of Knowledge

Knowledge is something that we make, as well as something that we discover. This means that it bears the imprint of our making. For example, we discovered centuries ago that the earth revolves around the sun. From that analytical discovery by Copernicus, and its later supporting theory and mathematical explication, we have built knowledge with different purposes. The mechanics of planetary motion, at first an enterprise of theory, has, centuries later, become integrated into national space programs with both military and commercial applications. From the starting point of celestial mechanics there have also developed abstruse theories of the origin of the universe, with no "practical" applications. And in still another direction, the discovery of the solar system has been developed into a heliocentric astrology, an updated version of the old earth-centered astrology.

A given discovery, then, can be elaborated into a

variety of different knowledges, with different assumptions and intentions. The same discovery can even be the basis of contradictory claims to knowledge -- as is the case with an astrology revised but still based on assumptions inimical to today's astronomy, which takes the Copernican revolution as exclusively its own special heritage.

We can see a historical development of knowledge, as discoveries, theories and applications build one upon the other. So we have gone from precise observation of the skies (which, however, allowed us to conceive of the earth as the center of the universe), to mathematical theories which shifted the center of observed planetary motions, to the combination of physics, astronomy, engineering, and massive-scale bureaucratic administration which enables us to put space shuttles into orbit, and to place human beings on the surface of the moon. The shift from an earth-centered to a sun-centered view of our world is generally considered to be a useful point for marking the beginning of the scientific era, although many other factors contributed to the rise of a scientific approach to the world.

It is commonplace to contrast science with religion, and sometimes the comparison between the medieval world and the modern one is made, for purposes of simplification, in these opposed terms.¹ But the development of a scientifically oriented society has taken centuries, as did

the development of a society organized to meet the requirements of the Christian faith. Christianity was, of course, not the only organizing principle of medieval society, any more than science is the only organizing principle of ours, but just as we devote substantial resources to the maintenance and growth of scientific endeavors, the medieval world devoted substantial resources to the maintenance and growth of the Christian faith.

The forms of knowledge -- religious and scientific -- of these different eras can be called dominant in their pervasiveness and in their political support or connection with ruling power. In its pervasiveness, a dominant form of knowledge shapes our understanding of the world.

Understanding is not wholly individual; it is shaped by society through education, example, precept, law, custom. It is not necessary to be a scientist to have a science-influenced understanding of how the world works.² Perhaps the influence of forms of knowledge is clearer in the case of religion, because we are less immersed in it as a society than we are in science, and can view it from some distance. Many Americans who do not actively attend religious services nonetheless identify themselves as Christian, Jewish, Muslim, or of some other faith, and hold beliefs about life, morality, and sanctity that come from the tradition of that faith. It is not necessary to be a church-goer to have a

religion-influenced understanding of life.

Dominance of a form of knowledge has nothing to do with its intrinsic worth (if that can be judged). It also is not directly related to power over the conscience or aspirations of the individual, where, for example, religion may eclipse science. It is not pervasiveness alone that makes for dominance, for just to take the case of the United States, religion (as religiousness) remains pervasive, but in different spheres of action from science. It is the connection of a form of knowledge with the educational, political, commercial, governmental, and legal institutions of society that give it dominance.

It has taken time for science to become central to our lives. Western society did not immediately give up religion for science as central to institutions and knowledge, and in the intellectual debate over secularization, it moved from an emphasis on religion as the guiding force of society to an emphasis on politics, nationhood, and statecraft, on contractual agreements as the basis of what we now call political and economic stability. It did not go directly to an emphasis on science. This change became particularly evident with the Enlightenment,³ and our (liberal-progressive) idealization of society as a joint effort toward equality and justice dates to that time. That 18th-century political understanding of society, however, based

on a concept of what I call a "just society", no longer seems to us to be an explanation or description of society. It is now seen as more inspirational than realistic; it continues to inspire the desire for democracy, but does not provide an accurate picture of its 20th-century form. The just society is one for which justice is considered both a cause of its coming into being (since the social contract is to assure liberty and equality, and the lack of these is injustice) and an end to be pursued; justice is to be assured by a combination of rational interest, natural rights, and the rule of law.⁴

From Just Society to Scientific Society

But we are now shifting from a classically political attitude in Western society to a scientific attitude, from the notion of a just society to the notion of a scientific society. We still do politics, just as we still have religion, but just as we once justified politics with religious arguments, we now justify it with scientific ones. The justification we have used since the rise of the nation state and the development of political science -- that of a philosophy of the relation between citizen and state -- is giving way to a reliance on scientific (or putatively

scientific) validation for legitimacy. The shift from politics to science could also be called the shift from social contract to science. That is a more specific way of naming it.

The contrast between politics and science is not as clear to us as the contrast between science and religion, because the shift is still occurring, and we have less historical distance on the difference, and thus less experience with the effects of the change. Also, we often ignore contrast if it is not outright opposition. On many points, science and religion are opposed, but science and politics, though contrasting, are not so often clearly in opposition. One very important point of opposition between science and politics, however, is that in principle science is directed toward the universal and impersonal; in the interests of truth it must adopt disinterest, and this has been expected to be the practice of scientists themselves. Politics, on the other hand, is the negotiation of particular interests; even if it is theoretically aimed at the general interest, it is rarely expected of politicians that they act disinterestedly. Politicians have constituencies; scientists have principles to answer to.

The Scientific Attitude

What is the scientific attitude? There are many enumerations of the characteristics of scientific endeavor, but for the purpose of studying forms of knowledge as competing claims to truth, the primary characteristic of science is that it has as its goal objective knowledge: knowledge that is so whether or not we like it, agree with it, or believe it. Scientific knowledge is supposed to be uncolored by personal input and to be the same for everybody. It is usually described as requiring observation, experiment, and the possibility of being either verified or falsified by test, especially a test by persons other than the one originally making the claim.⁵ Over the past generation or so, considerable debate has developed over whether science meets its own criteria for objectivity. One part of the critique of scientific objectivity is that science does not achieve in practice what it professes as a principle; another part is that the mind can never be sure that it has grasped the world objectively.⁶

In modern society we see our understanding of and approach to the world as substantially different from that of pre-scientific society. Now we have fact; before, we had belief and ignorance: that, in its simplest terms, is our understanding of the changeover to scientific knowledge.

Even if our previous knowledge was valuable, and even if it was right, we believe, it was not as complete or as substantial as scientific knowledge, which can be universally proven, whereas unscientific knowledge can only be personally validated or taken on faith.

This conviction that we have advanced over time to a superior knowledge is a major characteristic of knowledge in our time.⁷ The conviction that science "knows more" is part of our education and part of our presentation of our achievements and problems in the news, on talk shows, and in soap operas (in which the unavoidable factuality of scientific medical knowledge may itself be an 'actor'). (This conviction, of course, is not the same thing as being scientifically knowledgeable.) At the same time, we have the sense that there are many areas of our life where science does not apply -- family life, personal relationships, religious conviction, enjoyment of music and art, and what goes on inside our heads generally (i.e., when we are not thinking analytically -- and especially in our dreams).

Yet even in these areas, science pervades our lives. A family may be started with a child's conception and fetal growth scientifically mediated by genetic counseling and surgical intervention. Or the survival of a premature newborn may depend on technological monitoring. Personal

relationships are affected by scientific tests that reveal the AIDS virus, and personal behavior may be moderated by psychiatric therapies that are based on a scientific model and often include the use of behavior-modifying drugs. Organized religion is constantly in the position of having to contend with or integrate scientific knowledge -- the theory of evolution and the use of medical techniques are two examples. The music most of us hear is electronically transmitted, and sometimes electronically generated. Art restoration is technologized with sophisticated techniques of materials analysis, and artistic creation often relies on new technologies and non-natural materials that are scientific spinoffs. Only inside our heads do we seem to live in a non-scientific world.

Even here, we have a scientific habit of mind which takes the world as data to be organized for analysis; even if we don't bother to do the analysis, we assume that things can be figured out -- that we can calculate distances, times, sizes, weights; that we can move things around, increase or diminish them; that we can connect cause and effect, and prove that connection in a way that invalidates contending but incorrect explanations. We also extend this attitude of calculation about the physical world to the psychological world, "weighing" psychological states, but being less successful in assigning cause and effect.

Lending Authority to Knowledge

Besides being pervasive in our lives, science gives authority to knowledge. By comparison, in the medieval Western world, religion gave authority to knowledge. The institutions that preserved and transmitted knowledge were religious ones, and the arguments that one type of human action was to be preferred over another were made from the authority of religious scripture as interpreted by the Church. This does not mean that everyone was devout, or that no one calculated weights and measures, that no one made political calculations, or that poetry and song had only religious content. What it does mean is the influence of religion was inescapable. Religious imagery was the dominant symbology; the stages and duties of life were defined in terms of the sacraments, from baptism to extreme unction, because life was to be directed toward salvation. Today, stages of life are marked off physiologically and as points on a path of career and family responsibilities. We have a multitude of symbols, but the foremost are material wealth as a symbol of status and personal achievement, and sophisticated technology as a symbol of societal advancement. Emphasis is more on fulfillment in this life

than on salvation in the next.

In matters of law and governance, medieval secular and religious authority had different jurisdictions, but ecclesiastical courts had jurisdiction in matters of heresy -- that is, control over contending knowledge. Rulers competed politically, just as we have political struggle today, and they fought with the pope as well as with one another, but they justified their actions or were made to answer for them according to the dictates of religion, not in the language of politics.⁸ Not until Machiavelli did anyone make a formal and widely publicized statement of the argument for coldly calculated personal and political power. Merchants traded, and commerce had periods of growth and decline, but the guiding economic principle of trade was supposed to be the Christian one of "just price," or profit limited to the maintenance of the producer's status quo. The pursuit of profit itself was considered against Christian principles.

Today, science has taken the place of religion as the organizing and inescapable force of our modern Western and/or industrialized society. Not everyone does science, any more than everyone 'did' religion by becoming a monk or a nun in medieval society, but everyone is affected by the institutions and knowledge of science, as in the medieval world everyone was affected by the institutions and faith of

religion. The effect of a dominant form of knowledge such as science or religion is not evenly distributed across society; there are gaps and bumps, valleys and mountains in the terrain of its influence. Other types of knowledge are always present, to contend with the dominant form in varying degrees of success or non-success.

The power of science to lend authority has two major bases: one is its institutional presence and power; the other is its epistemological claim to objectivity. Science owns facts, and facts are to us as the words of the Bible were to the medieval world -- they are treated as foundations of formal knowledge. (Whether they are foundational or not is another question.) We can distinguish formal knowledge -- the knowledge we are given formal instruction in, are educated to -- from personal knowledge, the knowledge we gain from our experience of life, which cannot easily be articulated or put into a formal statement. Science could also be part of our personal knowledge, if we are scientists, but will not necessarily be so.⁹

Analyzing Knowledge across History

Grouping historical periods and knowledge in this broad

way -- medieval and religious, modern and scientific -- is an exercise in making categories that can never entirely fit events. The medieval world, the modern (post-Renaissance) world, our contemporary world (sometimes called post-modern) are constructs that help us see difference and change across time, but they are imperfect because they cannot fit the variety of human life and thought that is always present. These historical eras are ideal types, specifications of major characteristics which can mark off categories of things, but which are never all matched by the examples picked to exemplify the category. Max Weber is famous in sociology for his use of the ideal type as a way to analyze "the market", or "bureaucracy", neither of which exist in their pure form. Also, social scientists disagree on what that pure form could be, on what characteristics should define the ideal type of the market or of many other elements of society and economy.

But the social sciences are not the only place where ideal types are found. Clothing sizes are a very mundane example of the ideal type: they are a perfect fit for no one but an imaginary person, but a good general fit for different real people; some of the specifications overlap from one category (size) to another; and one manufacturer's size will have different characteristics from another manufacturer's size with the same name or number. Michael

Landmann has called Weber's ideal type an intellectual picture that unifies historical events in a "contradictionless universe of context."¹⁰ This analytical requirement of a contradictionless context should be kept well in mind not only for the ideal types of historical eras, but for the other ideal types presented here -- dominant forms of knowledge. Contradictionless contexts do not really exist in the course of history, or in the development of knowledge, or in ways of thinking.

When it comes to the classification and study of knowledge, the contradictions that are in question, of course, are the ones that are interior to a category -- within the category of science or within the category of religion or of politics; the contradictions between such ideal types as science and religion are already clear. In fact, specifying the contradictory opposition is part of the idealization of types. But contradictions within categories cast doubt on whether the category is meaningful.¹¹

"Bureaucracy" is not just rational and efficient by virtue of its purpose and structure (as in its ideal type), it is also irrationally hampered by those same rules and form of organization. Thus, some analysts reject ideal types, and those who accept them argue over their contents.

All classification is for a purpose, and different systems of classification serve different purposes. The

purpose here is to understand our Western worldview, and to see how it has moved from one central concern to another. The attempt is to categorize broad and general ways of thinking that are both a response to and an influence on events in society at a given time. This sociological version of intellectual history connects ideas to social groupings, to life experiences in the context of social organization. At a time when the Western worldview is increasingly recognized as partial, it becomes increasingly important to understand what that partiality is, how it changes, and what it derives from. Without such an analysis, we are left with descriptions of the Western worldview as either ethnocentric prejudice or sublime humanism. To the argument that there are not worldviews, this analysis responds that there are, and that despite the diversity and contradictory views present in any society, there is an arena of public discourse in which central concerns are evident.

Science as the Power to Legitimate

That science and its effects, including its associated technology, are a matter of central concern for us can be seen in the news, in political debate, in academic analyses,

in change in the workplace, in health care, in calculations of advantage and disadvantage in the global economy, and with pressing urgency in matters of the environment. Science dominates our society epistemologically and institutionally.¹²

As a way of thinking, science is especially linked to facts, or to claims of objectivity. By claiming knowledge that can be universally validated, science makes a claim on truth. Science becomes identified with truth, and in a complementary process, truth becomes identified with science, so that for a thing to be true, it must be scientific. For individuals in a scientific society, personal truths about the meaning of life are still true, but they are not provable in the way that scientific truth is. This is the epistemological power of science, a power advantage in claiming ownership to the most certain and stable ground for knowledge.

The institutional power of science is its integration into education, government and business, and its presence in the media and in the consumer marketplace. Although a convincing argument can be made that the educational system in the United States does not give the majority of high school students an adequate understanding of scientific reasoning,¹³ and that too few college students major in scientific fields, science is firmly in place in the

institutional structure of education. Though bachelor's degrees granted in the natural sciences, math, and engineering together hovered around just 16%-18% of all B.A.s in the 1980s,¹⁴ these fields of study get a primary share of resources at the college and university level. In the 1980s, about 60% of all federal aid to universities and colleges was for support of science and engineering. More specifically, federal financial support for research and development is heavily weighted toward the natural sciences, particularly the life sciences, which received approximately 50% or more of such aid in the 1980s. Physical sciences, environmental sciences, and mathematics received approximately 25%, and engineering 15% or more, usually leaving less than 10% for the social sciences (including history), psychology, and "other sciences."¹⁵

In government, the allocation of federal money to scientific projects is a major annual budget exercise in the United States Congress, involving tens of billions of dollars committed over periods of many years.¹⁶ Science is integrated into business as research and development, as technology in manufacturing and in end product, and as the scientific approach of systems management. Science has media presence. Major metropolitan daily newspapers report daily on medical technology, or military technology, or manufacturing technology, or on environmental problems

either traceable to scientific advances, or to be solved by scientific advances, or both. Twenty of the top one hundred daily newspapers (highest circulation) in the United States have weekly science sections of two to eight pages; The New York Times, one of the highest-circulation papers, averages 12 pages in its weekly science section.¹⁷ Television makes a superior medium for the popularization of science because it can show physical change -- the stuff of science -- with all its movement, color and sound. It displays particle traces, distant nebulae, gives us the eye of a microscope to make journeys through the human body, shows the unfolding of a flower or the development of storm clouds in seconds of compressed time -- in short, offers visual "proof" of the factuality of science. Science saturates the consumer marketplace: the availability of computers, VCRs, CDs, video cameras, technologically sophisticated toys,¹⁸ fast-acting medicines, birth-control pills and home pregnancy tests immerses consumers in a world of scientific knowledge and its technological expression.

Both what we call "science" and what we call "technology" are evident in these examples. Although they may be reasonably distinguished from each other, they have become one thing in effects on our lives. They are also united by the interplay between them. Technology is not just the outcome of science, it also reacts back on science

and affects the direction of scientific research, or shapes it in the first place.¹⁹ "Science and technology" has become one thing, although some scientists or public policy advisers still want to separate the two, sometimes to distinguish basic or pure research from applied research, sometimes to refute the assertion that science is responsible for its technological outcomes.²⁰

To speak of "science" (or of "technology") is like speaking of "government" or "education" -- the word becomes the subject of a sentence, as if it were a unitary actor. "Science has brought us progress," "Science has led to destruction of the environment" are sentences like "Government must find a way to balance military and social needs," "Education is failing to prepare students for skilled jobs." In reality, the government is not a single actor, as the subject is in the sentence, "Joe must find a way to balance his budget." And science is not a single actor, either (inclusive of technology or not). This kind of grammatical construction is unavoidable; it is part of the "ideal typing" we do all the time in order to be able to speak of things. If we don't gather common though varied characteristics of a thing together in one word, we can't proceed with speech or thought.²¹

Similarly, in this analysis of science as a form of thought, I am gathering common characteristics together, and

I will speak of science as if it were some abstract thing that has a self-existence and the power to act on us. While it often seems that that is the case, I am not claiming that "science" exists like a Greek god dwelling on a mountain, or that like electromagnetism in our physical world, it is an invisible but actual and actively felt force. I do not wish to reify science, to "thingify" it, but this tendency of speech and thought is unavoidable in ordinary language.²²

The dual strength of science -- institutional and epistemological -- gives it the power to legitimate social and political action. Before government makes decisions on social policy, it requires scientific surveys of social problems. Whether undertaken by government or industry, the damming of rivers, the mining of land, the regulation of deep-sea fishing, all require scientific validation of the actions proposed or taken. The same is true of the acceptability of new drugs, of potentially hazardous manufacturing processes, of military defense technology, of agricultural techniques, and of innumerable other projects affecting our present and future. Science legitimates action epistemologically by associating it with truth, with the facts of the matter, and institutionally by being integrated into society's organization of knowledge-gathering and decision making.

The concept of epistemological legitimation that I am

using is akin to the concept of a philosophical basis of legitimacy for the course taken by a society in a given era, examined by Hans Blumenberg. The legitimacy concept turns around the question of whether the modern age in the West is only a secularized version of the earlier Christian religious age (with philosophical premises that are stolen and distorted to fit concerns that are material rather than spiritual), or instead, has its own, legitimate (Enlightenment) basis for its political culture.²³ There is another sense in which "legitimation" is used, more common in American social sciences, to refer to the legitimizing of state power by establishing conditions of consent among citizens of the state. Both concepts refer to the political course of society, but one examines the techniques of politics and another examines the philosophical basis of what we would call politics and ideology.

When I say that we have shifted from the notion of a just society to the notion of a scientific society as central to our debates over what is the right course of social and political action, I am proposing a perspective related to Blumenberg's (which is that there has been a genuine and philosophically sound change), but I am not discussing the "legitimacy" of our age. Rather, I am discussing conceptual frameworks that organize

understanding, and I am convinced that this "conceptual shift" is the wider meaning of the centrality of science to much public debate.

How Should Science 'Be' in Society?

Science and technology have contributed a new level of comfort, security, and longevity to human life. At the same time, they have presented humanity with a host of problems associated with the ability of our technological domination of nature to outrun our understanding of nature. Now we are faced with air pollution, water pollution, ozone layer depletion, greenhouse warming, rainforest destruction and consequent species and oxygen loss, hazardous chemicals in the workplace, the threat of nuclear destruction or radiation contamination by accident, groundwater depletion, the vulnerability of single crops produced on a massive scale to destruction by pests or disease, problems of accelerating population growth, species extinction, and many other environmental abuses and imbalances.

In addition, we face ethical issues for which we cannot find the grounds of decision in our scientific worldview: medical technology that prolongs life beyond any quality or desirability; manipulation of the genetic instructions that

govern human, animal and plant growth; the use of animals in "scientific" research that benefits only an industry based on the luxury needs of consumers (cosmetics); the control of behavior through psychoactive drugs, and the identification of individuals at behavioral "risk" by analysis of neurochemical brain function; intervention in fetal development, whether by an abortion pill or by corrective surgery (and the attendant issues of who shall have access to these interventions); and, not least, the seemingly insurmountable gap between the science-and-technology rich nations and the poor ones, between starving peoples and people overwhelmed by choice of foods in semi-automated supermarkets.

None of these problems, particularly the last, can be laid at the feet of science alone, but they are, unarguably, one of its outcomes -- even the gap between rich and poor is tied in with a dominatory use of natural resources in which the "industry of science" has been prominent. Engaging in such use exploits nature without accepting responsibility for long term consequences in the natural world, and affects the economic future of many of the world's people while denying the interaction of science with politics.²⁴ Both scientific and political institutions are relatively weak in mechanisms for taking responsibility for long term consequences of scientific research and technological

developments. Western scientific thinking itself has been critically analyzed as historically permeated with a dominatory bias.²⁵

Science is not free of the culture it grows up in; it is not only materially constrained or aided by that culture, it is epistemologically structured with its elements. Since no form of knowledge is everywhere and at all times the same, it is as true that ecologically conscious and humanly responsible attitudes can be located in the scientific tradition as ecologically blind and humanly irresponsible ones can. These interior-to-science contradictions in attitudes toward the object of scientific study clearly exist; what is at issue is which attitudes have held sway, and whether a dominatory approach to nature and persons is inherent in the scientific worldview that we are heir to. The (feminist) charge that Western science shares the (masculinist) bias of Western culture toward analysis and dominatory control is based on a reinterpretation of texts and historical events which opposes the abstraction that presents science only as an ideal type, science as objective and neutral in a realm separate from historical and cultural processes. To the picture of what science should be is opposed a record of what science has been.²⁶

The existence of interlocked problems arising from scientific knowledge and technological development, and the

threat of overwhelming environmental damage that could end, forever, human life, has resulted in serious questioning of how science should 'be' in society. Should it be a special endeavor, with a legally and politically protected autonomy? Then, goes the argument, it can do the pure research it requires for true knowledge, without having to answer to popular pressure for better drugs or better brains, or to government pressure for better missiles and remote spying techniques. Or should science instead be directed toward specific social goals, so that it does not produce a plethora of unplanned and unintended consequences which endanger our health and survival? This issue of how science should 'be' in our society will increasingly dominate our public concerns.

Changing Knowledge

The turn from pre-scientific to scientific knowledge is our primary example of a change in knowledge.²⁷ Why did this change occur, and why did it happen when (approximately the 17th century) and where (Europe) it did? This is one of the great questions of intellectual history, and it is not yet answered.

Knowledge is not simply idea-driven; it is rooted in

conditions of life. While we can trace the influence of one idea upon another, this does not give a complete picture of the development of knowledge. Knowledge has material conditions, and this is true of intellectual knowledge and abstract ideas as well as of practical knowledge of how to do things. By intellectual knowledge I mean knowledge that is speculative, self-aware, and not necessarily tied to utilitarian purposes. One of the conditions of intellectual knowledge is that thinkers have time to engage in it, and the opportunity and means to communicate with one another. This condition can be met at very simple levels of material development, so long as not all of available time is spent at survival activities, and people regularly come together to talk. For this condition, the thinker in a village of hunter-gatherers can have an advantage over the modern urban worker who holds two jobs and has no extra time. But at some point, an intellectual and speculative development of knowledge requires written communication, which allows rapid transfer of ideas among a large and differentiated number of people, gives the opportunity to compare different accounts at the same time, allows accurate translation, and can put diagrams, pictures, and mathematical formula alongside words. In medieval Europe, this need was first met with manuscripts (as it had been in earlier centuries); the use of the printing press after the mid-15th century quickly

increased the circulation of texts, and was a major factor in the expansion of knowledge.

The invention of the printing press was in turn something that required town life to support it, and towns required agricultural surpluses as well as relatively complex systems of commerce, law and government. A money economy and mercantilism encouraged exploration and travel for the increase of national wealth through trade. Exploration of the new world, and the navigational needs that went with it encouraged technological developments. Trade with the Arab world and the East brought with it new ideas. Capitalism and free markets were a spur to technological development in pursuit of profit, and technology gave impetus to scientific theories. All of these material conditions contributed to the development of science. Whether or not they are all necessary preconditions is still being argued. But it is clear that science requires a certain space in which to operate, certain forms of social organization, and institutions of support -- it is not a development of ideas alone. Yet knowledge is also not just materially driven, and the development of scientific reasoning and the emphasis on objective knowledge based on observation, measurement and test of physical phenomena, and directed toward prediction and control, has had many twists and turns in Western

thought (including influences from outside the West) since the Greek philosophers first speculated on the fundamental constituents of matter.²⁸

NOTES TO CHAPTER ONE

1. For more on this comparison, see Roland N. Stromberg, An Intellectual History of Modern Europe (New York: Appleton-Century-Crofts, 1966), Suggested Reading for Chapters 1 and 2.

2. Science-influenced understanding is not the same as being able to reason scientifically, nor is it necessarily knowledge of scientific findings. Surveys of U.S., British, and Japanese citizens have shown considerable unevenness in scientific literacy, but in none of these countries is it at much more than minimal levels by the terms of the surveys. However, this type of literacy is not what is meant here by having a science-influenced understanding or scientific attitude. It is instead the more general belief that science can understand the world, and that benefits of science outweigh the costs. The same surveys that find low scientific literacy find that this belief is present.

For U.S. and British surveys, see National Science Board. Science and Engineering Indicators - 1989 (NSB 89-1). Washington, D.C.: U.S. Government Printing Office, 1989. (NS 1.40) for summaries and further references. For comparisons of the U.S. and Japan, see Science and Engineering Indicators - 1987.

3. For the relationship of our current ideas of society to the 18th century, see entry under "society" in Raymond Williams, Keywords: A Vocabulary of Culture and Society (New York: Oxford University Press, 1976).

4.4. The 17th and 18th century concept of natural and inalienable rights of individuals, with the state having the function of safeguarding these rights but not owning them (Locke and the philosophes), though attacked by other thinkers then and since, still exerts a strong pull in the popular demand for "democracy" -- in the established democracies of Western Europe, in Eastern Europe and the USSR as shown by the recent changes on government, and in China as shown by student protest. This widespread insistence on basic rights is briefly discussed by Burns H. Weston in the entry "Human Rights" in the Encyclopedia Britannica, 15th edition, Vol. 20, pp. 714-717 (Chicago: Encyclopedia Britannica, Inc., 1987). Also see, in the same edition of the Encyclopedia, the entry "Philosophy, The

History of Western" (section on "Modern Philosophy" by Albert William Levi), Vol. 2, p.762 ("Social and political philosophy") for the political problem of the Enlightenment as the revolt against injustice.

5. This common educated understanding of science is so taken for granted that it is hard to find any specific, condensed discussion of it. Science textbooks do not bother to spell it out. Philosophies of science debate or support this understanding, but do not provide any synopsis of it, instead going right to the details. I was suprised to find that among my many books on science, I could find no simple statement about observation, experiment, and verification.

6. For recent critiques of scientific objectivity, see: Gernot Bohme and Nico Stehr, eds., The Knowledge Society: The Growing Impact of Scientific Knowledge on Social Relations (Dordrecht and Boston: D. Reidel, 1986); Martin Hollis and Steven Lukes, eds., Rationality and Relativism (Cambridge, MA: MIT Press, 1982); Karin Knorr-Cetina and Michael Mulkay, eds., Science Observed (Newbury Park, CA: Sage, 1983); Stephen Toulmin, "The Construal of Reality: Criticism in Modern and Postmodern Science" in The Politics of Interpretation, edited by W.J.T. Mitchell (Chicago: University of Chicago Press, 1983) Alan Chalmers discusses the arguments about science in Science and Its Fabrication (Minneapolis: University of Minnesota Press, 1990). Steven Yearly provides a review of critiques, particularly by British scholars, in Science, Technology, and Social Change (London: Unwin Hyman, 1988).

7. Progressive knowledge, and the contemporary age as most advanced, is a concept often traced to the Enlightenment. In a sentence I read long ago and can no longer locate, a concise author said that The Enlightenment (or 18th century) was the first era to conceptualize itself in terms of thought. It is this kind of self conscious knowledge that its owners see as in advance of previous forms. Hans Blumenberg discusses a similar idea in The Legitimacy of the Modern Age (Cambridge, MA: MIT Press, 1983); see (for brief comments) p.97, pp. 462-63.

8.8. In hindsight, we can see much of the history of the middle ages as a sparring between religious authority and secular politics, but this is a theoretical distinction made in our time, not in theirs. The 11th century provides an example of the weight given to religion. Holy Roman Emperor Henry IV (1056-1106) contested Pope Gregory VII's (1073-1085) ending of lay investiture of bishops, i.e., appointment of bishops by the emperor, who also granted them

land and the equivalent status of nobles if they did not already have it, and thus gained their allegiance. Henry called a council of German bishops to depose Gregory; Gregory responded by excommunicating the emperor and absolving his subject nobles (and bishops) from allegiance to him. Henry made penance, standing barefoot in the snow at the gates of the pope's residence in the Apennines. If Gregory were to refuse absolution to Henry, the emperor would be successfully deposed, but the pope's spiritual authority would be undermined by his failure in the priestly duty of absolving the penitent. Gregory absolved Henry, and the struggle between pope and emperor continued.

This event is presented as a dilemma for Gregory by Gerald Kurland in Western Civilization I (New York: Monarch Press, 1971), pp.134-36. But James Viscount Bryce in The Holy Roman Empire, a 19th-century history, views Henry's penance as an abasement of the crown, since it confirmed the pope, rather than the emperor, as the "highest power on earth, created by and answerable to God alone." (London: Macmillan, 1961; reprint of 1904 - 5th - edn., pp.154-63).

9. On scientific practice as personal knowledge, see Michael Polanyi, Personal Knowledge (Chicago: University of Chicago Press, 1962).

10. My lecture notes for the course "Philosophical Foundations of the Social Sciences," New School Graduate Faculty, New York, 5/7/83. The complexities of typifying the aspect of knowledge that we call reason are examined in Michael Landmann, Alienatory Reason (Normal, IL: Applied Literature Press, 1978).

11. Doubt over internal contradictions arises under the strictures of Aristotelian formal logic. If the dialectical logic of "unity and struggle of opposites" is accepted, internal contradictions are a matter of course.

12. For an analysis of the interaction between these two bases of scientific hegemony, see Stanley Aronowitz, Science as Power: Discourse and Ideology in Modern Society (Minneapolis: University of Minnesota Press, 1988). Aronowitz argues that authority in the contemporary world rests on the possession of legitimate knowledge, i.e., science. Science defines rationality, and integrated with technology, permeates production, education, and business and government decision-making. The way in which science constitutes its methods and objects of inquiry is tied not only to its formal logic but also to the social and technical division of labor. The 'objectivity' of science is therefore inextricably linked with social factors which

must be critically analyzed.

13. For news reports of government-sponsored studies of science skills, see Joseph Berger, "U.S. Pupils Get Low Marks in Science," The New York Times, 9/23/88, p.24 (the National Assessment of Educational Progress -- "the Nation's Report Card"); Barbara Vobjeda, "Survey of Math, Science Skills Puts U.S. Students at Bottom," Washington Post, 1/31/89, p.1 (international study by the National Science Foundation and the Department of Education). For non-government-sponsored comparative data on U.S. and other students see International Association for the Evaluation of Educational Achievement, Science Achievement in Seventeen Countries: A Preliminary Report (Oxford: Pergamon Press, 1988).

The international studies, in which U.S. secondary school students are compared with those in Canada and in European and Pacific-rim countries, show them ranking at or near the bottom in math and science. The national study shows primary and secondary school students' understanding of science improving slightly over the period 1969-1986, but remaining so low as to still count as scientific illiteracy.

14. On B.A. degrees in the natural sciences, mathematics and engineering, see U.S. Department of Education. Office of Educational Research and Improvement. National Center for Education Statistics, The Condition of Education -- 1989, Volume 2: Postsecondary Education, edited by Curtis O. Baker and Gayle Thompson. (CS 89-651). Washington, D.C.: U.S. Government Printing Office, 1989. Their natural science category does not include "agriculture" or "health sciences." Natural sciences showed a slightly declining trend from the 1970s, while engineering increased, and computer sciences increased sharply. If computer sciences are added to the NCES figures, science B.A.s increase to 18%-20% of total B.A.s.

When social and behavioral sciences are included in the count, as in National Science Board biannual reports (Science & Engineering Indicators), B.A. degrees in the sciences approach 30% of total B.A.s.

15. In 1986, the life sciences received approximately 53% of such aid; the physical sciences, environmental sciences, and mathematics received about 25%; engineering received approximately 17% -- for a total of approximately 95% for "hard" areas, leaving about 5% for the social sciences (including history), psychology, and "other sciences." National Science Foundation. Federal Support to Universities, Colleges, and Selected Nonprofit Institutions -- Fiscal Year: 1986. (NSF 87-318). Washington,

D.C.: U.S. Government Printing Office, n.d. (Surveys of Science Resource Series) (NS 1.30/2). Also see National Science Board, Science & Engineering Indicators -- 1989.

16. William J. Broad, "Heavy Costs of Major Projects Pose a Threat to Basic Science," The New York Times, 5/27/90, p.1: "New projects now planned for completion in the 1990's will cost more than \$60 billion to build. More than \$100 billion will be needed to operate the instruments over their lifetimes...." These projects include the space stations (\$30 billion to build); the human genome project (\$3 billion); Saturn and Mars probes, and a comet rendezvous (\$2.1 billion); earth-orbiting satellites -- EOS and others -- to gather environmental and other data (\$19.2 billion); astronomical observatories and astrophysics satellites (\$2.2 billion); the superconducting supercollider, an ion collider, and an electron beam accelerator (\$8.7 billion); an advanced photon source, an advanced light source, and a high magnetic field laboratory (\$665 million).

Also see other articles in this series, collectively titled "Big Science -- Is It Worth the Price?": 5/29/90, Malcolm W. Browne, "Supercollider's Rising Cost Provokes Opposition," p.C1; 6/5/90, Natalie Angier, "Great 15-Year Project to Decipher Genes Stirs Opposition," (described as "biology's first foray into big-ticket science"), p.C1; 6/10/90, William J. Broad, "How the \$8 Billion Space Station Became a \$120 Billion Showpiece," p.1; 6/19/90, William K. Stevens, "Huge Space Platform Seen as Distorting Studies of Earth," p.C1; 9/4/90, William J. Broad, "Small-Scale Science Feels the Pinch From Big Projects," p.C1.

17. Survey by Scientists' Institute for Public Information, reported in SIPIScope, Vol. 18, No. 1, Spring 1990, p.26. This updates an earlier report summarized in Science, 1/23/87, p.425, "Science Sections in U.S. Newspapers Increase Dramatically in Past 2 Years," by Barbara J. Culliton. Circulation figures are from Editor & Publisher YearBook, 1990 (front pages, no page number).

On newspaper science-reporting see Maurice Goldsmith, The Science Critic: A Critical Analysis of the Popular Presentation of Science (London and New York: Routledge & Kegan Paul); and Dorothy Nelkin, Selling Science: How the Press Covers Science and Technology (New York: W.H. Freeman and Co., 1986)

18. I thank Lou Amdur for bringing this to my attention.

19. As argued by Robert Merton, the commercial need for improved technological devices for navigation was a major influence on the direction of development of 17th-century science in England. Science, Technology and Society in Seventeenth-Century England (New York: Howard Fertig, 1970. Orig. pub. 1938 in Osiris, vol. 4, Pt. 2) . Derek de Solla Price asserts that the growth of science follows technology, not the other way around; his example is that Galileo's telescope made the Copernican revolution; in Little Science, Big Science ...And Beyond (New York: Columbia University Press, 1986, Ch.12).

20. Whether or not a separation is made between science and technology is a reflection of two basic and opposing philosophies of science, in the analysis of Anne L. Hiskes and Richard P. Hiskes, Science, Technology and Policy Decisions (Boulder, CO: Westview Press, 1986, Ch.1). Logical empiricism emphasizes objective knowledge and rejects the intrusion into (pure) science of interests and social forces implied by technological goals. The new philosophy of science (since the 1960s) takes the historically supported view that science has never been dissociated from either the values of society at large or from its own internal values and interests.

Richard Barke quotes Derek de Solla Price as saying that the science/technology distinction is useful to scientists when they want "'to get money', 'to get out of responsibility', or 'to get status for themselves'" in: Science, Technology and Public Policy (Washington, DC: CQ Press, 1986, p.7).

21. The grouping of common characteristics for the purpose of defining (which of course includes defining what is common) doesn't mean that meanings don't shift, that signifier and signified are always in the same relationship; it means that we try to resist this movement. Many social thinkers agree that this resistance exists, although they have different theoretical conceptions of it. Garfinkel says that common understanding shifts and moves, but that it is constructed between participants in a situation so that they can save the notion that there is an objective world about which there can be common understanding. Garfinkel doesn't speculate on why we have this resistance to forgoing agreed-upon meaning, but it is classical sociology to say that we must, in order to have society.

For Durkheim, common understanding or shared intellectual and emotional representations of the world are the sine qua non of social life. At the level of conceptions about time, space, cause, number, etc., meaning is not continually negotiated, as in Garfinkel's analysis,

but at the level of totem and symbol it is the outcome of social interaction.

Moscovici takes Durkheim's collective representations and puts them in the framework of social psychology as "social representations." They remain, as in Durkheim, more coercive over the individual than negotiated by individuals, but they have a developmental course, and common sense is always being created. The purpose of social representations is "to make the unfamiliar familiar," to give the unidentified a social identity.

Concerning the literary theory of deconstruction, which intentionally destabilizes meanings and the possibility of meaning itself as understood in Western culture, traditional sociology takes the position of "common sense" and resists the dismantling of agreement.

22. Moscovici observes that our "social representations" -- commonly-used and common-sensical words and ideas about social phenomena -- give to the things they describe an ontological status. Serge Moscovici, "The Phenomenon of Social Representations" in Robert M. Farr and Serge Moscovici, eds., Social Representations (Cambridge: Cambridge University Press / Paris: Editions de la Maisons Sciences de l'Homme, 1984).

23. Hans Blumenberg, The Legitimacy of the Modern Age (Cambridge, MA: MIT Press, 1983). The concept of epistemological legitimation that I am using cannot be considered the same as or as sophisticated as the concept of legitimacy which is the issue that is the starting point for Blumenberg's book, a work situated in German social theory, in its long-standing debate over modernity, and in a discussion of legitimacy that has been going on for a generation.

24. For the connection between science and politics in the U.S., see David Dickson, The New Politics of Science (New York, Pantheon, 1984). For a philosophy of science view on this connection, see Joseph Rouse, Knowledge and Power: Toward a Political Philosophy of Science (Ithaca, NY: Cornell University Press, 1987).

25. The critical theory of the Frankfurt School, and its concept of instrumental rationality, in which means become ends, is a major source of this thinking. Dialectic of Enlightenment (New York: Seabury, 1972) by Max Horkheimer and Theodor W. Adorno is often cited for drawing attention to how Western thought gives to reason the role of dominating nature and circumstances, but this is a somewhat ritualistic reference for those who lack the original

context of the argument. The centrality and even the outline of the notion of domination are difficult to see in the book without that context, which now must be reconstructed around several diverse essays whose meaning was further developed in intellectual discussion following their original postwar publication in Europe.

26. For feminist critiques of science, see Sandra Harding and Merrill B. Hintikka, eds., Discovering Reality: Feminist Perspective on Epistemology, Metaphysics, Methodology, and Philosophy of Science (Dordrecht: D. Reidel, 1983); Sandra Harding, The Science Question in Feminism (Ithaca, NY: Cornell University Press, 1986); Evelyn Fox Keller, Reflections on Gender and Science (New Haven and London: Yale University Press, 1985); special issues of Hypatia: "Feminism and Science - I, Fall 1987 (Vol. 2 #3), "Feminism and Science - II," Spring 1988.

27. The idea of a change in knowledge is familiar to classical sociology. Comte (like Hegel) arranged the history of human society and knowledge into three progressive stages. Comte's were the theological, metaphysical, and positive. His "positive" stage was what we would call scientific, and characterizes his, and our own, time. Each stage is an advance and complete break from the one before; science cannot admit metaphysics as knowledge. Comte saw no advance beyond this third stage, which he considered the final achievement of "positive" knowledge. Scheler (first to use the term "sociology of knowledge") said that religion, metaphysics and science are not stages but types of knowledge, existing side by side and equal in rank. Scheler proposed several different classifications of knowledge by form or type, but did not develop a systematic sociology of knowledge.

28. For a comprehensive history of the development of science and scientific reasoning, see Sir William Cecil Dampier, A History of Science and Its Relations with Philosophy and Religion (London: Cambridge University Press, 1961; reprint of the 1948 -4th- edition).

CHAPTER TWO

CONCEPTUAL SHIFT

The previous chapter discussed science as a dominant form of knowledge and the shift in Western society from a political attitude to a scientific attitude, with the attendant question of how science should 'be' in society. This chapter continues the discussion of change in knowledge and understanding, with the environmental movement as an example of a social and historical condition to which scientific knowledge is essential.

The Environmental Movement

The environmental movement is now visible to the point of being ordinary. At the same time, however, the movement signifies a major change taking place in how we conceptualize the economy, the state, and the individual. This conceptual change is a subject for the sociology of knowledge, which has, from its beginnings, concerned itself with the relationship between knowledge and politics.

The environmental movement encompasses a wide variety of groups whose two basic purposes are to defend the environment against degradation and to defend human beings against the health-threatening or life-threatening effects of the technological disruption of the natural world. Damage to environment and humans is seen, by critical environmentalists, as the outcome of rampant technology, or of the domatory purposes of science, or of the ideology of economic growth, or all of these. Yet, not all environmentally concerned voices are critical in this way, and from Earth First! monkey-wrenchers who have spiked trees so that they will be useless for lumber to scientists observing minute interactions in natural environments, the movement is so broad that it is hard to say what it is.

The breadth of the environmental movement, the complexity of environmental problems, and the relative newness of the political presence of environmentalism has resulted in opposed evaluations of the political character of the movement. Some see it as left, others as at least partially right, while still others say that left/right definitions cannot be made to fit.¹ The movement is conservative in its Nature philosophy (which is tinged with conservative 19th-century thought) and in its emphasis on local control; it is radical in its requirement, explicit or implicit, for economic restructuring. This problem of

definition is an interesting problem for the sociology of knowledge, because it indicates the failure of a general framework of thought in modern society -- a framework into which the left/right opposition fits. That failure in turn indicates the occurrence of a "conceptual shift" in our collective approach to explaining our society to ourselves. It is not just that the complexity and newness of the environmental phenomenon make it difficult to classify; it is that the framework that we are accustomed to using for classification lacks the elements for a proper fit to the issues. To understand conflicting interests in society we have long used a political framework; politics has been the center of this discourse. But for some time, a new center of discourse has been emerging, and has now taken a central place: that center is science.² With this new center, the old left/right polarity no longer works to explain or classify many social and political developments. As a result, we lack a simple and commonly accepted analytical framework for evaluating these developments or for acting on them.

We often turn to the use of left and right labels for a quick and simple explanation of where a group or idea fits on the current scene. If you ask whether environmentalists (or any particular group of them) are conservative or liberal, you are assuming these terms can fit their

concerns. But conservative/liberal or right/left labels grew up along with a particular concept of politics, or rather, a group of concepts forming a framework, which no longer fits the facts of a world of environmental problems linked to scientific and technological developments.

Conservative and Liberal Political Philosophies

The political framework which encompasses the conservative/liberal terminology dates from the 18th century, and was further developed in the 19th century. It incorporates a relationship between citizen and state, and a balancing of rights and responsibilities based on some philosophy of the nature of man. Men (and we must note that women were left out of these political philosophies) are either individuals of a universal, generic type with inalienable rights and the rational capacity to steer a course toward liberty (liberalism); or they are particular individuals, localized and without universal rights -- although with rights established by local custom -- requiring the boundaries of community or nation to contain their irrationality as well as to assure them benefits (conservatism).

The right and left political categorization can be

looked at in several ways. One way is to define the content of their respective political philosophies. Another is to identify their social context: who is it that is left, and who right?³ Here I only consider philosophies. The terms conservative/liberal and right/left are not an exact match, especially in the European context, but they are often used interchangeably. These terms are tied to concepts whose origins are in historical developments that have been superseded. The terms shift in meaning, and they differ between Europe and the United States.

To the classical, 19th-century form of conservatism, with its emphasis on tradition, institutions, and the establishment has been added, in the 20th century, support for the free market and capitalism, along with opposition to state intervention and public expenditure. To the classical, 19th century form of liberalism, with its emphasis on freedom, individual rights, and limited government has been added, in the 20th century, an agenda for social justice and support for the welfare state. As a result of these additions, the classical British liberal has his equivalent in the modern-day American conservative. As one dictionary puts it, in the United States, progressives (that is, those in favor of the welfare state) "have captured the 'liberal' label, and the older liberals are now called 'conservatives'."⁴ Another dictionary says of

liberalism that "a term that meant small government and low taxation in the last century has in this century come to mean big government and high taxation."⁵

Obviously, conservative/liberal terminology is not fixed in meaning, and it changes over time. In general, yesterday's liberals are today's conservatives, sometimes called neo-conservatives (and occasionally called paleo-liberals). Today's liberals are sometimes called neo-liberals, to distinguish them from those liberal forerunners who would not accept a welfare state. A simpler way of keeping this straight is that today's liberals like to think of themselves as for social justice, while today's conservatives like to think of themselves as for the freedom of the individual from interference by the state. But what has not changed as characteristically conservative or liberal is the respective concept of human nature. If you're a conservative, whether neo or old-fashioned, you doubt the perfectability of human nature; if you're a liberal, paleo or neo, you take it that altering people's circumstances alters their behavior.

Human Nature

Human nature is a basic component of the political-

thought framework of the conservative/liberal terminology. Philosophically, for both, human nature determines the best arrangement for governance. For liberals, human nature is basically good, or at least not fundamentally flawed; it has a universal character not conditioned by time or place; all men (ideally all people but in originally in effect all property-owning males) are equally endowed with basic rights to life and liberty, and these rights can be vested only in individuals, not in the state; human will and reason can shape human destiny; social evils arise out of the structure of society, not out of human nature. Thus, government is to be by consent of the governed, and -- for classical liberals -- that government is best which governs least. Government is not a natural development; it is a contractual arrangement.

For conservatives, human nature is essentially flawed, or at least unavoidably irrational some of the time, and the problems arising from the limitations of this nature can only be ameliorated, not abolished. We are to be skeptical about the perfectability of society through the application of human will and reason. There is nothing in humans or in human nature which gives grounds for the belief in universal equality. Liberty does not exist as an abstract right, but only as the hard-won gain of many generations of human experience, preserved in traditions and institutions which

are necessarily local, not universal. Thus tradition, and traditional rulers and institutions, are to be respected and not overthrown by revolution, which will only leave room for new excesses of irrationality. Government should be limited in its extent, but not limited by popular sovereignty, since this gives room to the irrationality of the passions of the moment. Limits on government should be by rule of law which is itself a repository of custom, or practices proved worthy over time. The institutions of the state are an organic development; attempts to design government according to abstract and universal principles (such as liberty and equality) are only "Utopian blueprints" which have no basis in empirical reality.⁶

The social psychologist Serge Moscovici has summed up the differences between left and right explanations of the reasons for social phenomena by saying that personality is a right-wing explanation; situational causality is a left-wing explanation.⁷

Frameworks

Does this political philosophy have anything to do with a world of environmental problems linked to science and technology? I have gone into some detail over the

philosophical content of conservatism and liberalism in order to show that there is a framework of linked ideas for political philosophy, each idea depending for meaning on several others. The distinctions made between conservative and liberal, or between right and left, are part of a framework of understanding for politics that is different from the framework of understanding that we increasingly apply to environmental problems. This other framework is the one that we have for science. The lack of fit between these two frameworks -- political and scientific -- makes left/right distinctions inapplicable to many (if not most) scientific and technological issues, even though science and politics are inseparably connected in modern life.

The political framework has four main elements: the state, the citizen, human nature, and the economy. In the framework, state and citizen are linked by rights and obligations; the nature of this relationship is determined by human nature. The economy flanks state and citizen. The economy supports the state, and the state safeguards, at least minimally, the economy. You are a citizen in respect to the state, but an individual in respect to the economy, i.e., on your own.⁸ This framework holds for both conservative and liberal. Other relationships can be specified, and excluded non-citizens noted, but they are left out of the basic framework.

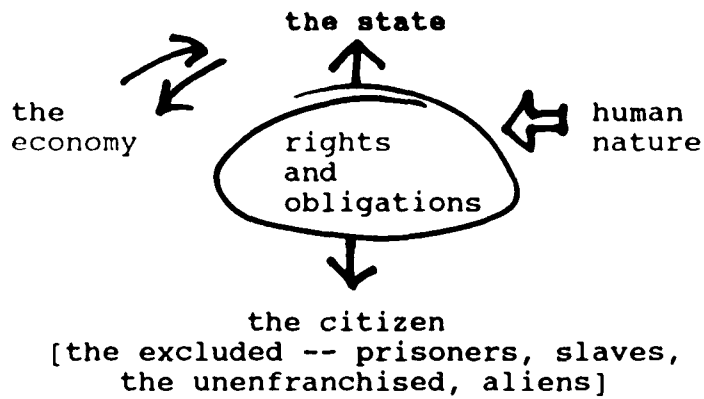
This framework is not meant to be an accurate representation of how politics works in society. It is not a working diagram for social and political engineers; it is a conceptual framework for thinking about politics and society, for handling information, for making sense of events. The relationship of its elements has been theorized at high levels, but the framework also has its place in common understanding. Many elements are left out; the framework is simplified for the purpose of being able to deal with many variants. I am proposing this framework both as an analytical tool, to help us see a change that is occurring in our society; and as a model of how, as members of our society, we actually do understand it. In the latter sense, it is kind of a cognitive prototype. Like the prototypical mental chair that allows us to recognize both Barcaloungers and folding metal chairs as chairs, it allows us to recognize many kinds of societal phenomena as variants of a familiar political and economic form.

In the framework that I see developing for thinking about science in society, science occupies the place that the state does in the political framework. Then, instead of the citizen, there is the utilizer or passive recipient of science. This includes utilizers of scientific method as well as users of the products of science. Instead of human nature, there is the natural world; and again, there is the

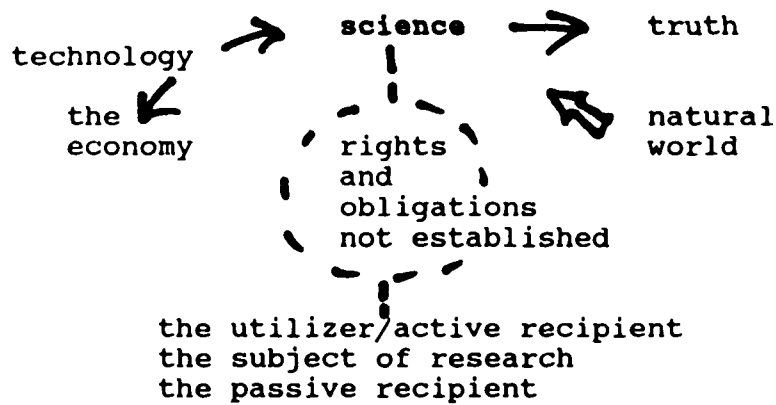
economy.

The rights and obligations between science and utilizer/recipient are yet to be worked out, so the relation is not yet established (unlike the relation between state and citizen). The natural world does not determine obligations between science and its recipients as human nature does for state and citizen. Instead it determines only what science should be (at least in the classical model of scientific endeavor). So far, the only obligation established for science is to the truth of this natural world, and at the highest reaches of science, to truth in general, thus truth among human beings. (This obligation of science to truth is something like the obligation of the Hegelian state to the highest expression of mind.) The economy flanks science and its utilizers/recipients as it does state and citizen, with technology as mediator. This framework for science doesn't have the state or government in it. However, once again, what's at the bottom is an individual, this time even more on his or her own than in the political framework, because, here, no rights and obligations are established.

FRAMEWORK OF UNDERSTANDING FOR POLITICS



FRAMEWORK OF UNDERSTANDING FOR SCIENCE



(Arrows represent established and accepted relationships)

Note that both these frameworks use ideal types, and are also presentations of the way things are conventionally said to be, not necessarily the way they actually are. Although the state is not in the framework for understanding science, there is empirically a relation between them; this is a fault in the model we have for thinking about science. There are, of course, theories about the relation between science and the state (or its expression, government) among academics and ordinary citizens, but we still at the same time have this contradictory model of an autonomous science.

What has happened is that we have developed a way of thinking about science that has left out politics. Use of this autonomous-science model means that terms are lacking for certain developments. The attempt to use left/right labels for many scientific and technological issues doesn't work either, because the political-thought framework, for historical reasons, doesn't include science.

Environmental Issues

In particular, many commentators have noted that it is difficult to classify the environmental movement on the whole as left or right, despite left claims by some Greens. I would say that the issues of environmentalism, as well as

its activist groups, cannot adequately be captured by the left/right characterization. Rather, they call for characterization by a polarity that expresses differences among various social groups over how science (and its associated technology) should 'be' in society. This polarity in its extreme form is autonomous science/servant science, and the dispute is over what controls, if any, should be placed on science. Science skeptics doubt that science can be free of interests. The extreme argument of skepticism is that, since science serves particular social goals anyway (military and industrial, for example), we should straightforwardly direct it toward human benefit and ecological balance, and not be taken in by claims for the need to have scientific autonomy in order to serve scientific objectivity.

Science and politics are entwined in environmental issues. For examples, I have taken some newspaper and magazine reports from the last few years. What follows are headlines, leads, quotes, or brief summaries.

California growers say "we are not going to let the environmental community put an arbitrary scientific standard on the chemicals we can use."⁹

"rapid changes in global environment caused by human activity demand urgent corrective action on an international scale"¹⁰

The Green Belt tree-planting environmental movement headed by Wangari Maathi is labeled "subversive" by the Kenya government."¹¹

"World Lenders Facing Pressure From Ecologists -- Activists Urge Banks to Halt Harmful Projects."¹²

"Ivory Trade Is Banned To Save the Elephant"¹³

"U.S. Court Says Industry Polluters Should Pay Full Environmental Cost"¹⁴

A mothers' group in East Los Angeles stops a planned above-ground oil pipeline that would go through their neighborhoods, "bypassing affluent white coastal communities."¹⁵

"Save the Rain Forests, Eat Ice Cream, Meet Ben" - 40% of profits from Ben & Jerry's Rainforest Crunch ice cream will go to rainforest groups.¹⁶

"The greening of the church"¹⁷

"Does Your Cup of Coffee Cause Forest Fires?"¹⁸

"Traditional definitions of national security are shaken by global environmental threats."¹⁹

Women's group meets at U.N. to plan for "full participation by women in environmental policy at all levels."²⁰

East German authorities at a huge chemical complex say "the region was poisoned willfully in a scheme to raise money for the state." Government officials refused funds to plant managers for antipollution technology, then skimmed off millions of dollars worth of fines when the plants dumped chemicals into nearby rivers.²¹

"University's Choice: Stars or Squirrels." Astronomers are pitted against biologists over plans for a mountain-top observatory that would endanger a dwindling subspecies of squirrel.²²

In these examples, as contending players in the unspecified relation of science-utilizers and recipients to science as the fount of truth, we have growers (industry) resisting environmentalists and "arbitrary" science; mothers against oil companies which rely on scientific technologies;

astronomers against biologists. Acting in the field established by scientific knowledge, but not included in the conceptual framework for it, we have a democratic government trying to assess industry for environmental costs; a communist government forcing industry both to pollute and to pay for polluting. Then, in regard to the free market and the nation state, international trade is restricted to save the elephant; international action to save the environment is said to be urgent; international lenders are called upon to help preserve ecological balance; global environmental threat makes traditional definitions of national security inadequate. Additionally, women are a particular class of environmental advocate; savvy businesses and progressive churches go "green"; seemingly inconsequential individual actions on coffee break have far-reaching, possibly disastrous, consequences. (Literary theorists and cultural analysts can observe an environmental drama being written in these reports.)

At issue here are the reliability and useful -- which is to say, timely -- predictive power of scientific information about the environment. Also at issue are the "ownership" -- if any -- of the natural environment and thus of the corresponding rights and obligations concerning it; the fact that national boundaries cannot contain environmental problems or be manned in defense against them;

the free market as a threat to ecological stability.

Conservative and Liberal on the Environment

Today's conservative position is that the private sector, rather than government, should solve environmental problems. In support of this position, conservatives can refer back to either classical conservatism for the argument that social ills cannot be solved by social engineering according to abstract principles, or to classical liberalism for the argument that the least government is the best government. But neither of these classical notions of limited government -- whether limited by conservative caution or by liberal insistence on individual liberty -- specify anything about "rights" of the natural world and other species, or about human "obligations" toward nature. At the same time, each tradition assumes, but does not specify, the rights of humans to dominate nature in the very way that has led to environmental damage.

"Conservative" and "liberal" used as labels for positions on environmental issues are only patches on a conceptual framework that no longer works to help us see the whole picture in a society shaped by science. They may tell us where politicians, corporations, and environmental

activists stand on the free market, but they don't explain the changed relationship of the market to the social and political structure when science begins to supplant certain functions of the state. These so-called liberal and conservative stances on the environment are dependent on a political-economic framework of thought. But environmental issues go beyond this framework.

Without factoring nature into the equation of rights and obligations, how will we determine courses of action to maintain a sound environment? Relying on the old equation is not enough. What do the liberty and equality of human beings have to do with the mountain-dwelling red squirrels of the newspaper report cited earlier? What is the value and meaning of 'private' property if actions thousands of miles away and possibly many years previous in time contaminate it -- if it is land, water, crops or livestock? Or, if the private property is capital, what value does it have if it cannot be invested on the assumption that economic growth is, in principle, unlimited?

Can the environmental problem be solved outside of government? The conflict between growers and environmentalists in California over pesticides could be theoretically relegated to civil society, that sphere supposedly separate from the state, if it were still possible to believe in such a sphere, but state regulations

and federal farm policy already apply to the farm industry there. Yet despite the involvement of the state, the key relationship here is not citizen and state, flanked by the economy and driven in some way by human nature, but is utilizer and passive recipient of science/technology, flanked by the economy and constrained by the ecosystem of the natural world. The terms conservative and liberal can be grafted onto the relationship, but they suggest roles for citizen and state that are no longer adequate to the situation.

Comparing Frameworks

We can compare frameworks of understanding for the California growers versus environmentalists over pesticides. In the framework for thinking about science and society, the California growers are utilizers of science, and a major factor in the economy. Environmentalists are a segment of the recipients of science -- in this case of the chemical science of pesticides and the rational science of crop management -- who are unwilling to be in the position of recipient. Science sets standards for safe pesticide use, ultimately derived from studies of how the natural world works. In the framework for understanding politics and

society, both growers and science-recipients are citizens of the state, and individuals in civil society -- producers and consumers in the economy. But science is not in the traditional political conceptual framework, and its standards are not relevant, nor is the condition of the natural world a conceivable part of any negotiation of rights or powers. Correspondingly, the state is not in the science conceptual framework, and scientific standards are assumed to be, by those who accept them, rationale enough for taking action, and legitimacy enough. Both science trusters and science skeptics accept the knowledge claims of science, but science skeptics, while referring to science for environmentalist arguments, are not willing to separate science from special interests, power alignments, or ideology.

Accepting the claims of science as the most valid report on reality shifts players to another framework from the familiar political one, whether they are critics of the current uses of that science, or proponents of it. The claims that global changes in the environment require international action; the reports that world lenders face pressure from ecologists; the labeling of a tree-planting movement as subversive; the banning of the ivory trade to save the elephant -- all occur within a conceptual frame in which science tells the truth about nature, and we are all

recipients of this information, with the need or obligation to respond to it, rather than primarily citizens responsible to different nation states.

A U.S. court's judgment that polluters must pay exemplifies the complexities of the cross-overs between science, politics, and the economy. In a challenge to rules formulated by the U.S. Department of the Interior as its interpretation of environmental laws passed in Congress, a federal appeals court concluded that the restitution that should be made by an industry which has polluted the environment extends to restoring the environment to its pre-polluted condition, not just to paying the market value of damaged natural resources. In the case of the Valdez oil spill, for example, Exxon would not just pay the market value of seal pelts damaged by oil, but would also be liable, perhaps, for the deaths of sea birds with no commercial value (presumably having to somehow pay or arrange for their replacement).²³ The court said: "From the bald eagle to the blue whale and the snail darter, national resources have values that are not fully captured by the market system."²⁴

Here is an environmental problem that starts off positioned within the traditional political frame but then is found to fall outside of it in respect to the economy. In the political framework, the state, through the

judiciary, partially regulates the economy by the assessment of fines upon the violation of some standard. There is a considerable body of environmental law developing around such issues, but the political framework has to be bent in order to fit the issues. Value is not just market value; standards are given by science, not by political philosophy or economic theory. Restitution is, ultimately, not made to individuals or classes, but to Nature. The legitimation for social action -- in this case, the action of restitution for damage -- comes not primarily from the established rights and obligations between citizen and state, but from science as the source of truth about our survivability and quality of life.

The New Identity of Politics

Because politics is always with us, we can easily go along thinking it's still the same politics it always has been. All the assumptions that accompanied the formation of our idea of politics -- citizen and state, economy and human nature -- are in our attempts to understand our political situation, but they no longer advance our understanding. Instead, these assumptions remain fixed, while reality moves ahead. We find it necessary to develop a new framework of

understanding.

The conceptual shift from the traditional political framework to a science-oriented framework does not remove politics as an empirical reality. Politics remains in place, but it is taking a new identity, an identity in relation to science.²⁵ Newly framed environmental issues offer evidence that it is now scientific knowledge that legitimates much of social action, rather than the concept of a just relation between citizen and state.

NOTES TO CHAPTER TWO

1. Among those who find left/right terminology inadequate for describing the environmental movement are Robert Paehlke, Environmentalism and the Future of Progressive Politics (New Haven: Yale University Press, 1989); Jonathon Porritt, Seeing Green: The Politics of Ecology Explained (Oxford: Basil Blackwell, 1985); and Anna Bramwell, Ecology in the 20th Century (New Haven: Yale University Press, 1989). Green thinkers Petra Kelly, in Fighting for Hope (Boston: South End Press, 1984); Fritjof Capra and Charlene Spretnak, Green Politics: The Global Promise (New York: Dutton, 1984); and Rudolf Bahro, Building the Green Movement (Philadelphia: New Society Publishers, 1986) reject these labels. Murray Bookchin, in Post-Scarcity Anarchism (Berkeley, CA: Ramparts Press, 1971) and The Ecology of Freedom (Palo Alto, CA: Cheshire Books, 1982), and Johann Galtung, "The Green Movement" in The Future of the Environment, ed. David C. Pitt (London and New York: Routledge, 1988) locate the environmental movement or the Greens in the non-violent anarchist tradition.

2. The proposition that science is a new common center for thought in the public arena is my extension of Mannheim's theory. Although the concept of the centrality of politics to the 19th and 20th centuries is Mannheim's, the framework I present for politics is not derived primarily from his analysis.

3. See entries under "conservatism" and "liberalism" in political dictionaries by Vernon Bogdanor, ed., The Blackwell Encyclopedia of Political Institutions (Oxford: Basil Blackwell, 1987); Louis Filler, Dictionary of American Conservatism (Seacaucus, NJ: Citadel Press, 1988); David Miller, ed., The Blackwell Encyclopedia of Political Thought (Oxford: Basil Blackwell, 1987); M.A. Riff, ed., Dictionary of Modern Political Ideologies (New York: St. Martin's Press, 1987); David Robertson, A Dictionary of Modern Politics (Philadelphia: Taylor and Francis, 1985); Roger Scruton, A Dictionary of Political Thought, (New York: Harper & Row, 1982); Jay M. Shafritz, The Dorsey Dictionary of American Government and Politics (Chicago: Dorsey Press, 1988).

4. John Zvesper, "Liberalism" in Miller, p.287.

5. Shafritz, p.325.
6. Noel O'Sullivan, "Conservatism" in Miller, p.99.
7. Serge Moscovici, "The Phenomenon of Social Representations" in Robert M. Farr and Serge Moscovici, eds., Social Representations (Cambridge: Cambridge University Press, 1984), p.50.
8. Individuals "on their own" are actually positioned within an economic class which affects their life chances, but the conceptual model ignores the effect of this positioning.
9. Keith Schneider, "Growers Reach for the Ballot in California Duel Over Pesticides," The New York Times, 2/22/90, p.A20.
10. Philip Shabecoff, "Urgent Help for Environment Is Plea at Forum," The New York Times, 5/4/89, p.A23
11. Jane Perlez, "Nairobi Journal: Skyscraper's Enemy Draws a Daily Dose of Scorn," The New York Times, 12/6/89, p.A4.
12. Philip Shabecoff, "World Lenders Facing Pressure From Ecologists," The New York Times, 10/30/86, p.1.
13. Jane Perlez, "Ivory Trade Is Banned To Save the Elephant," The New York Times, 10/17/89, III, p.13.
14. John H. Cushman, Jr., "U.S. Court Says Industry Polluters Should Pay Full Environmental Cost," The New York Times, 7/15/89, p.1.
15. "Mothers' Group Fights Back in Los Angeles," The New York Times, 12/5/89, p.A32.
16. Advertisement for Bloomingdale's department store, The New York Times, 12/3/89, p.7.
17. "The greening of the church," U.S. News & World Report, 11/27/89, p.66.
18. Curtis A. Moore, "Does Your Cup of Coffee Cause Forest Fires?" International Wildlife, March-April 1989, pp.39-44.
19. Philip Shabecoff, "Environment" (column title), The New York Times, 5/29/89, p.24.

20. Marvine Howe, "Women's Group Seeks Environmental Role," The New York Times, 10/28/90, p.16.

21. Marlise Simons, "New Taint on East German Pollution," The New York Times, 9/9/90, p.20.

22. Seth Mydans, "University's Choice: Stars or Squirrels," The New York Times, 5/21/90, p.A16.

23. As of November, 1991, Exxon made a \$1 billion settlement with the federal government, \$100 million of which represented "restitution," to restore the oil-damaged sound, to be split between the federal government and Alaska. Most of the remainder of the settlement, \$900 million, was for civil litigation brought by the state and federal government; a small portion was criminal fines. Private lawsuits were still pending. See "Payment is Made in Exxon Case," (AP), The New York Times, 11/14/91, p.D4 and "Judge Accepts Exxon Pact, Ending Suits on Valdez Spill," The New York Times, 10/9/91, p.A14.

24. State of Ohio v. U.S. Dept. of the Interior, 880, Federal Reporter, 2d series, pp.462-63. (D.C. Cir. 1989)

25. I am suggesting that the identity of 'politics', which remains central to our society, is changing because it is now in a context of science that is more pressing for us than its traditional context of the state. I owe my concept of changing identity to Oscar Ichazo. See Ichazo, Between Metaphysics and Protoanalysis (New York: Arica Institute Press, 1982).

CHAPTER THREE

WORLDVIEW AND STYLE OF THOUGHT

The previous chapter discussed a "conceptual shift" to reliance on scientific legitimation for social action. The difficulties of integrating scientific and political concepts were briefly considered. This chapter considers how the arguments about science and society can be examined using the concepts and methods of Mannheim's sociology of knowledge. A central concept is "style of thought." The concept does not stand alone, but is part of a theory of knowledge as socially situated. The categories of this theory are discussed below.

Knowledge and Traditions

One of the sources of knowledge is tradition -- not the traditional practices that are quaintly old-fashioned, but the ways of living, economically and socially based, that are reproduced with each generation and that influence outlook on life. Not just what is known, but what is

considered worth knowing, what counts as knowledge, and how to go about becoming knowledgeable -- these are passed on as information, practices and attitudes from one generation to the next, or from old hands to newcomers.¹ It is not just aristocracy or gentry who have such traditions; all social groups have them, and the groups need not be descended through family relationships. Even when the original social and economic conditions that strongly supported a way of life are weakened by change, the older complex of information, practices and attitudes can be maintained in modified form. Certain beliefs may have to be held underground, or in determined resistance to prevailing currents of opinion and political realities, but they do not disappear. Democratic convictions are held by subjects of dictatorships; racist convictions are held by citizens of equality-affirming democracies; creationist convictions are held by people in a scientific world who reject the evolutionary account of life. All these convictions are tied into their respective traditions of outlook on life, and people can be associated with these traditions by birth or by choice.²

Knowledge and Conditions

Another major influence on knowledge is existing conditions. It may not be only a tradition of belief in democracy that supports democratic convictions in a country become a dictatorship, but the oppressive conditions themselves that fuel the desire for democracy. Or, on the side of acceptance of the status quo rather than resistance to it, prosperity and relative class mobility could make believers in capitalism out of American workers when their European counterparts were turning in large numbers to socialism. Tradition and conditions interact, so that the same scientific worldview which is adopted by most Americans because it is the contemporary one, is exactly what requires determined resistance by Americans who have adopted or inherited the tradition of religious fundamentalism. As deterioration occurs in the natural environment, these changed environmental conditions reactivate traditions of a desire for emotional harmony with Nature on the one hand, while giving rise to rationalist systems of environmental management based on new technologies on the other.

Tradition, Conditions, and Styles of Thought

These twin influences on knowledge and thought -- tradition and conditions -- combine in styles of thought, in analytical and persuasive arguments that each have their own noticeable style because of the concepts they refer to, the language they use, and the outlook on life that they display. Styles of thought are the intellectual products of particular social groups, which can be economic classes, or generations, or adherents to a religion, or any other group that shares a combination of traditions and conditions which acquire vital importance because of the course of events.

The concept of such styles of thought was developed by Karl Mannheim, a founder of the sociology of knowledge -- the study of the connections between groups of people and ideas, between societal purpose and intellectual endeavor. Mannheim analyzed 19th-century conservative thought as a response in opposition to the French Revolution and liberal Enlightenment thought. Conservative thought had its social base in a landed class threatened by the ideas of the revolution. Today, accelerated change in the environment is an event that can push various views on the relationship between humans and Nature to opposing poles. It can bring out an 'environmental' style of thought supported by a social group that is positioned to take the change as a

threat. Inevitably, such a style of thought must take a position on science.

Science as a Center of Contention for Styles of Thought

The question of how science should 'be' in society is the issue at the center of many arguments that are intended to affect social action, to make something happen or not happen which requires concerted effort and commitment by private groups, or government agencies, or business and industry, or by all sectors. The environment, medical technology, energy use, consumer goods, education -- all involve the uses of science and the making of choices guided by the scientific attitude. There is a spectrum of differing arguments concerning science in society, and as mentioned in the Introduction, at one extreme are those who trust science to take a direction that benefits people and planet, while at the other are those who are skeptical of its uses and wary of its direction.

The focus on science is particularly evident in the environmental debate, and it is just in this area of environmental position-taking that the traditional political categories of right and left are proving most difficult to apply.³ The conservative/liberal polarity applies to

stances taken on the market, and thus to the economics of the environment, but not to deeper environmental issues. We are at a point where the left-right categorization of public debate on issues is often no longer adequate or, in some cases applicable at all. It may be that we have a science-truster/science-skeptic spectrum developing, because the concept-organizing center of much debate is no longer a notion of a just society based on contractual agreements and philosophical ethics, but is instead the notion of a society able to determine its best course through the application of science to all its problems. The arguments which legitimize action are no longer only about citizen and state, but are also about individual and science, and planet and science. It's not that we don't argue anymore about the just distribution of social good, but that the terms under which and by which we argue about those goals have changed. The identity of our politics is changing.

Science as Worldview

To some extent, in a society where science is a dominant form of thought, we all think scientifically. Thus, even critics of science will use scientific reasoning and scientific findings to support their positions.⁴

Science as a dominant form of thought is the intellectual part of a scientific worldview. Worldview is knowledge and attitudes that are organized into an outlook that serves as an orienting device in many different situations for the individual. That outlook, however, is collectively formed, not unique to the individual. It is acquired through socialization -- partly through formal education, partly through informally received attitudes. With a scientific worldview, we view things through scientific eyes, through scientific assumptions and habits of thought. We are scientific, however, in comparison to a pre-scientific time -- in a very general way, not as if we were scientifically trained. Along with this intellectual predisposition, we have values that are related to science (putting a positive value on change and progress, for example).

The scientific worldview is more general than the appearance of science as a central issue for opposed arguments. Historically, it began to take shape earlier, in the 17th century or in the Renaissance.⁵ It has become a view that the world is something to be measured, understood, acted upon, and mastered. The scientific worldview has not always had science itself as the organizing center of argument and public debate. As mentioned in the Introduction, in 19th-century Germany, according to

Mannheim, politics was the center of contention for styles of argument/thought, because of the preceding polarizing event of the French Revolution.

Science as a Form of Thought

Science is also a form of thought -- as described earlier, a dominant form of knowledge. "Knowledge" and "thought" are used interchangeably here, with "thought" referring, not just to the process of thinking, but to the intellectual product of a historical time and place.⁶

Science is a form of thought or knowledge because it differs from pre-scientific thought in form as well as in content. It is not just quantity of facts which distinguishes science, but an approach of objectivity and calculation. There are other examples of differences in form which may make this distinction clearer. There is a difference in form between computer information and book information -- not only is content within a given physical space increased, but access is changed. The variety of routes of access is much greater by computer, because the information is in a different form from the printed form. Computer information is digital and electronically accessible; it is compact; it is highly manipulable. These

things distinguish it from the printed book form. This difference in form engenders a difference in attitude toward information, toward the content of the form -- content becomes something to manipulate, fragment, and integrate in a new way. In a somewhat more abstract way, science is a form in which knowledge and information can be put and accessed in a different way from non-science. To give another example, life experience is a form of knowledge. Our awareness of this form of knowledge, even if we don't have a name for it, often gives us the feeling that it's not what you learn in books that's important in life. In this way, personal or experiential knowledge seems different in both content and form from book knowledge.

Classifying Knowledge

How do all these things fit together -- style of thought, center of contention, worldview, form of knowledge or thought? The scientific worldview is a historical phenomenon that we can trace back only a few centuries, but it is often observed that scientific reasoning, or science as a form of thought, had its beginnings in ancient Greece, although for many reasons, it did not develop there into the inductive method that is so important to modern science.⁷

Science as a dominant form of knowledge is a recent development on a historical scale, and science as an organizing center for arguments (or styles of thought) is a current event.

Some of these terms for speaking about knowledge and thought are also categories at different levels of generality, like Linnaean categories for living things: Kingdom (animal or vegetable, for instance) is more general than Phylum (e.g., the chordates among animals) and so on down through a series of classifications. Thus, humans and dogs are both in the chordate Phylum and, less generally, both are in the Class of mammals. However, in the next less general classification, dogs are in the Order of carnivores, and humans are in the Order of primates. Within the Order of primates, humans belong to the hominid Family, while chimpanzees and gorillas, which are also primates, do not belong to this Family. Each category is followed by a subgroup that is more specialized.

In a similar way, worldview is more general than whatever is the center of contention in styles of thought; that center is more general than the specific styles of argument. A scientific worldview can have politics as a center of contention, because the center organizes intellectual activity at a different and more specific level than worldview. Politics can have either conservative or

liberal styles of thought, because these arguments are varieties of political thought -- sub-versions. Different major worldviews exist concurrently, although one may dominate the others.⁸ This classification of thought and knowledge is not exactly like Linnaean categories, however, for several reasons. One important reason is that the contents of Linnaean categories make an array of evolutionary stages, but worldview and thought style do not have higher or lower evolutionary forms.⁹

Form of thought (e.g., scientific or religious) is a characteristic that, with some qualifications, has the possibility of running through the levels of generality. It can be part of worldview or of style of thought. If worldview and thought style were horizontal lines, form of thought would be a vertical line that weaves between them.

These categories are not necessitated by some unchangeable characteristics of knowledge; they are simply aids to trace a history and sociology of intellectual concerns. What is important is not so much the terms as that there is more than one dimension of classification. Thought or knowledge not only covers an area which can be defined either broadly or narrowly, it also has different forms and, thirdly, different historical durations.

Worldview - The Broad Term

"Worldview" is a translation of the German word Weltanschauung. This term was given its theoretical development by Wilhelm Dilthey, the 19th-century philosopher and historian of ideas. His concept of worldview was more philosophical than the concept that has evolved with use of the term by others. "Worldview" is now used more sociologically than philosophically. For Dilthey, a worldview "undertakes to resolve the enigma of life."¹⁰ It is not the product of thinking per se, but emerges from life experience in general, from the totality of our psychological existence (called "lived experience" -- Erlebnis).¹¹ From it derive ideals and principles of conduct. A worldview is a systematic relationship of views rather than a single view.

Worldviews are ephemeral in the individual, changing with life stages, time, place and experience, but they fall into a few major cultural formations within any historical period. While worldviews are historically conditioned, they have basic types, all of which can emerge within the different "cultural systems," identified by Dilthey as poetry or literature, religion, and philosophy. Mannheim took the concept of worldview from Dilthey, and proposed that it appears in "styles of thought," which present ideas

at a theoretical level, but not necessarily as philosophy. Neither Dilthey nor Mannheim spoke of a scientific worldview.¹² Science, for them, was the pursuit and accumulation of objective knowledge, separate from knowledge with psychological and metaphysical elements, as found in the worldview.

Dilthey's theory of worldviews is complex, combining philosophy, psychology, hermeneutics and attention to history. Like Kant, he thought that there are categories of mind behind which you cannot go for their causes. The "attitudes" underlying worldviews are such mental categories. These are not attitudes of the kind polled in opinion surveys, but fundamental responses of mind to external reality, to the question of the meaning of life, and to one's own course of life. Thus worldview has considerable depth. A knowledge and attitudes survey would only touch the surface of the total complex of the worldview held by any of the survey's respondents, or alternatively, of the historical worldview which the survey findings, on average, represent.¹³ There therefore must be other ways to get at worldview than to ask people what they think; survey methods are not sufficient for analysis.

Style of Thought - The Narrower Term

Using the category of style of thought is one of several ways to take the broad category of worldview and break it down. Dilthey studied worldview itself, and classified worldviews into philosophical types and historical examples. Mannheim investigated how worldviews act in society. Society develops through both cooperation and competition, and since knowledge is a social effort, it too develops both cooperatively and competitively. When a significant and change-making event occurs in society (a political revolution, for example), groups with contending views each develop their arguments about how to deal with it. The event polarizes, and becomes the "impetus" to a sharp differentiation of styles of argument, as opposed groups draw on different worldviews and refer to different material experiences in order to respond to new circumstances. This happens when the event occurs in what Mannheim called a matrix of "oriented change" -- wholesale change affecting all of society -- political and economic restructuring.

A thought style integrates some of the fundamental attitudes of its adherents (derived from a shared worldview) with a developing stance on events that are currently of pressing importance for them. It articulates elements of

the worldview and particulars of the group's material experience in ways that have not been necessary before, but are vital now because the group feels its material and philosophical position threatened or denigrated, or feels its own possibilities of power. Mannheim's analysis was that styles of thought develop oppositionally, the response, roughly speaking, of the "outs" to the "ins." On their side, the "ins" sharpen their arguments in turn. Styles of thought, Mannheim said, "crystallize" around a central issue of debate which has become important because of the polarizing event.¹⁴

A contested sphere of social activity (center of contention) becomes the center around which concepts are organized as opposing arguments develop. The opposed arguments (thought styles) draw on more general worldviews, and each comprises distinguishable but related lines of thought. The summaries below compare the levels of thought organized around politics and those organized around science.

WORLDVIEW LEVEL	TRADITIONALIST	PROGRESS-ORIENTED
CENTER OF CONTENTION	<u>POLITICS</u>	
THOUGHT STYLE LEVEL	<u>Conservative</u>	<u>Liberal</u>
SUB- VERSIONS	Burkean; Romantic; Feudalistic; etc.	Bourgeois- revolutionary; Laissez-faire; Egalitarian; etc.
WORLDVIEW LEVEL	HOLISTIC	REDUCTIONIST
CENTER OF CONTENTION	<u>SCIENCE IN SOCIETY</u>	
THOUGHT STYLE LEVEL	<u>Environmental</u>	<u>Technoprogressive</u>
SUB- VERSIONS	Conservationist; Green; Back-to- Nature; etc.	no common descriptive terms yet -- examples in bioengineering, resource management

Mannheim took the French Revolution to be the polarizing event that was the impetus for social and intellectual change. Intellectually, there was a change in the center for European styles of thought. With the French Revolution that center became politics. (Earlier, Mannheim says, it might have been religion, but he does not expand on this comparison.) With politics as a center of thought, conservative and liberal arguments each expressed some aspects of the differing worldviews of opposed social groups.

Different arguments were not only different in content, but had an identifiable style, analogous to styles in art that are identified by its different motifs -- recurring thematic or design elements. The thought style also had recurring themes and conventionalized ways of presenting them. Beyond this, the thought style also had an intention, comparable to the motivation behind an art style that was postulated by the art historian, Alois Riegl. This concept of Riegl's influenced Mannheim's construction of the concept of style of thought.¹⁵ That arguments had a style, that they didn't just have innumerable elements that didn't come together, rests on the fact that they articulate a particular set of circumstances, a bounded social experience, and a social intention, and do so with certain available intellectual materials. Not only were the

political purposes of conservatives and liberals different, their outlook on life was also different, and their intellectual styles and the types of knowledge they referred to were different.

Different arguments about what society should do are rooted in different social and material conditions, in the different experiences of different groups. "The principal thesis of the sociology of knowledge," Mannheim said, "is that there are modes of thought which cannot be adequately understood so long as their social origins are obscured."¹⁶ For a style of thought to develop fully, it must have an effective group behind it. Groups can be classes -- bourgeoisie vs old line aristocrats; proletariat vs bourgeoisie -- as in Marxist theory; or socioeconomic "lifestyle" classes; or as pointed out by Mannheim, they can be in other categories which were then often overlooked, such as generations. The group will have a "basic intention," for example, to hold on to a traditional way of life, or to initiate change in the name of progress. Their arguments will take up a "key problem"; this is not a particular social or political goal, but an epistemological problem, a question of what the valid grounds of knowledge are.

Mannheim does not provide a systematic identification of the elements of empirical reference and conceptual

analysis of a style of thought as I have given them here. This presentation is my own synopsis, derived from his "Conservative Thought" essay. Summarizing (and using Mannheim's own terms in quotes), what is needed for the appearance and development of "styles of thought" is a "catalyzing" (polarizing) event, in a context of "oriented change," and groups at either end of the spectrum of responses to that event who can effectively argue their case. Their arguments, or styles of thought, can be characterized according to a polarity, e.g., conservative/liberal. Styles of thought have both a social context and an epistemological content. These can be analyzed as "basic intention" (social) and "key problem" (epistemological). The arguments will "crystallize" around a center of contention -- an issue central to the polarizing event (or it can be said that the event will be construed in terms of that issue. Thus, the French Revolution and Enlightenment thought were debated by the two sides as matters of politics and government, as the issue of whether the norm should be a just society realizing natural equality, or a stable society incorporating traditional or natural aristocracies. All of these social and conceptual elements must be identified in an analysis of a thought style.

The Center of Contention

The conceptual tools that Mannheim used to study 19th-century thought can help explain the late 20th-century's complex relations of science, ideology and power. I am applying the same methodology to contemporary environmental thought that Mannheim applied (retrospectively) to 19th-century political theory. What I have called "argument" he called "style of thought" (arguments made to convince as part of a debate about societal goals). Politics, Mannheim said, became the "crystallizing agency" for (European) styles of thought -- the center around which differences crystallized -- as a result of the French Revolution. Subsequently, Enlightenment thought and Conservative thought contended for the vision of social good that would guide organized action by people living in the nation state and the capitalist economy. What Mannheim called the "crystallizing " center or agency, I call the concept-organizing center, or center of contention. In comparison, I am saying that the center of contention for styles of thought has now shifted from politics to science.

This central issue of debate organizes the arguments, but it is not always directly addressed by them. It is not always an explicit center of contention. In Mannheim's analysis, politics was a conceptual center which acted as a

focus for anti-Enlightenment thought, in which such diverse strains as Romanticism and Pietism contributed to the development of what became the conservative argument. Romanticism, a major influence in the early stages of conservatism, did not make a direct political argument, but in its emphasis on unique individuals and the qualities of place, it implied a citizen and community very different from those posited by universalistic Enlightenment thought. Romanticism's celebration of the emotions and qualities ignored by rationalism provided material for the political argument against the Enlightenment. Similarly, there are celebrations of Nature, critiques of specific technologies, and fact-centered arguments which do not directly address the role of science in society, but which nonetheless imply different uses of science and a different direction for it than are now the outcome of a conventional view which posits a science autonomous and separate from social values.

With politics as a center for arguments, there developed "conservative" and "progressive" (or "liberal") styles of thought -- that is, specific styles of argument at each end of the politically-focused spectrum. With science as an organizing center for argument, we now get, for lack of better terms, "science truster" and "science skeptic" styles. In the environmental movement, there is a particular version of the science-skeptic style.

Connecting Style of Thought to Worldview

The social context and the epistemological content of the thought style, combined and integrated, represented something theoretically similar to Dilthey's worldview. Mannheim did not use Dilthey's typology of worldviews, which was psychophilosophical, but made a sociological assessment of worldviews. Styles of thought were analyzed by Mannheim as very particular to a time and place, and he limited his investigation to "one period, one country, one social group"¹⁷ -- the first half of the 19th century; Germany; declining nobility (represented by four or five major theorists who spoke for them, if they were not of them). His starting point was to analyze the conservative style of thought, and from that beginning, he went back to the social context. He did not start with the social group and try to find out how they thought; he started with the thought style and tried to link it with its social origins using the theoretical tool (from Dilthey) of worldview rooted in life experience.

Similarly, I am starting with a thought style that I am provisionally calling environmental, limiting my investigation to the United States in the 1960s and 70s, and taking a few theorists (or their contemporary replacement,

committed popularizers) for analysis. At the beginning of the analysis, it will not necessarily be clear who the "effective group" are, other than that they can be called "environmentalists." The analysis of the thought style will help to identify the group, by identifying what interests the argument represents. This application of Mannheim's methodology is a test of its usefulness both for identifying major societal concerns and for identifying the knowledge locations in society from which contending arguments originate. The question of who is represented by these arguments, and why certain groups support them, requires a historical investigation. Mannheim only touched on such an investigation in "Conservative Thought" and I only touch on it in the investigation of environmental thought.

A few studies suggest that environmentalists (that is, those members of the public who support or profess environmentalism) are white, middle class, service-sector professionals.¹⁸ These studies are attitude surveys, and as such they are methodologically suited to singling out groups characterized by a set of opinions, and to locating those groups socioeconomically. Like the survey approach, the sociology of knowledge approach links attitudes and social groups, but in Mannheim, its method and categories are directed toward finding the meaning and history that attitudes have for the people that hold them, rather than

toward making a detailed specification of their social position.

Interpretation

The problem of interpreting what other people say, or what they present or accept as knowledge, has always been of concern in the social sciences. This concern is related to the historical fact that there are two major schools of thought in the social sciences on how to approach the object being studied, whatever it may be.

One is positivist -- "positive" knowledge is that, and only that, which can be objectively verified. The other finds positivism inadequate for or inappropriate to investigation of social life. The non-positivist position can be taken from several standpoints, among which is an interpretive one. As was the case with "scientific attitude" in Chapter One, "positivism" has many definitions.

For the purposes of discussing the social sciences, positivism can be considered to assume that the object being studied -- whether it is attitudes or the percentage of population living in urban as compared to rural areas -- is something that exists like the objects of the natural world. That is, the object has an existence or a reality of its own

that is not altered by our experience of it. The physical object of the natural world, even though it is mediated through our physical senses in order for us to perceive it, exists without that mediation taking place. But the object in question need not be a physical object; it can be an object of study, a goal of investigation, an objective to be reached. Even if the object is attitudes, it is assumed to exist in this same manner, and what we must do to gain knowledge of it is to observe it, and as in the natural sciences, to measure it in some way so that it may be included in calculations which may eventually accumulate and be theoretically ordered to reveal regularities and behavior according to general laws. Then knowledge of the object will be "positive" knowledge, and predictions and tests of the object's behavior will be possible. Positivism takes the method of the natural sciences to be to be the only route to valid knowledge; any other methods are metaphysics, resulting in unprovable assertions. Thus the social sciences must use the same methods as the natural sciences to achieve valid knowledge.

There are various standpoints from which to criticize this positivist view, most of them philosophical. Some reject positivism entirely, others resist its tendency to demand its method of all inquiries, but accept its usefulness for certain purposes. From within the social

sciences, the approach that does not accept positivist strictures can be called an interpretive one. That is, it takes the objects of social science inquiry to be in some way unlike objects of the natural world, because they cannot simply be observed and recorded in mathematical (thereby universally valid) terms, but must be interpreted by rules that are open to argument, even in the initial stages.

Depending on what version of the interpretive approach is being used, this requirement for interpretation may be posited either because all knowledge is taken to be a process of interpreting the world, rather than observing it, or because things of the social world all occur through human mental effort, and are thus already interpretive constructions, are already something that has a human intention in it that must be read rather than recorded. Each act is already part of a story being told; that story is the actor's interpretation of the world and of the actor's self. The social act, or interaction, has something beneath its surface appearance that can only be found by an interpretation that recapitulates the interpretive act that was part of its making. If just the surface appearance is recorded, that deeper part is missed.

The positivist approach in the social sciences uses natural-science-like techniques of investigation (along the lines of field observation in the biological sciences rather

than along the lines of experiment in chemistry and physics). Surveys are an example of positivist social science: a bounded population is selected for study so that it can be clearly stated what the object being studied is and what it is not; statistical theory guides the selection of representative samples; the questions that elicit response from the people studied are designed to have simple, short answers whose meanings can be coded within a manageable number of categories; answers are coded so that they can be quantified, and thus measured mathematically, as is necessary for unequivocal statements in the natural sciences.

Mannheim's style-of-thought analysis is an example of the interpretive approach, and ultimately derives from Dilthey's philosophy of the human sciences (Geisteswissenschaften), which he asserted were necessarily different from the natural sciences. Dilthey's theory of worldviews gives a description of the interpretive construction we all put on the world, and through which we both experience the world and act on it. Mannheim's thought styles are partial versions of worldview, specific and consciously constructed arguments meant to persuade to a course of action and to justify an interpretation of life and society.

These different methods -- positivist and

interpretive -- are constructed around different theories of investigation and serve different investigative purposes. Both recognize, for instance, that attitudes have a social context, but they study the relationship between context and any individual component of it (such as attitudes) in different ways. Each method can offer description and explanation of the "object" to be examined here -- an environmental argument, but they will do so out of different traditions of research and with different methods.

Questions about Interpretation

Any interpretive method faces the difficulty that anyone can ask why one interpretation should be favored over another. Aren't interpretations, after all, different from facts in that they are not something that can be agreed on regardless of whether you want to accept them or not? There are two answers to this question, from the two versions of the interpretive approach: 1) facts are also interpretations; 2) interpretations too have standards.

The answer that there are standards comes from hermeneutics, a theory and practice of interpretation that goes back to the interpretation of the meaning of Biblical texts, and the comparison of varying copies of these texts.

Hermeneutics moved from theology to philosophy in the 19th century, but the goal of interpretation continued to be deeper meaning and authenticity. It would be possible to reach these goals because reader and writer of texts share, according to the theory, a common subjectivity (or common human nature) that allows for one person to perceive the meaning intended by another. The hermeneutic method takes meaning to be contextual; thus, the part can not be understood without relating it to the whole, nor can the whole be understood without reference to its component parts. So a sentence must be referred to the complete text, the text to its author and social and historical context, and all of these to the shared subjectivity of human beings. But just as the meaning of a sentence may be clarified by knowing the overall intention of the whole text, the intention of the text may be clarified by key sentences. This way, interpretation follows a "hermeneutic circle" to reach fuller understanding. This philosophy of interpretation was developed by Schleiermacher early in the 19th century.

Dilthey's contribution to hermeneutics was to refer meaning to lived experience, and to postulate worldviews in which this experience was a crucial element. Dilthey took the non-positivist position that an interpretive method was essential to the human sciences, which could not use the

same methods of investigation as the natural sciences, because human sciences must deal with the subjectivity of their objects of investigation, while the natural sciences need not do so. Another way of saying this is that social scientists are part of the phenomena they seek to explain, while natural scientists investigate phenomena that are external to them.¹⁹

In the 20th century, Heidegger saw that the reader or interpreter brings so much of their own understanding to the process of interpretation that they remake, to some extent, what they are interpreting. Along the same lines, Gadamer calls the particularities of one's own understanding the "horizon" of the interpreter.²⁰

Another answer to the question of the relative worth of interpretations comes from phenomenology (albeit in an indirect line). In this approach, even so-called facts are interpretations, because we see objects through states of consciousness. We can't make a distinction between our inner experience of an object, and its supposed external existence. The goal of phenomenology, as put forth by Husserl, is to explore subjectivity: the everyday world we live in in our consciousness (Lebenswelt), and the workings of inner experience itself (Erlebnisse). In this exploration, the thinker should set aside or "bracket" assumptions about the causes and consequences of these inner

processes, in order to get at their essence. This philosophy was brought into sociology by Schutz as a study of how people comprehend, typify, and indeed "construct" the everyday life-world (Lebenswelt) as a process of consciousness. Rather than begin with social structure as the determinant of social interactions, Schutz suggested that these interactions might be the outcome of our "natural attitude" by which we take the everyday world for granted, and make our way through it by "common sense."

In an offshoot from this, the American sociologist, Garfinkel, conceived of people as continually constructing a version of the everyday world which they constantly check with one another in order to reach some kind of agreement about what is going on -- an agreement which will enable all to carry on in a normal manner. Other non-positivist sociologies which share some of the predicates of phenomenology and of Garfinkel's ethnomethodology, although they are not directly derived from them, take all knowledge to be socially constructed, and facts thus to be colored by the social interactions which accompanied the investigations and findings by which the facts were arrived at. All facts, even those of the natural sciences, are then results of a process of interpretation at many levels -- socially commonsensical, linguistic, tradition-influenced, peer-influenced, paradigm-influenced (a paradigm being a body of accepted

principles and practices within a science or discipline), and influenced by the material equipment of investigation (the tools at hand).

Whether the reference is to the historical and philosophical concerns of Dilthey, to the hermeneutic circle from Schleiermacher, the phenomenology of Husserl and Heidegger, ethnomethodology, or contemporary hermeneutics, all interpretive emphases counterpose different forms of thinking or knowledge: practical reason is counterposed to theoretical reason; a natural attitude to the world to imposed artifice; lived experience to conceptual abstractions; intersubjective "cultural" understanding to "scientific" methodological understanding; everyday and common-sense knowledge to institutionalized knowledge. The problems of interpretation are not entirely resolved by these theories and methods, but neither are the problems of positivism resolved by theirs. These problems include the problem of induction (whether observation can be a reliable basis for knowledge; whether observations can be stated with words that map exactly to observations; whether we can predict from finite observations to infinite cases) and the denial of the influence of human subjectivity. The interpretive approach, and the positivist one, are expressions of different worldviews, and they remain antinomical to each other -- equally valid on their own terms but irreconcilable from either side.

NOTES TO CHAPTER THREE

1. Pierre Bourdieu's work deals with such transmission in detail. See Outline of a Theory of Practice (Cambridge: Cambridge University Press, 1977) and Distinction (Cambridge, MA: Harvard University Press, 1984).
2. In addition, traditions are not necessarily fixed in what has gone on before. The Invention of Tradition, Eric Hobsbawm and Terence Ranger, eds. (Cambridge, MA: Harvard University Press, 1983) gives several examples from British history at home and in colonial lands of how present interests shape the meaning and even invent the content of the past.
3. The political, economic and social issues raised by environmental problems can appear to be made for solutions from the right, or the left, or both -- whether or not it is considered possible to characterize the environmental movement as at either end of the spectrum. More is said about this in later chapters.
4. Or it can be said that the criticism of science is itself science. Blumenberg (op. cit., Ch.1, note 23) says this, and comments: "That the difficulties we have, and will increasingly have, with science are always integrated into it as scientific difficulties is only one aspect of the outlook on the subject of 'theoretical curiosity': the inevitability of a failure to find an Archimedian point over against the reality of science... Science integrates into itself even the responsibility for the consequences of its consequences, by itself giving the alarm." (pp.229-30)
5. See Marie Boas, The Scientific Renaissance, 1450-1630 (New York: Harper and Row, 1962). For Renaissance and varied beginnings up to the 17th century, see Hugh F. Kearney, ed., Origins of the Scientific Revolution (London: Longmans, Green & Co., 1964) Several such general histories of science were published in the 1950s and 60s, and remain standards; recent histories of science are more specialized: by time period, or discovery, or philosophical or sociological issues.
6. The use of the term "form of thought" is for convenience, to distinguish form from content; it is not especially related to Mannheim's analysis. Scheler

distinguished qualitatively different "forms of thought" according to their purposes or motivations. The motivation of practical control characterizes science. See "The Forms of Knowledge and Culture" in Philosophical Perspectives by Max Scheler (Boston: Beacon Press, n.d. [1958]).

7. Classical statements of the importance of induction are made by Francis Bacon in his Novum Organum (1620), by J.S. Mill in his System of Logic (1843), and by William Whewell in The Philosophy of the Inductive Sciences (1840, 1847). For a general discussion of induction and its problems, see Stewart Richards, Philosophy and Sociology of Science: An Introduction (New York: Schocken, 1984).

8. "Thought style" is a direct translation of the original German for style of thought -- "Denkstil." It was introduced by Mannheim, and soon after, used by Ludwik Fleck in Genesis and Development of a Scientific Fact (Chicago: University of Chicago Press, 1979), a 1930s precursor to Kuhn's paradigm version of scientific development; see p.xv, p.168.

9. Dilthey, the theorist of worldviews, did not rank them and did not take any one to be superior to or more comprehensive than another. One of his comments on this subject:

"As the botanist classifies plants and investigates the laws of their growth, so must the analyst of philosophy hunt for the types of Weltanschauung [worldview] and recognize the regularity in their formation. Such a comparative procedure raises the human mind above the conviction, rooted in its finitude, that in one of these Weltanschauungen it has grasped the truth itself." Wilhelm Dilthey, The Essence of Philosophy. Stephen A. Emery and William T. Emery, trans. (Chapel Hill, NC: University of North Carolina Press, 1969), p.41.

However, Dilthey did compare the competition between worldviews to the struggle among living things for "existence and room," (p.40) and said that "Worldviews are shaped by the same process that creates the variety of organic creatures." See Wilhelm Dilthey: Selected Writings, H.P. Rickman, ed. (Cambridge: Cambridge University Press, 1976), p.139. They are fit or not to last because they give understanding and goals.

10. Rickman, *ibid.*, p.25

11. Emery and Emery (op. cit., note 9, in their introduction) trace this translation of "Erlebnis" to Herbert A. Hodges. It is widely used to indicate being "consciously affected" by an event rather than just being there to observe it, which is the kind of experience indicated by the German word Erfahrung.
12. Though Dilthey did not speak of a scientific worldview per se, one of his three major types of worldview, "naturalism," has many of the characteristics of the scientific attitude, and is taken to its extreme form in the positivist practice of science.
13. For example, the scientific literacy surveys referred to in Chapter One, note 2.
14. Karl Mannheim, "Conservative Thought," in From Karl Mannheim, ed. Kurt H. Wolff (New York: Oxford University Press, 1971), p.141; and Conservatism, ed. David Kettler, Volker Meja, and Nico Stehr (London and New York: Routledge & Kegan Paul, 1986), p.51.
15. See Karl Mannheim, "Conservative Thought," p.136, and "On the Interpretation of Weltanschauung," pp. 32-33, both in From Karl Mannheim.
16. Karl Mannheim, Ideology and Utopia (New York: Harcourt Brace Jovanovich, n.d., first published in English in 1936), p.2.
17. Mannheim, "Conservative Thought," p.137.
18. See notes to chapter sixteen for more about these studies.
19. Or so it seemed until the revolutions in physics at the turn of the century, and the attendant proposition that human intervention affects the object studied as if observer and observed were one system. According to the Copenhagen interpretation of quantum mechanics introduced by Niels Bohr in the 1920s, entities such as electrons, which have characteristics of both waves and particles, display one property or the other according to the nature of the experiment, and thus can't be said to have a property apart from our observation of it. Reality can only be ascribed to our observations, not to the physical world. (See Brush, ref. below, pp.399-407.)
 To this has been added Werner Heisenberg's indeterminacy principle, which states that the experimenter cannot measure one parameter of a system without disturbing the value of another parameter. Statistical laws describe

quantum reality, and indeterminism is a fundamental fact of that reality. "There is an uncertainty both of destiny and identity," says Heisenberg, and "basically it is only our knowledge of the [elementary] particles alone which we can make the object of science." (Quoted in Richards, ref. below, pp.74-75.)

See Stephen G. Brush, The History of Modern Science (Ames, Iowa: Iowa State University Press, 1988) and Stewart Richards, Philosophy and Sociology of Science: An Introduction (New York: Schocken, 1984) for summaries of the "new physics."

20. This summary of hermeneutic tradition relies in part on the definition of "hermeneutics" by Ellman Crasnow in A Dictionary of Modern Critical Terms, Roger Fowler, ed. (London and New York: Routledge & Kegan Paul, rev. edn., 1987).

CHAPTER FOUR

MANNHEIM AND CONSERVATIVE THOUGHT

The previous chapter introduced Mannheim's interpretive approach to socially positioned arguments through what he called "style of thought." Mannheim studied a style of thought centered on politics; I am examining the possibility of a style of thought centered on science. This chapter reviews in detail what Mannheim did in his study of conservative thought, but begins with a better known work that also concerns the oppositional development of thought.

Knowledge and Interests

Mannheim's best-known work in the English-speaking world is Ideology and Utopia. This book introduces the sociology of knowledge through a series of essays. Mannheim observes that we only ask about our knowledge in certain specific situations, when social and political change makes existing verities uncertain. To query the social origins of knowledge is a modern phenomenon. Before society itself was

recognized as an object of inquiry, questions about the roots of knowledge did not include consideration of social influences. Knowledge was a topic for philosophy. But when the social origins of ideas did become an issue, it was not because there was an academic attempt to explain them. Rather, "The discovery of the social-situational roots of thought at first... took the form of unmasking," that is, of revealing the self interest in an opponent's political philosophy.¹ When religion framed thought, crises among the intelligentsia took the form of religious conflict; when politics frames thought, the state claims the right to interpret the world, and "politics... use[s] its conception of the world as a weapon."² Arguments take increasingly rationalistic and scientific forms as 'objective' support is sought for the justification of political programs.

As the translators of Ideology and Utopia, Wirth and Shils, point out, the German original was published at a time when only intellectuals were questioning the ideals of Western civilization (1929); the English edition appears when such questions have become much more widespread (1936). Mannheim had his own comment on the prevalence of doubt:

"It is imperative in the present transitional period to make use of the intellectual twilight which dominates our epoch and in which all values and points of view appear in their genuine relativity. We must realize once and for all that the meanings which make up our world are simply an historically determined and continuously developing structure in which man develops, and are in no

sense absolute."³

It is not just previously accepted truths that are in doubt, but the motives of those that propound them. Wirth and Shils observe that we know very well now that different social groups have different interpretations of the facts of social situations, but that Mannheim goes beyond this generality and tries to show specifically what the connections are between knowledge and social existence. Interest is one of these connections, but not the only one.

Ideology and Utopia makes the connections between knowledge and society in two ways: with examples of arguments in modern society, and with theoretical propositions about the epistemology and ontology of a sociology of knowledge. In this book, Mannheim continues to speak about the centrality of politics, as he did in his earlier work on conservative thought. But he also both sharpens the distinctions between the thought of 'In' and 'Out' groups in society -- ideology and utopian thought, respectively -- and emphasizes the common factor in both groups as they advance their interests: the attempt to keep their own blinders on while they "unmask" the thought of their opponents. Ideologists, with the intent of preserving elements of the past that, as part of the status quo, 'maintain stability', can't see the negatives of the existing situation; utopians, with the intent of changing

the present, can't see the positives of the existing situation.

Ideology

In Ideology and Utopia, Mannheim has chosen the two "slogan-like concepts" of the title as symbolic of the intellectual crisis of the loss of a unitary worldview, and of the process of unmasking "situational motivations" behind thought.⁴ The tension between stability and change in the political and social order was the dominant concern of the Europe in which Mannheim lived. Born in Hungary in 1893, by the time he wrote the essays in Ideology and Utopia he had experienced the upheavals of the First World War, Hungarian independence from Austrian rule, socialist-communist post-war government, its collapse, and the beginning of a repressive regime which decided him to live in Germany;⁵ in Germany he met the shifting political conditions of the Weimar Republic. Within four years of the publication of Ideology and Utopia he would be a refugee from Nazi Germany, living in exile in England. These experiences must have increased his sensitivity to the extremes of political thought and action.

Despite the separate naming of the two groups in the

title, it is clear that ideologists and utopians both practice what we now consider ideology. "Ideology" has many meanings, quite a few of them derogatory, but in its most general sense it refers to the practice of unfailingly and programmatically (or unrelentingly and inflexibly) casting situations in a light that promotes the interests of those telling the story, while obscuring or ignoring whatever information would throw doubt on what is being said.

Mannheim is specific about how this is done on both the "ideology" and the "utopia" side. The social and political positions of ideologists and utopians are opposed, but the two groups have the same motivated approach to understanding the world and presenting their view of it. They both fail on some point of comprising the whole of the current situation in their thought, though they fail at opposite ends of the pole.⁶

This polar opposition of groups who wish to maintain the stability of the past as reflected in the status quo, and those who want change and a better future, is a central concept in the study of conservative thought which preceded Ideology and Utopia. Mannheim sets out to show, among other things, that styles of thought develop oppositionally. A necessary precondition for that oppositional development is a historical period of thoroughgoing change. Though Mannheim studies a period one hundred years back from his

own time when he analyzes conservative thought, his observations are highly relevant to his contemporary scene.

Style of Thought

Mannheim's study of conservative thought, originally written in German, is now available in two versions in English, an early one called "Conservative Thought" and a more recent one called Conservatism. Because the versions vary, it is necessary to say something about them and to explain why I chose to work from the one I did, the earlier version. This background is given in a note to this chapter.

Mannheim begins "Conservative Thought" with a statement about "the recently developed sociology of knowledge": "at the heart of [its] method," he says, "is the concept of a style of thought."⁷ The idea of 'style' is taken from the history of art; a style is a distinctive form that originates at a certain time and place, and has formal tendencies which develop in a certain way. Mannheim's methodological goal is that it be "just as possible to 'place' an anonymous piece of writing as an anonymous work of art...."⁸

Mannheim contends that thought is neither ahistorical,

as in some philosophies, nor derived from great personalities, as some literary historians would have it. Thinkers of a given period are representatives of different styles of thought, which are characteristic of time and place and comprise more than individual tendencies. And just as common elements will be handled differently in different styles of art, in styles of thought the same words will have different meanings for different social groups within a given period. Thus "the analysis of meanings will be the core of [the] technique"⁹ for identifying styles of thought and their connection to the social groups that bear them.

Meanings cannot be analyzed separately from the social groups who impart them to styles of thought. Those meanings in turn derive from a basic intention which underlies the thought's development.¹⁰ The intention, arising from the group's experience of life, is what it wants for itself in society. But the intention is not just narrow self interest; it is a view of life as a whole. It calls up a desired world (my term, not Mannheim's).¹¹ "Basic intention" is used for Grundintention in the earlier translation of Mannheim's work;¹² the more recent translation¹³ uses "fundamental design" in most cases, except where the translators find a more psychological meaning called for, when they use "fundamental

inclination."¹⁴ They make this choice to emphasize that the term "can refer to an objective pattern as well as a subjective undertaking."¹⁵

For an example on which to carry out this method of analysis, Mannheim chooses the development of conservative thought in Germany in the first half of the 19th century. In effect, this means a study of conservatism in Prussia, Germany's dominant territory at the time. He limits his analytical task to "one period, one country, and one social group."¹⁶ This limitation gives the advantage that all published and otherwise accessible utterances of the group can be acquired. Also, the French Revolution had produced a "polarizing tendency" in thought throughout western Europe, so that just after it, "styles of thought developed in very clear-cut extremes."¹⁷ Any analysis of the thought of the first half of the 19th century, Mannheim claims, must start with the fact that the French Revolution catalyzed both different types of political action and different styles of thought. There was a development of thought along party lines -- liberal and conservative -- and at the same time, the related development of Romanticism in literature, the arts and philosophy. Reviewing the political and philosophical differences between France, Germany and England in the early 19th century, Mannheim asserts that "Germany achieved for the ideology of conservatism what

France did for the Enlightenment -- she exploited it to the fullest extent of its logical conclusions." England provided the stimulus for conservatism, but Germany did the "thinking through to the end'."¹⁸

Although he has chosen a "paradigmatic" example of the development of a thought style in early 19th century German conservative thought¹⁹ Mannheim notes:

"Our choice has the disadvantage, however, that it suggests that political action is always the centre around which styles of thought crystallize. This is not necessarily the case. Our contention is only that in the first half of the nineteenth century politics gradually became the centre around which the differences in both the fundamental attitudes and the Weltanschauungen of various social groups developed."²⁰

In other periods, he comments, the "crystallizing agency" might have been religion. A thought-style, then, will have a center around which it develops its form, or crystallizes.

The Reaction to Rationalism

Before analyzing conservative thought itself, Mannheim discusses "Modern Rationalism and the Rise of Conservative Opposition." He starts with the historical context of conservatism as an intellectual trend: Conservatism was in part a reaction to modern rationalism, which itself arose in opposition to medieval Aristotelian scholasticism and to the

Renaissance philosophy of nature. Scholasticism emphasized qualities and teleological aims; Renaissance philosophy showed sympathy for magic and analogy. Qualities were too vague for rationalism, ultimate aims unprovable, magic and analogy unscientific. In turning away from rationalism, conservatism did not return to magic, but it favored arguments stressing the uniqueness of qualities.

Mannheim summarizes the basic attitude of modern rationalism as "not to know more about things than can be expressed in a universally valid and demonstrable form, and not to incorporate them into one's experience beyond that point." Its "clearest and most radical application" is in the exact sciences.²¹ However, modern thought is not exclusively the growth of rationalism; forms of thought that have been repudiated have not altogether disappeared.

"Our problem begins at this point and the study of conservative thought takes on a practical importance. We want to know: what became of all those vital relationships and attitudes, and their corresponding modes of thought, which were suppressed by the rise of a consistent rationalism?"²²

Here Mannheim extends the history of ideas into the sociology of knowledge. The suppressed modes of thought, he observes, "did in fact persist," in social and intellectual strata outside the process of rationalization and capitalism: among peasants; within petit-bourgeois groups descended directly from earlier handcraftsmen; in the

aristocratic tradition of the nobility; in Pietist religious sects. Their pre-rationalist ways disappeared from public and official life but not from intimate relationships. Max Weber, Mannheim notes, calls such a development the "recession into privacy."²³ In this way "germs" of a style of thought and life remain dormant until they become relevant to social struggle -- in the case of conservatism, to counter-revolution.

Romanticism provided expression to pre-rationalist thought. Mannheim discusses its function as

"the historical opponent of the intellectual tendencies of the Enlightenment, in other words, against the philosophical exponents of bourgeois capitalism. It seized upon the submerged ways of life and thought... [and lent] them new dignity and value...."²⁴

At the same time, however, because Romanticism was conditioned by the thesis it opposed, in its attempt to "rescue... repressed irrational forces... the mere fact of paying conscious attention to them meant an inevitable rationalization."²⁵ Mannheim repeatedly draws attention to the dialectical development of thought, and cautions that opposed styles are not simple oppositions in which each completely rejects all elements of the other. In addition, different thought-styles, situated in the same historical complex, share certain common concerns.

"No antithesis escapes conditioning by the thesis it sets out to oppose, and romanticism suffered the same paradoxical fate; its structure was

fundamentally conditioned by the attitudes and methods of that very movement of Enlightenment in opposition to which it originally developed."²⁶

The Emergence of Conservatism

After reviewing this background of the contending styles of rationalist and pre-rationalist thought, Mannheim sketches how historical developments enabled conservatism to emerge in opposition to rationalism and in some sympathy with pre-rationalism. Historical developments include thought as well as events, and Mannheim constructs the analytical type of "objective mental structure" to explain how this is so. The first historical question is, Is conservatism a new product or does it occur in all times? The answer is both: There is 'traditionalism' as characterized by Max Weber -- clinging to old ways of life; and there is 'modern conservatism', the product of particular historical circumstance. What political form conservative action will take depends on concrete circumstances, whereas traditionalism is a general psychological attitude that takes relatively predictable forms.

But the politics of conservatism includes elements of the past as well as responses to the present, and "the

individual is consciously or unconsciously guided by a way of thinking and acting which has its own history behind it, before it comes into contact with the individual."²⁷

..."Political conservatism is therefore an objective mental structure, as opposed to the 'subjectivity' of the isolated individual. It is not objective in the sense of being eternally and universally valid...It is not an immanent principle.... But as compared with the hic et nunc experience of the particular individual it has a certain very definite objectivity."²⁸

Mannheim says this type of objectivity is an alternative to the extremes of nominalism (abstract terms are only names; e.g., conservatism -- or any other style of thought -- is only a convenient label for the subjective content inside individual heads) and realism (abstract terms refer to things that really exist, are external to us, and are independent of our conception of them):

"[this type of objectivity is] a dynamic, historical structural configuration; a concept implying a type of objectivity which begins in time, develops and declines through time, which is closely bound up with the existence and fate of concrete human groups, and is in fact their product. It is nevertheless a truly 'objective' mental structure, because it is always 'there' 'before' the individual at any given moment, and because, as compared with any simple range of experience, it always maintains its own definite form -- its structure."²⁹

The structure must not be regarded as static, though; it is dynamic and historically conditioned.

"Within every dynamic historical structural configuration, we can discern a distinctive 'basic intention' (Grundintention), which the individual makes his own in the measure that his own

experience becomes determined by the 'structural configuration' as such."³⁰

Conservatism is just such a configuration; it is not just political, but also "implies a... philosophical and emotional complex...."³¹ And it takes a particular historical form of traditionalism and develops it. This happens in response to the development of progressivism.

"Traditionalism can only become conservatism in a society in which change occurs through the medium of class conflict -- in a class society. This is the sociological background of modern conservatism."³²

Certain conditions are necessary for the rise of conservatism. First, there must be "oriented change" in society, in which every event assumes a function affecting the whole. The modern era has this dynamic process of oriented change; by comparison, in the Middle Ages, towns, though dynamic centers, existed within a static world. More specifically, traditionalism becomes conservatism in a society in which change occurs through the medium of class conflict, as shown by:

- social division into classes, some forwarding social process, some retarding it
- differentiation of ideas along social lines; antagonistic styles of thought
- social differentiation which takes on political and economic character; "the political factor must be autonomous and must become the primary nucleus around

which new groupings crystallize."³³

A modern, capitalist class society with politically active and contending groups is the historical and social context for conservatism.

Elements of Method

Mannheim now begins a discussion of the method for studying conservative thought. Both the final form and the historical development of the thought-style should be described. To achieve this "morphology" of conservative thought one must identify the "inarticulate group experience" which provides the basic intention out of which the style of thought grows. One must also study "articulated theoretical statements" to work out what key problem "gives this style of thought its theoretical unity, determines its growth, and makes its interpretation possible."³⁴ The discussion of method is interwoven with examples from conservative thought. In abbreviated form, it is as follows.³⁵

The Basic Intention: Look for "authentic manifestations" in order to "safeguard against arbitrary constructions." (This instruction raises problems of interpretation which have

been discussed in Chapter Three.) Such manifestations or characteristics of the conservative way of life and thought are:

- It prefers the concrete, the immediate, the actual, details (by comparison, progressive thought prefers overall structure and consciousness of the possible).
- It is especially concrete in its concept of property: property is bound up with its owner in a non-transferable reciprocal relationship (e.g., rights of original owner do not transfer to next owner).
- It has a qualitative idea of liberty, a feudal compared to an egalitarian one, in which liberty is a matter "concerned [with] the private and subjective side of life only, while all external social relations [are] subordinated to the principle of order and discipline."³⁶

The basic intention behind all of this, that which these sequences of thought manifest, is "a harking back to an earlier way of life."³⁷ It is related to traditionalism, but it is traditionalism become conscious.³⁸ Mannheim stresses that the point is not to add up all these characteristics to equal 'conservatism', but to see the basic intention, follow its unfolding, and understand its function in the social process.

"To see things authentically as a conservative, then, is to experience events in terms of an attitude derived from social circumstances and situations anchored in the past."³⁹

The Key Problem: for conservatism is opposition to the natural-law mode of thought. This offers a "theoretical nucleus" around which a self-aware conservative mode of thought could develop out of an earlier "more or less latent impulse." But the opposing types of thought are not "cut-and-dried systems." "Conservatism did not merely want to think 'something different' from its liberal opponents; it wanted to think it differently...."⁴⁰

In relation to the Key Problem, Mannheim characterizes natural law and conservative thought as follows:⁴¹

Natural Law Thought:

<u>contents</u>	<u>method</u>
doctrines of:	-- rationalism for problem
state of nature	solving
popular sovereignty	-- deduction from general
inalienable rights	principles
	-- universal validity claimed
	for individuals
	-- universal applicability of
	historical and social laws
	-- atomism and mechanism
	-- static thinking (Reason
	unaffected by History)

Conservative Thought:

contents
 (attacks on
 natural-law
 doctrines)

method
 -- Reason replaced with History,
 Life, Nation; i.e., Being above
 Thinking
 -- irrationality of reality
 counters deductive thought
 -- individuality counters
 universal validity
 -- organism counters universally
 applied laws
 -- "We" counters "I"
 -- dynamic reason counters
 static reason

These characteristics are not a checklist for conservative writers, however. No one conservative thinker attacks all of natural-law thought.

"Thus it is impossible to juxtapose two static, completely developed systems of thought. All that can be done is to demonstrate the two ways of thinking, the two ways of tackling problems."⁴²

In "Conservative Thought" Mannheim demonstrates one of these ways of thinking with an analysis of two major authors and comments on several others. A third author is analyzed in the German original, and there are indications that he planned a more extensive study.⁴³ His treatment of the content and context of conservative thought is reviewed in the next chapter.

NOTE:

The first available version of Mannheim's study of conservatism, and the most accessible, is called "Conservative Thought." "Conservative Thought" is a translation of the journal article which Mannheim adapted from his Habilitationsschrift (the dissertation which qualifies one to become a university lecturer, but not yet a Doktor); Mannheim did the first draft of the translation himself, and the draft was later edited by Paul Kecskemeti, his son-in-law, also a sociologist. It was published in a collection of Mannheim's writings called Essays on Sociology and Social Psychology (1953), and later in a collection titled From Karl Mannheim (1971).¹

For many years only the journal article, in either English or German, was available; the original dissertation was lost. However, it was recovered, edited by David Kettler, Volker Meja, and Nico Stehr, and published in German in 1984. It was published in English translation in 1986 under the title Conservatism. Conservatism includes material that was not in the journal article, and in addition, it displays more of the philosophical and theoretical tenor of Mannheim's writing than the earlier version does. Many authors have observed that Mannheim, in adapting to his new English home, changed his scholarly approach from a highly theoretical European style to a less philosophical one, oriented to the more concrete and psychological explanations favored by what he considered the Anglo-Saxon mind. Some of his abstract sociology is lost in this change, and his ironic turn of phrase disappears also.

Although the basic outline and argument of the book Conservatism is like that of the essay "Conservative Thought," reading it is like reading a different work. The two are best discussed, I believe, on different terms; I may take this position because a comparison would be extremely difficult to maintain when applying the method of Mannheim's study to another case, as in this dissertation.

Most of this chapter is based on the earlier version because it is the one I first met with (in 1986). I continued to refer to "Conservative Thought," but was not aware until 1989 that I would use it as the basis of this dissertation, and thus I did not go beyond my initial unsuccessful attempts to obtain the more recent and expanded

¹ Since From Karl Mannheim is the more readily available book, I have used it for page references. It reproduces the essay in exactly the same format as in Essays...; deducting 58 pages from From Karl Mannheim will give the equivalent page numbers in Essays...

version. Most of my notes are based on the earlier work. The summary I give of Mannheim's method is not greatly affected by the difference between the two versions; some of the deeper questions concerning his analysis and its implications are affected, but they are not crucial to this chapter. The more recent version adds subtlety and depth to Mannheim's analysis; it deserves comment on its own account.

NOTES TO CHAPTER FOUR

1. Karl Mannheim, Ideology and Utopia (New York: Harcourt Brace Jovanovich, n.d.; reprint of 1936 edition), p.39.
2. Ibid., p.36.
3. Ibid., p.85.
4. Ibid., pp.39-40.
5. Colin Loader, The Intellectual Development of Karl Mannheim (Cambridge: Cambridge University Press, 1985), pp. 1-2.
6. Paul Ricoeur, in Lectures on Ideology and Utopia (New York: Columbia University Press, 1986) says that Mannheim was the first "to link ideology and utopia together under the general problematic of noncongruence... with the general trend of a group or society." [p.159] He discusses the commonalities and differences of ideology and utopia in detail, along with the problem of finding an Archimedean point for these classifications.
7. Karl Mannheim, "Conservative Thought" in From Karl Mannheim, ed. Kurt H. Wolff (New York: Oxford University Press, 1971), p.132.
(This title is hereinafter abbreviated FKM.)
8. FKM, p.133.
9. FKM, p.135.
10. Mannheim compares the idea of this intention to the Kunstwollen theorized by Alois Riegl in his analysis of styles of art. This is translated as "art motive" and should not be confused with art motif; it is a will toward art. Unlike art motives, however, styles of thought must axiomatically be linked with the social conditions of their carriers. In the translation by Kettler, Meja and Stehr (Conservatism), Mannheim does not refer to this theory of art.

11. While Mannheim does not use this term, he does say:
"The conservative does not want satisfaction of his
interests alone, but also his own world, a world in which
his interests are at home." (Conservatism, p.55.)
12. Translation in FKM.
13. Karl Mannheim, Conservatism, ed. David Kettler, Volker
Meja, and Nico Stehr (London and New York: Routledge & Kegan
Paul, 1986).
(Hereinafter referred to as Conservatism.)
14. Conservatism, p.83.
15. Ibid., p.250.
16. FKM, p.137.
17. FKM, p.137.
18. FKM, p.140.
19. Conservatism, p.48.
20. FKM, p.141.
21. FKM, p.143.
22. FKM, p.145.
23. FKM, p.146.
24. FKM, p.147.
25. FKM, p.147.
26. FKM, p.147.
27. FKM, p.153.
28. FKM, p.154.
29. FKM, p.155.
30. FKM, p.155.
31. FKM, p.156.
32. FKM, p.159.

33. FKM, p.159.
34. FKM, p.160.
35. FKM, pp.163-65.
36. FKM, p.165.
37. FKM, p.167.
38. FKM, p.160.
39. FKM, p.172.
40. FKM, p.174.
41. FKM, pp.175-76.
42. FKM, p.176.
43. Conservatism, Introduction.

CHAPTER FIVE

HISTORICAL CONDITIONS OF CONSERVATIVE THOUGHT

The previous chapter introduced Mannheim's approach to the analysis of a particular type of thought in connection with social change. This chapter makes a detailed study of the historical conditions that Mannheim identifies as the impetus to conservative thought, and comments on his way of relating context to the content of a style of thought.

The Politically Effective Group

Having outlined the form of conservative thought, Mannheim begins the task of investigating its historical development, especially its social context.

"The aim of [the] analysis is to find out how [the]... trend of thought... reflects the sociological characteristics of the group or individuals who stand behind it and through whom it finds expression."¹

Mannheim has selected Prussia as "the outstanding centre of conservative thought."² In 19th-century Prussia, Mannheim observes, only the nobility and the bureaucracy had

the level of social organization to be politically effective in response to the French Revolution; the proletariat was guild groups rather than a class; the Mittelstand (middle class) was not politically a bourgeoisie in the French sense.³ A feudal society had not yet become a class society. Instead of the French conflict between king and people, there was a struggle between the nobility and the monarchy (represented in Prussia by the monarchical bureaucracy) -- the German version of the working out of the conflict over ruling the state from 'above' (the monarchy) or (as demanded by the French Revolution) from 'below'. Mannheim is arguing that because Germany lacked a common people able to act against the state, Germany in effect had to substitute part of its nobility in that function in an era of challenge to the state.⁴ The nobility, though 'above' socially, functioned as a 'below' politically.

Yet since the nobility wanted to solidify their position at the top of the social order while acting to change the governmental order, Mannheim says that they had a conservative analogue of the French 'revolutionary impulse'. They wanted change toward "an 'organic' society"; "[the impulse was] a desire to revive the corporative structure of medieval society"⁵ which had given them position and power. The corporative society was the theoretical opposite of the absolutist state of the 18th and 19th centuries, in which

there was (theoretically) a supreme sovereign with final authority, rather than a monarch who shared power with representative assemblies.

At the same time that there was a conservative move toward the past, there was also a liberal impulse in Prussia from those intellectuals who had welcomed Enlightenment thought. As Mannheim and others observed, in Prussia, unlike in France, centralizing and rationalist Enlightenment-like reforms came from 'above', from the absolutist and bureaucratic state, partly against the interests of the nobility. (Although the reformers came from the nobility -- of necessity, since they held high bureaucratic positions which only nobles could hold -- they did not come from Prussia, but from other German states. They represented an impulse toward a new German nationalism; Prussian nobles, in contrast, inclined toward conservatism and local rule.)⁶

The conservative Prussian nobility wanted to revive the corporatism of medieval society, which organized the clergy, nobility, and city magistrates into Stände or corporate political bodies (the Diet) which had an advisory function in the state. Many medieval institutions at all levels -- monasteries, ecclesiastical and secular courts, the church, the kingdom, principal cities -- were each considered as a corporate body which could act for those it "represented" in

matters of government. In Germany, in the 16th and 17th centuries, these corporate bodies participated in the Imperial Diet and in territorial diets, some of which even included the peasantry; there were also some city diets.⁷

Stände -- loosely, standings -- is also a more general term for recognized social orders (peasantry and townspeople as well as clergy and nobility), or the people who are part of them, and connotes fixed and hierarchical social structure with associated rights and obligations. The corporation was, as under modern law, able to act as one person and have the rights and responsibilities of an individual; conservatism's attachment to the corporate order included the sense that the rights, privileges and responsibilities of the community were more important than the rights of its individual constituent members, particularly as the theoretical basis of a state constitution. So the response to the power of a supreme sovereign took a different turn in Germany than it had in France:

"The situation [of resistance to the absolutist state in Germany] found its ideological expression in a feudalistic reaction... [A] movement.... with the most advanced ideological weapons... fought for aims which were determined by the social position of the nobility."⁸

Political and Social Structure of Prussia

Mannheim could assume a familiarity with the late 18th/early 19th-century period on the part of the German-speaking reader of his original written work on conservatism, and perhaps for this reason he does not delineate it. Some background, however, is necessary for the American reader.⁹ After the French Revolution of 1789, as Mannheim indicates, all of Europe's ruling classes were sharply conscious of the political effects of Enlightenment thought. The countries of Europe (as we now know them) were, like pre-revolutionary France, mostly monarchies, with the exceptions of a few republics. What is referred to as the Germany of the time was larger than today's Germany and was fragmented into about 300 sovereign divisions or territorial states, ruled by princes or bishops. It was part of what was still called the Holy Roman Empire. The Empire, which included much of what would later be Germany, Poland, Austria, and Switzerland, was under the rulership (sometimes nominal, sometimes effective) of the Holy Roman Emperor, who had for centuries been elected almost entirely from the Hapsburg (Austrian) dynasty by a handful of high nobles and archbishops (electors), including those in Germany. The nobility's status as electors provided a base for their power in competition with the monarchy. The Holy

Roman Emperor ruled the Empire as a whole, but nobles ruled their own territory within that empire (and the Hapsburg emperors also had their own family territories).

In Germany, besides the 300 sovereign states, there were approximately 1500 manorial estates belonging to nobility who had no intermediate sovereigns between them and the Emperor, and some 50 free cities with the same unmediated relationship. Thus there were nearly 1,900 rulers in Germany. Customs were local, and what was 'local' was circumscribed by a day's journey when journeys were made by foot or on horse. Kings, archbishops, counts, dukes, and margraves at the head of the states, and other nobles in their own small estates, in effect continued a feudalistic social system (though having dispensed with the personal ties of feudalism at the level of the territorial state).¹⁰ A few states dominated in this 'Germany', either because of success in trade, or size, or, as with Prussia, both size and military power.

The rise of Prussia had begun in the 17th century, after the Thirty Years War had weakened the Hapsburg dynasty. Prussia began to grow around the core of the state of Brandenburg (whose court city was Berlin), as the Hohenzollerns began successfully to make alliances and military gains of territory under Frederick William the Great Elector. He and his successors encouraged immigrants

to build up the undeveloped territory. The landed nobles of Prussia, colonizers of border lands which were added to the state, were militaristic and pragmatic, and their alliance with the Hohenzollerns solidified Prussian strength. For this alliance, the nobles (collectively called Junkers) were given absolute control over the peasants who worked their land.

Prussia became known for its military might. In the 18th century, the Prussian army was a feudal-entrepreneurial system in which nobles, as salaried army officers of the Prussian state, ran military companies that owed occasional service to the Prussian ruler, but whose finances were otherwise under the company commander's control, with any profit he could make on maintenance of his soldiers his to keep. The rank and file soldiers were a combination of peasant draftees or recruits, and hired foreigners -- mercenaries who could only be controlled by the most rigid military discipline. Prussia vied with the Austrian monarchy for control over Germany and other parts of the Empire. The central bureaucratic administration that was necessary to a military state continued after its high point under the "enlightened despot" Frederick the Great in the mid to late 18th century, but had limited control over the nobility's privileged rule of its own lands.

Prussia's nobility, which provided the state's high

bureaucrats (although not its reformist ones) as well as its military officers, were basically exempt from taxes, which were borne disproportionately by the thin middle class of tradesmen and artisans. Peasants were still serfs, tied to the land they were born on and owing so much labor to their lords that they had difficulty farming their own land.

While hereditary serfdom had disappeared in many German states during the 18th century, it remained in Prussia even into the early 19th. Until the emancipation of the serfs, the peasants on the nobles' estates had to have the lord's permission to marry, to move off the estate, to have their children learn a trade or go to school. Peasants owed varying amounts of unpaid labor to their lords, and their children had to perform domestic service for the lord.¹¹ Some of Prussia lay outside the boundaries of the Holy Roman Empire, remote from traveled areas. Prussian nobility, unlike their counterparts in western Germany, were not just landlords. They did not live in town or at court, but on their estates, managing them for agricultural production and exercising authority over their peasants. Nobles had laws and courts pertaining only to them, and they dispensed justice and their own law enforcement on their own lands.

From the mid to the late 18th century, Prussia had been ruled by Frederick the Great, an Enlightenment figure who was also a brilliant military general. He doubled the size

of the army, and through years of war he almost doubled the territorial size of the state. He died shortly before the French Revolution and was succeeded by other Prussian kings who were pale leaders by comparison. Following the aftermath of the French Revolution, Napoleon began the military expansion of a new French Empire. He defeated Austria in war, refused to acknowledge the Holy Roman Emperor, and rearranged German states east of the Rhine. With this change, the Holy Roman Emperor had to abdicate.

Prussia then declared war against Napoleon in 1806, in alliance with Russia and Saxony, and only a week later lost a decisive battle at Jena.¹² Napoleon's victory there was so devastating that Prussian forces at some remaining fortresses surrendered without firing a shot. Napoleon entered Berlin, Prussia's capital city, took the horses-and-chariot victory monument from the top of the Brandenburg Gate, and carried it off to Paris.¹³ Prussia lost nearly half its territory, and owed a huge indemnity to France. What had been the Holy Roman Empire was now divided into three parts: a reduced Prussia; Austria; and the Confederation of the Rhine. Germany's 300 states had been consolidated to about thirty. Prussia, whose militarism was its main claim to reputation, was humiliated. If the Prussian state was going to regain power, it would have to change.

Reform and Resistance

As Mannheim observes, the same set of historical conditions gave rise to both liberalism (progressivism) and conservatism. There had been many contradictions in Germany; it had been home both to a backward feudalism and to enthusiasm for the Enlightenment. Even in Prussia there were reforms, but they were reforms motivated from above, from a ruling (and mostly non-Prussian) noble class of government administrators who sometimes wished to strengthen not just Prussia, but a greater Germany. To achieve economic strength they planned to eliminate obstacles to capitalist development. Reform ministers in the administration of the Prussian state after Napoleon's victory abolished serfdom and guilds in the first decades of the 19th century. These reformers (Stein and Hardenberg) were not native Prussians. Army recruitment and discipline were also reformed under officials (Scharnhorst and Gneisenau) who were not native Prussians.¹⁴ These reforms, if they were effective, would take from Prussian nobility their feudal privileges and their profit-making positions of military leadership.

The reforms and the increasing centralization of government administration, which, except for taxes, had previously been parceled out among the estates of the

nobles, were opposed by the conservative nobility. Prussia was still mostly agricultural; until its boundaries were extended after the defeat of Napoleon, Berlin was its only city of any size (about 150,000 inhabitants in 1800, 20% of whom were soldiers or their dependents; London at the time had a population of 1.1 million, Paris about 600,000).¹⁵ Though Prussian peasants had been emancipated from serfdom, it cost them much of their land, which they had to give as compensation to the nobility for loss of the peasants' services. Meinecke explains why this compensation came about:

"...it would never have been possible to impose reforms against the opposition of the landowners. They still constituted the wealthiest and most powerful group in society, and Prussia lacked a socially and economically strong middle class that might have helped the state to defeat the nobles. The true opponent of the nobility was the higher bureaucracy...."¹⁶

Social positions (Stände, estates) had been basically hereditary until the 1800s; burghers could only rarely become nobles (by virtue of ennoblement by a ruler), nobles could not take up middle class occupations without losing their status and privileges; peasants could not become burghers. The reforms changed this, and "Estates turned into classes...."¹⁷ but while some burghers and well-off peasants were able to move upward (and buy estates of the nobles), the nobility did not take up another style of life. It "retained the character of an Estate,"¹⁸ attached to its

old forms. Before the reforms, nobles could not incorporate peasant land into their estates; afterward the Junkers increased their holdings, by receipt of land as compensation and by purchase of other lands. With their now larger estates, and the need to re-establish productivity after the war, the Junkers more than ever needed agricultural labor to work the land, and managed to get exceptions to the freedom of landed peasants from obligatory services.

In practical terms, the abolition of serfdom was a temporary phenomenon in some areas. Alongside these still-serfs, a rural proletariat began to form as some peasants became landless because their remaining holdings were too small to be productive and had to be sold; these peasants worked as paid labor for the nobility. The reformer Stein in time "regarded the Prussian nobles as a burden on the nation: there were too many of them, most of them poor... undereducated and too demanding."¹⁹ Max Weber, a hundred years later, still regarded the Junkers as a recalcitrant class, and said that though they might have been landed nobles, they were never aristocrats.²⁰

The nobility's authority over lands and people was imbued with the concept of Herrschaft, translated as dominion or rule, but literally lord-shaft (as in the shaft of a spear), and similar in sense to the English word "lordship". The exerciser of Herrschaft was der Herr, the

lord and master. Sheehan comments:

"The nobility's claim to political power was rooted in their Herrschaft, a concept which... fused various forms of authority with the person of the individual...."²¹

Herrschaft had both legal and cultural meaning. It established jurisdictional rights of rulers, though not without room for contention between competing parties.²² In the 18th century, centralized government, with its written rules and legal codes "replaced the complex of customary law and tradition upon which the world of Herrschaft had depended."²³ Culturally, Herrschaft supported a patriarchal system of both family and government:

"As a Herr im Haus, the father's authority, his Herrschaft, was linked with a hierarchy of other authorities, ranging from the noble lord to the prince to the divine source of all legitimate rule."²⁴

The emperor, princes, bishops, nobles, the guilds, were all part of Herrschaft. With the changes at the end of the 18th and beginning of the 19th century:

"In Prussia, as in other German states, the conflict between the reformers and their enemies continued a longstanding struggle between the advocates of state sovereignty and the defenders of Herrschaft... To its enemies, reform endangered religion, property, and authority."²⁵

Why, under these circumstances, so favorable to conservatism, were there any attempts at reform in Prussia at all? For one thing, the cities had very different

economic interests, and different social forms from the countryside and its nobility, and wanted reforms (though for the most part they did not get them). For another, Prussia was not just a rigidly bureaucratic and militaristic state; it had also experienced Enlightenment ideas and progressive administration under Frederick the Great. It also had different regions, not all of them Junker-ruled. With Napoleon threatening to rule all of Europe, there were hopes that Prussia, though temporarily defeated, would yet be the "protector of German freedom and culture.... Heroism, military glory, energy, enlightened Protestantism -- these were the forces that made Prussia appealing in Germany...."²⁶

Both the conservatives and the liberals hoped for a Prussia restored to its former strength, and an alliance with Russia against Napoleon from 1813 to 1815 made possible the "Wars of Liberation," followed by Napoleon's defeat at Waterloo. Prussia came out of the subsequent Congress of Vienna, as part of the new German Confederation, with boundaries that increased its share of western Germany. The Confederation included Austria, the Netherlands and Denmark. Prussia continued to struggle with Austria (where Metternich consolidated reactionary forces) for control of central Europe.

The early 19th century was a period of emerging

nationalism in Germany. In an attempt to build a nation state out of centuries of fragmented, personally-aggrandizing small rulerships, German thinkers drawing on idealism and Romanticism conceived of a national feeling residing in the people as a whole -- the Volkstum. This encompassing spirit was held to be an immanent quality of all the sharply divided German estates and classes -- the peasants, the Bürgertum (bourgeoisie, townspeople, citizens rather than subjects, the middle class)²⁷, the nobility, craftsmen, the proletariat. In the late 18th and early 19th century, romantically nationalistic works came from Novalis, Herder, Fichte, the Grimms, Schelling, Schleiermacher, and reached a high point in Hegel's philosophical marriage of spirit and the state. But the nobility still distrusted the bourgeoisie; the bourgeoisie feared the proletariat and a rootless peasantry.

Conservatism and Intellectuals

Here we can pick up again on Mannheim's analysis. He has said that the reformist bureaucratic state is acting in part against the nobility. The conservative nobility are looking for a way to re-establish the world they knew only a generation before. An alliance, as Mannheim puts it, now

forms between Romanticism and feudalistic conservatism. Romanticism, intellectually opposed to the Enlightenment, shares conservatism's social base: those outside of the current of modern capitalism and rationalization (previously mentioned by Mannheim in connection with "suppressed modes of thought"). Aside from the nobility, these are the petit bourgeoisie and (lacking institutionally-strong Catholicism in Prussia) Pietist Protestants. (Peasants, although also earlier identified as 'outside' by Mannheim, are not specified as part of Romanticism's social base.)

By the time Romanticism becomes a movement, however, its exponents are chiefly 'socially unattached intelligentsia',²⁸ from the same stratum that provided proponents of the Enlightenment. But while Enlightenment writers had the ideological support of the bourgeoisie, "conversion to romanticism meant for the intelligentsia an increasing social and philosophical isolation."²⁹ The German bourgeoisie was not politically conscious; newspapers were few and not independent of the ideology of the state; the profession of independent writer was a new and insecure one. Although there had been an upsurge in the publication of books and the founding of journals and newspapers in Germany at the end of the 18th century³⁰, they promoted a literary culture rather than political commentary. This literary public was probably less than 5% of the total

population.³¹ Early 19th-century Germany "lacked a political or cultural center like London or Paris."³² Under Frederick the Great, poets and scholars wrote of the spirit, not of the politics of the state, and nobles gave them patronage without concerning themselves with what these thinkers wrote. But as the 19th century begins, the intellectuals "sell their pens";³³ on the negative side, Mannheim says, they become "mercenary pamphleteers"; on the positive side they raise questions as they speculate on history and philosophy. Their observations could be astute, but lacking social roots,

"...they defended causes which had their social basis elsewhere -- in strata of greater social vitality. Their fate is typical of the fate of the intelligentsia in the modern world -- clearly traceable since the eighteenth century."³⁴

Now, in a Germany on the edge of the industrial revolution,

"The fate of the world of thought is in the care of a socially unattached, or barely attached, stratum.... This fact is of the greatest importance for modern thought...."

because ultimate aims of ideological movements derive from their social background. In the hands of intellectuals who don't share this background, aims can be "frittered away." But, on the other hand, without intellectuals to speculate on philosophical questions and to perceive and discuss qualitative differences,

"it might easily happen that all spiritual content

would disappear from our increasingly capitalistic society and leave nothing but naked interests. For it is the latter which are at the basis of ideas as well as ideologies."³⁵

Mannheim examines the thought of some of these "socially unattached" intellectuals. They are freischwebende -- "free-floating" (or free-soaring) -- because they are neither of the class of their birth nor of the class of their aspiration as they move across the social order in their attempt to establish their living. They still, however, have the personal history of their class origins to influence their actions, as well as their ambitions. They are not unrelated to the social order, but are in a position of suspension (another meaning of Schweben), of hovering.

Early Conservatism

As examples of precursors of such unattached intellectuals in early German conservatism, Mannheim discusses the writings of Adam Müller (1779-1829) and Justus Möser (1720-1794), and compares them to the English conservatism of Edmund Burke (1729-1797), whose attack on the French Revolution influenced Müller. In German social thought, Mannheim says, Müller stands at the "juncture" of intellectual Romanticism and feudal conservatism.³⁶ Like Burke, Müller is the nobility's "middle-class" interpreter,

whose distance from the nobility gives him perspective on their social conditions, while his interest in becoming one of them gives him solidarity with some of their views.³⁷ Müller, the son of a minor official, was a tutor to families of the nobility; he gained a noble title a few years before his death. Möser was another middle-class interpreter, the son of a lawyer who had risen to an important government position alongside aristocrats; the younger Möser's career followed a similar path.³⁸ He is analyzed by Mannheim as an influence on Müller; he was himself a late 18th-century writer and government official, and a Westphalian, not a Prussian.

Like Burke, Müller emphasizes gradual historical development and continuity, and makes nobility the prime actor in history. Like Burke, he is romantic about Europe's past. Mannheim traces Müller's romanticism to the attitude of pantheism, another pre-rationalist remnant. Pantheism is so attuned to the rhythms and fluctuations of the world that it reaches the point where, in Mannheim's words, "thought must not portray the world; it must accompany its movements." This is an important development and "from this tendency," Mannheim says, "arises everything we call 'dynamic thinking'."³⁹ Müller's Elemente der Staatskunst (Elements of Statecraft), prepared as lectures for German nobility who were government officials, is "a plea for the

nobility and the whole feudalistic attitude."⁴⁰ It was a response to a pamphlet by a liberal writer and was "encouraged" by Friedrich von Gentz, Müller's friend and a writer and politician who spread Metternich's reactionary views.⁴¹ The influence of Burke, Mannheim says, can be verified by Müller's own references; there is also an influence from Möser, Mannheim claims, though he is not quoted by Müller.

Möser, Mannheim says, doesn't romanticize like Burke, he simply "lives in the remnants of the past which still exist in the present";⁴² the past is not yet an object of reflection. He wrote a history of his home district, Osnabrück, and many newspaper essays. The history put forth the theory that traditions and custom contribute to the form of government. Even a sympathetic observer notes that Möser's theory is more consistent than his history;⁴³ Mannheim, in a footnote, calls the Osnabrückische Geschichte "largely a tissue of more or less gratuitous explanations."⁴⁴

Möser's writing, Mannheim says, praises 'practice' in contrast to 'theory', and favors 'qualitative' thinking against universals (an element of Romanticism, Mannheim points out, which was already in feudalism and its local differences of customs). Möser justifies serfdom, and opposes general laws. Möser's theme (what a critic would

call the good old days of feudalism) is also in Müller, Mannheim finds, but more as a type of thought than as a direct influence from Möser. "Möser's... older feudalistic ideas... reappear on a romantic 'level' in Müller."⁴⁵ In drawing on both feudalistic and romantic sources, Müller gave "internal consistency to the ideological struggle" of counter-revolutionary thought.⁴⁶ The "alliance with romanticism" saved the old, feudalistic forms of thought and experience, "revived them, and equipped them with a modern theoretical foundation."⁴⁷

The Historical Determination of Thought

Mannheim analyzes how the writings of both these authors exemplify the characteristics of conservative thought listed earlier -- concreteness against abstraction; extreme individualization; qualitative thinking that is against generalization and uniformity (thus anti-bureaucracy). Conservative German thought, he says, started out in opposition to the Enlightenment tendency to bureaucratic centralization, then after allying with Romanticism, also opposed the natural law thought of the revolutionary bourgeoisie. It thus opposed two forms of rationalism: bureaucratic rationalism, which 'equalizes'

territorial and social differences in a narrow sphere; and bourgeois rationalism, which "wants to rationalize the whole social order... in a systematic manner."⁴⁸

France had had a ready-made counter-revolutionary metaphysics in Roman Catholicism; northern Germany, home to Protestantism, had to formulate its opposition and did so by attacking the logic and method of liberal thought. Enlightenment thought, Mannheim notes, is unilinear -- the unfolding of single principles is its 'progress', its 'rights of man'. Müller opposed static (rational) thought with dynamic thinking, and the "historical school" opposed rationalism with irrationalism (the not always reasonable course of actual events). In Müller's Elemente der Staatskunst

"grows up that phenomenon which, under the name of 'philosophy of life' (Lebensphilosophie), has ever since, and today with renewed vigour, assailed rationalism in all its diverse forms."⁴⁹

All these different tendencies become unified in a single Weltanschauung.

The conservative opposition to rationalism is a historically determined one. A priori, Mannheim says, we would speculate that progressives would emphasize Life (and its accompanying activity, movement and change), and that conservatives would rely on norms and rigid, unchanging abstractions. But empirically, historically, it is the

other way around, because the progressive thought of the bourgeoisie arose in alliance with rationalism (and its universal norms).⁵⁰ Romantics and conservatives, needing a key theoretical issue to challenge, made the natural-law, rationalistic thinking of the Enlightenment that issue. Responding to that core theoretical problem unified conservative thought.

"In bourgeois natural-law thought the state is established by a settlement (contract) between the contracting parties recognized for all time as just. In feudalistic, romantic thought the state is an ever-fluctuating dynamic settlement between antagonistic groups. Something in that conception sounds familiar to us."⁵¹

The familiar emphasis on the dynamic, according to Mannheim, has since been taken over by the Left.

Content and Context

In his essay on "Conservative Thought" Mannheim examines both the content of knowledge (including epistemological assumptions) and the social context of knowledge. His sociology of knowledge is not just about the social position of the knower, but is also about the ideas themselves, as in a history of ideas. The summary below breaks out what Mannheim says into these two areas; in

brackets [like this] is my way of phrasing when it is very different from Mannheim's (as translated in "Conservative Thought").

[see columns below]

CONTENT/EPISTEMOLOGY

Intellectually, rationalism arose in opposition to Aristotelian scholasticism and to Renaissance philosophy of nature.

Rationalism assumes true knowledge is only that which can be shown to be universally valid.

Intellectually, Romanticism arose in opposition to the rationalism of the Enlightenment.

Traditionalism is a general psychological attitude, transhistorical.

Ways of thinking or acting can have their own history; they pre-exist the individual and are [relatively] objective mental structures.

Each style of thought works out a key problem that: a) gives the thought its theoretical unity b) determines its growth c) makes its interpretation possible. (E.g. key problem for conservatives is to oppose natural-law mode of thought -- not just its

SOCIAL CONTEXT

French Revolution polarized thought as well as action.

Politics became the center of crystallization for styles of thought in the first half of the 19th century.

Social groups outside of the bourgeois movement for rationalization and capitalism are groups which continued the thought that rationalism suppressed -- Romanticism and feudal conservatism.

Conservatism is a specific product of class society. Traditionalism can become the historically-specific conservatism given the necessary juncture of events, which includes the need to oppose another style of thought. This happens in a class society, a society in which change occurs by class conflict.

Objective mental structures are bound up with the fate of human groups.

Behind each style of thought is a basic intention out of which it grows, the "inarticulate group experience" [derived from social circumstances]. (E.g. basic intention of conservatives is to hold onto a traditional way of life [which they still to

CONTENT/EPISTEMOLOGY

content but also its [epistemological assumptions]. They oppose Reason conceived of in static fashion.

Opposing styles of thought will have different intentions but may have the same impetus, and share characteristics. (E.g. "excessive subjectivism" of both romanticism and rationalism in the nineteenth century.)

Content or epistemology cannot be assigned to political positions a priori. (E.g. a priori, Life would seem to go with progressive thought, and norms and rigid abstractions with conservative thought, but it is vice versa because revolutionary thought of the bourgeoisie arose in alliance with rationalism.)

SOCIAL CONTEXT

some extent practiced before conservative thought went forward in its development].)

Left and right political positions may derive from the same basic opposition to a preceding style of thought [depending on social and political circumstances and events]. (E.g. Marxist and vitalist conceptions of dynamic reality develop from romantic opposition to bourgeois rationalism.)

Right wing opposition to capitalism initiated criticisms that were later taken over by the left. The structural difference remains, however, that left opposition (proletariat) grew out of capitalism, right did not.

A social group must have acquired a certain degree of organization to effectively respond to [pressure on their way of life], both in political action and in thought.

Exponents of a style of thought who are socially unattached intelligentsia will not have a cause of their own and thus will not understand [or theorize] ends; this typifies the intelligentsia today and is traceable to the 18th century.

The content of a style of thought is a response to social context; that context also includes already existing styles of thought, which may either be opposed or adapted by the developing style. It is the oppositional dynamic, however -- two different arguments competing to define meaning and social purpose -- that generates consciously articulated styles of thought. A style of thought is not inherently (by its content) suited to a left or right political position. Historical circumstances determine the political favor attached to ideas. The shaping of ideas by interests (and of interests by ideas) is not a mechanical process, but one which reaches deeply into lived experience, traditions, and desires.

After a close analysis of the writings of Adam Müller and Justus Möser, with asides on Burke, Ranke, Stahl, Savigny, de Maistre, Hegel, and other, more minor, authors, Mannheim concludes:

"It is not necessary to go into all the details....Our purpose was merely to show that not only the content of thought, but even the conceptions of reality of the twofold opposition against bourgeois rationalism were formed in direct reaction against it; that the product of the struggle was a concept of life which was characterized by movement, by dynamics; and that both the vitalist and Marxist conceptions of reality developed in clear continuity from this romantic opposition."⁵²

For the most part, Mannheim's account of the development of the conservative style of thought is an account of contents. Context plays a background part in his

description, though not in the theory which is meant to support his method. An overview of context (as given here) supports his argument that the social conditions, experience, and historical place of a particular social group provided the substance out of which conservative thought was built. But as Mannheim's critics complain, the mechanism of connection is not specified. However, Mannheim argues that the connection is not mechanical -- finding it is an interpretive process.

NOTES TO CHAPTER FIVE

1. Karl Mannheim, "Conservative Thought" in From Karl Mannheim, ed. Kurt H. Wolff (New York: Oxford University Press, 1971), p.177.

(Hereinafter referred to as FKM)

2. FKM, p.177.

3. The judgment of the 'failure' of the middle class in Germany, particularly later in the 19th century, has been a common explanation for the ills of Germany's political process since then, including Nazism. More recently, this evaluation of the middle class and the use of the French case (or the English) as a model, has been questioned. There is no indication in "Conservative Thought" that Mannheim means such a judgment. For a re-examination of this German exceptionalism, see David Blackbourn and Geoff Ely, The Peculiarities of German History: Bourgeois Society and Politics in Nineteenth-Century Germany (New York: Oxford University Press, 1984).

4. Although there had been an alliance between the nobility and the bureaucracy under Frederick the Great in the years just preceding the Revolution, subsequent reforms in the interests of the state weakened the alliance. The terminology of above" and "below" was used at the time, and Mannheim repeats its use. Sheehan [German History, p.294; see note below for bibliographic reference] reports that a Prussian minister, Johann Struensee, remarked to the French (in 1799) that the revolution in France was made from below; in Prussia it would have to be made slowly and from above.

5. FKM, pp.179-80.

6. See Meinecke (below), all. "Revolution from above" was a term from liberal reformers, who held that as their goal.

7. Dictionary of the Middle Ages, Joseph R. Strayer, editor in chief (New York: Charles Scribner's Sons), Vol. 3, 1983, entry on "Corporation"; Vol. 10, 1988, entry on "Representative Assemblies, German."

8. FKM, p.180. In Conservatism, Kettler, Meja and Stehr replace "feudalistic reaction" with "reaction based upon the estates" (p.114). The authors generally substitute a similar phrase for "feudal" throughout their translation,

because the estate system and feudalism are significantly different. However, for the American reader, the word "feudalistic" conveys the intended meaning of thought and social patterns based in a medieval, hierarchical world -- one which was inegalitarian.

9. Sources for this historical background are Dictionary of the Middle Ages, Joseph R. Strayer, editor in chief (New York: Scribners, 1988 - Vol.10, 1983 - Vol.3); Peter Gay and R.K. Webb, Modern Europe to 1815 (New York: Harper & Row, 1973);

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edition); A.J.P. Taylor, The Course of German History (New York: Capricorn Books, 1962; original edition 1946).

10. Snyder; Sheehan, German Liberalism.

11. Meinecke, Ch.4, pp.81-82.

12. Gay, p.515.

13. Snyder, p.26.

14. Meinecke, p.63, p.65.

15. Sheehan, German History, pp. 115-16; Brian R. Mitchell, European Historical Statistics: 1750-1975, 2nd edn. (New York: Facts on File, 1980).

16. Meinecke, p.81.

17. Ibid., p.82.

18. Ibid., p.82.

19. Ibid., p.89.

20. Max Weber, "National Character and the Junkers," in From Max Weber, Hans H. Gerth and C. Wright Mills, eds. (New York: Oxford University Press, 1946).

21. Sheehan, German History, pp.126-27.

22. Ibid., pp.25-27.
23. Ibid., p.39.
24. Ibid., p.81.
25. Ibid., p.302.
26. Meinecke, pp.34-35.
27. Footnote from Sheehan, German History, p.32:
 "[Commoners] came from various places in society: commerce and manufacturing, the civil service and free professions, education and publishing. While it is awkward to refer to them as 'non-noble elites', there is no more positive term that adequately describes them." Sheehan goes on to describe the difficulties of applying Bürgertum, bourgeoisie, or middle class to this group. The 'middle class' of this time was more like an upper middle class in America today than like America's broad middle class.
28. Mannheim credits Alfred Weber for this term, FKM, p. 183, footnote 1.
29. FKM, p.183.
30. Sheehan, German Liberalism, p.7; German History, pp. 154-57.
31. Sheehan, German History, p.157.
32. Sheehan, German Liberalism, p.13.
33. FKM, p.183.
34. FKM, p.186.
35. FKM, p.186.
36. FKM, p.188.
37. The middle class that Mannheim refers to here is, in education and social status, more like the American upper middle class. Since the whole social situation was different, there was really no equivalent to any American class of today.
38. Mannheim calls Möser's father a "patrician," that is, a wealthy townsman of high status. This terminology is another indication of the lack of counterparts for German 19th-century class and status in 20th-century America.

39. FKM, p.190.
40. FKM, p.191.
41. Gentz had first been a supporter of the French Revolution, but later changed his mind. He translated Burke's Reflections on the Revolution in France, and developed a reputation as a conservative ideologue.
42. FKM, p.198.
43. Johnathan B. Knudsen, Justus Möser and the German Enlightenment (Cambridge: Cambridge University Press, 1986), Ch.6.
44. FKM, p.197, footnote 4.
45. FKM, p.192.
46. FKM, p.204.
47. FKM, p.202.
48. FKM, p.207.
49. FKM, p.204.
50. FKM, p.205.
51. FKM, p.212.
52. FKM, p.222.

CHAPTER SIX

FROM CONSERVATIVE THOUGHT TO ENVIRONMENTAL THOUGHT

The previous chapters have discussed how knowledge functions in society, considered questions about what scientific knowledge contributes to worldview, and discussed how Mannheim investigated the influence of worldview by giving a developmental account of a "style of thought." This chapter turns to the comparison of different centers of contention for styles of thought -- namely, politics (as in Mannheim's example) and science (as I find central to arguments about the environment).

Together, Chapters 1-6 form Part I of this study. They introduce the concepts used for the analysis of environmental thought. Part II summarizes major environmental books of the 1960s and 70s, analyzing their concerns and underlying worldview. The last two chapters compare scientific and political frameworks for understanding social action, and evaluate the use I have made of Mannheim's method for analyzing the relation of worldview and argument, and the relation of social origins to the content of arguments.

Scientists as Environmental Voices

After I first read Mannheim's "Conservative Thought" I thought it would be interesting to see how left and right, or conservative and liberal, are now positioned on legislative issues before the U.S. Congress, and whether those positions accorded with any of the 19th-century conservative and liberal goals. To narrow the inquiry, I turned to environmental issues, but soon found that a left and right characterization of stances was not easily made. I wondered if this was because politics itself was not the center of contention where environment was concerned, but scientific data and opinion that was the focus of disagreement. I then began to think about science as an organizing center for an emerging style of thought, an "environmental" style of thought. My understanding of environmental issues had come out of a feeling for nature and an appreciation of its vitality, beauty and diversity. That nature tradition, I thought, might be like the persistence of feudal tradition among 19th-century conservatives -- a "suppressed mode of thought" that now, under new and threatening conditions, was finding its voice in a new way.

Thus I had two parallels to Mannheim's study of conservative thought: a concept-organizing center (science)

for contended issues, and a group with a neglected worldview who felt both the obligation and the opportunity to speak. The nature lovers, I thought, would have appropriated scientific arguments to make their case while developing a specific voice of their own, just as conservatives appropriated Romantic rhetoric -- a third parallel. In my memory of the 60s and 70s, when environmentalism sprang up, it was those who cared about nature who were carrying the flag and getting people to listen. Behind environmentalism's sudden appearance, I knew, was a long tradition of conservation. But when I tried to list the books that I remembered from that period, I could not remember books by nature writers. After some research, I found that the books that most captured the public attention, that were most widely sold (some in the millions of copies), were, for the most part, books by scientists. Scientists might seem to be likely authors where arguments have science at issue, but in fact, there are many constraints against scientists speaking out on public issues. The objectivity that science aims for is pragmatically coupled with neutrality, while environmental issues call for taking sides.

Perhaps, I thought, the two types of environmental voices -- scientific and nature-oriented -- combined in some way. I do think that this combination happens, but I did

not find much of it in the leading books of the period. (Rachel Carson is an exception to this general rule; her feeling for nature illumines Silent Spring.) Of course, there are many avenues to public opinion, and books are only one. The nature-oriented organizations that had long been active in conservation were not silent during the 60s and 70s. But the voice that captured attention was the voice of warning, and that warning was made most convincingly by people with scientific training.

So the works that are reviewed here are mostly books by scientists, although articles and books by non-scientists are also included. The works were chosen for the notice they achieved, evidenced either by sales figures or by frequent mention in other environmental literature. Although only these works are mentioned, I read many others -- poetry, reflections, fiction, polemics, meditations on nature. To my regret, I could not bring them all into one study. With my source material at hand, I considered how to apply Mannheim's study of conservative thought to this narrowed-down study of environmental thought.

Summarizing Mannheim

Mannheim selects a particular example of conservative thought, what he calls "early or old conservatism" in Germany in the first half of the 19th century, because this is a particularly "paradigmatic" case for his analysis of style of thought. He notes that the theoretical divisions of conservative thought, and their corresponding social class divisions, are not so clearly marked in England, where in fact conservative thought of the political type began.

An essential part of Mannheim's sociology of knowledge is that a consciously-developed ideological argument must have a particular social location, some "bearing strata," at least in the initial stages. Thus he locates the early conservatism of Germany in the Prussian nobility, but notes that conservative thought assumes different forms depending on whether it is borne by aristocracy, small estates, bureaucracy, or monarchy.

The way in which Mannheim identifies the social location of an ideological position is not to go into detail about socioeconomic status (landholding, relative wealth, social status, occupation, hereditary privilege, etc.), but is instead to trace currents of thought along a line of development that follows historical events. He does a history of ideas in which the ideas are related to material

developments. The principle of his sociology of knowledge as he applies it to conservative thought is that "thinking reflects existence."

In his analysis of conservatism, Mannheim identifies several key elements in the development of a style of thought. I have abstracted these key elements from what Mannheim says; he does not provide a summary of this method as I give it here. (Where I use his terminology it is in quotes.) Mannheim identifies a polarizing event (not his term) that gives impetus to the style of thought. (For conservatism, the polarizing event was the French Revolution.)

He locates the polarizing event within a sphere of social activity, and names that activity the point or agency of "crystallization" for styles of thought that develop oppositionally. This point is a center of contention around which groups develop their differences in the form of arguments meant to persuade.

He identifies an effective group, (my term) one with sufficient social organization to mount the response to the opposing style of thought. The actual authors of the response may speak for that group rather than being of it. (For 19th-century German conservatism the effective group was the Prussian nobility.

He identifies a "basic intention" that comes out of the

group's social situation. The individual can match this intention to his/her own experience, which is unarticulated until the style of thought articulates it. (For conservatives, to hold on to a traditional way of life.)

There is a polarity (my term) by which opposing styles of thought can be characterized, and which stands for the fact that styles of thought develop oppositionally. (Conservative/liberal.)

There is a "key problem" (epistemological issue) which is related to the group's intent, as Mannheim says, not only to think about different things, but to think about them differently. (For conservatives, to resist the abstract universals of Enlightenment thought.)

These elements must be situated within a context of "oriented change" -- extensive society-wide change which is the matrix within which polarization can take place. (In Mannheim's example, restructuring of the monarchical, European nation-state, the growth of capitalism, and class society.)

Following Mannheim

There are three major points to remember in analyzing a style of thought according to Mannheim's method: that the

overall method is an analysis of meanings (not of veracity, validity, or accuracy); that arguments express and derive from a basic intention related to a desired world; that the arguments are structured around a key problem that gives theoretical unity to the thought-style.

The basic intention is the intention of a group or class, not of any single thinker, and no single thinker will express all of it, but some "authentic manifestations" of this intention will be in any one individual author's work. "Authentic manifestations" are characteristics of the argument related to intention; they are authentic in that they come out of the experience of life shared by the group with the intention.

Similarly, there are characteristics of the argument related to the key (epistemological) problem, which come out of opposition to an already formulated argument for a desired world, one that the newly raised voices wish to keep from happening, or from developing further.

In conservative thought, for example, characteristics of the argument which are related to the intention to maintain or return to a traditional form of living are its emphasis on details rather than on overall structure, on a concrete notion of property rather than an abstract one, and on a qualitative idea of liberty rather than a universalistic one -- all related to an older feudalistic

structure of property ownership, rights, and obligations, with its local peculiarities and personal relationships.

Epistemological characteristics, formulated in opposition to revolutionary Enlightenment thought, are that History replaces Reason as a legitimating explanation -- it is the supposed principal mover of human events; the irrationality of reality is emphasized, rather than its adherence to universal laws; universalistic statements are countered by descriptions of individual cases; and finally, dynamic reason replaces static reason. (This dynamic reason, or dialectic, counters the static character of Aristotelian or formal logic, which relies on fixed identities for the progression of its reasoning. Fixed identities allow for the timelessness of universal laws, and for natural law as found in Enlightenment thought.)

Analyzing Individual Authors

All of these characteristics are Mannheim's summation of a body of conservative thought. He uses individual arguments to illustrate these characteristics, but he does not say how he went about evaluating each separate argument itself. Instead, he talks about how he treated the body of work as a whole. For my investigation, I have found it

necessary to ask the question, How may an individual author's work be investigated for its possible participation in a thought style? The overall process of investigation is hermeneutic: individual arguments with a similar theme point to a thought style; an apparent thought style gives meaning to the utterances of individual arguments. In order to piece together the whole thought style out of its individual elements, one needs an overview from reading many arguments, and a methodical way of approaching the individual works. For the works considered in this study, I had an overview as a result of having read many of the environmental works of the 60s, and some of the 70s, as they appeared. Of each individual work, after reading or re-reading it, I asked:

- What does the author praise? Criticize? Emphasize? Justify?
- What is the author's main argument?
- What other types of argument does the author ally with or adopt?
- How does the author define differently something that has already been given a definition by an existing and opposing thought-style?

From my overview of the works I listed provisional characteristics related to intention in environmental

thought as it comes from scientists:

- Emphasis on system complexity and interrelatedness.
- The frequent citing of facts and the use throughout of quantification.
- The use of prediction as warning or an emphasis on prediction as a requirement of responsible action.
- Speaking out in the context of moral responsibility.

The citing of facts and the use of prediction conceivably come out of the professional, occupational experience of all scientists, out of empirical investigation, out of the requirement that science be predictive to prove itself. Interrelatedness is not emphasized by all scientists. In the life sciences -- whose subject matter has a direct connection to environmental issues -- an emphasis on system complexity is particular to ecologically-oriented scientists, and it is counter to the reductionist discipline of molecular biology. Speaking out is another characteristic not common among scientists, who have been traditionally expected to stand apart from politics. Yet there has been, since the development of the atomic bomb, an ethic of speaking out as a moral responsibility under grave circumstances; it is the gravity of the situation that makes the scientist speak out -- a

case of no longer being able to keep quiet.

The key epistemological problem for scientist environmental writers in this period appeared to be holism vs reductionism. Some characteristics of the related arguments are:

- Wholes replace parts as elements of analysis.
- Interrelatedness counters isolated elements.
- Multiple causes, or cyclical causes, replace single or linear causes.
- Time-awareness replaces atemporality; the present is not a timelessly representative moment of universal laws, but is projected into a future which will change it.
- Behavior constitutes structure (as in ecology), rather than structure determining behavior (as in molecular biology); this is a choice of perspective, not a final either-or statement.

These "authentic manifestations" and epistemological characteristics of the environmental style of thought are to be found in the totality of the arguments made in the major environmental books of the 60s and 70s. As Mannheim observed, no one argument will include all elements.

Politics and Science as Centers of Contention for Thought

Mannheim's reading of European history is that politics became the center of crystallization for styles of Western thought in the first half of the 19th century, when the growth of the modern state made all social struggles political (i.e., gave them political relevance in the apportionment of power between and among government and governed.) Today, we could say that state intervention plays the part of state growth; all struggles are politically relevant because of the pervasiveness of the state.

In addition, today the growth of science (also a site of state intervention) provides a new center for styles of thought because it makes for new struggles: over the use of nuclear power; over the control of the processes and ownership of one's own body (and because of psychoactive drugs, thus over one's mind); over the environment, which transcends political boundaries; over the collection, use, distribution and control of information; over the meaning of ethical values themselves, not just over any particular values.

With science as the center of contention for styles of thought (arguments intended to persuade and legitimate), the fulfillment of Mannheim's categories can be hypothesized as

follows for the 1960s and 70s in the United States, the developmental period for a new environmental style of thought.

Polarizing event

Atomic bomb. This began the re-evaluation of science.

Center of contention

Science

Effective group

Critical responses to science are located in varying groups. For environment as the issue which elicits or provides the opportunity for this critique, and for critique which appears as coherent theoretical or persuasive argument in written form, one group is notable: relatively independent life scientists. Nature-oriented writers also present an environmental argument, but not as theoretically or pragmatically attuned to science.

Basic intention

To preserve the environment and protect human health and life.

Polarity

Science truster/science skeptic.

Key theoretical problem

To resist reductionism with holism. Scientific rationalism and technological growth suppress holism until the holistic view becomes relevant to the misuses of science/technology, whereupon it takes the form of "environmentalism."

Oriented change (issues in the United States, 1960s-70s)

atmospheric testing of nuclear weapons

population explosion

pollution

"Silent Spring" and subsequent environmental warnings

oil spills

extinction of species

loss of wilderness

Positioning the Analysis

The environmental works of the 1960s and 70s that have been chosen are reviewed in chronological order, to give a sense of the development of the environmental argument. I give a much more detailed account of content than Mannheim does with the works he considers. Mannheim presented the results of his analysis, not the process of it. The form of "Conservative Thought" is critique as much as analysis. Mannheim "unmasks" conservative thought, but does not do it oppositionally. In fact, some have argued that Mannheim intentionally reproduced the conservative approach in his insistence on the importance of concrete circumstances, local conditions, and dynamic change.¹ Yet since Mannheim points out that this emphasis was later taken over by Marxist thinkers, this characteristic of his work cannot definitely be used to position him politically. As Mannheim himself says, content cannot be assigned a political label a priori; historical circumstances will determine whether a given content will have a left or right meaning.

Since all analysis must be made from some position, and since Mannheim himself is subject to the same analysis that he applies, it is reasonable to ask where he stood, what his background was, and whether he could achieve some stance of neutrality in his work. That question requires much more

investigation than this study can provide. However, the same question can be asked also of me, and can be at least partially answered. In the environmental debate, I am on the side of those who are convinced that not enough is being done to make the changes that are necessary to preserve the environment and assure the future security of our own lives on the planet. In my own terms, I am a science-skeptic, one who does not trust that science and technology will be used for ecological balance, while at the same time depending on science to provide the information that warns of danger and makes environmentally positive action possible. In this study I am reviewing the works of people who mostly share that view. This study is not an account of both sides of the argument, but of one side -- although that one side has its own diversity. By being detailed about content, I attempt to give a balanced account of the development of that argument, as I believe Mannheim attempted to do in the case of conservative thought.

NOTES TO CHAPTER SIX

1. See the Introduction by David Kettler, Volker Meja and Nico Stehr, editors of Conservatism, by Karl Mannheim (London and New York: Routledge & Kegan Paul, 1986).

PART II

CHAPTER SEVEN

THE ARGUMENT FROM SCIENCE - SILENT SPRING

Part I introduced knowledge in society and the question of how science, as a particular form of knowledge, is to 'be' in society. The environmental debate has been identified as a place where this question is prominent. That debate was used as a case in point for a "conceptual shift" toward the use of a scientific framework for legitimating social action. Mannheim's study of conservative thought was reviewed and taken as a model to follow for the study of environmental thought. Part II analyzes environmental arguments. This chapter reviews the book that set off the environmental debate in the United States, Silent Spring, and the questions it raises about the uses of science.

Developing a Stance

We can see the concern about science in the environmental arguments that began developing in the United States in the 1960s. As environmental concerns were voiced,

a stance began to develop toward science in society that would engage not just occasional critics, but a large public. There was a century-old tradition of nature appreciation and conservationist ethic in American society, but this tradition did not contain positions on the activities of science. For that was needed a new type of argument -- itself scientific -- that would act as a banner for environmentally concerned people to hold up and rally around. That banner argument appeared with the publication of the book Silent Spring.¹

The Banner Argument

Rachel Carson's Silent Spring, published in 1962, was the first "environmental" book to capture public opinion. Her graphic account of the environmental damage done by the indiscriminate use of the newly synthesized pesticides, especially insecticides, was not only a best seller in the United States but was widely read elsewhere, being translated into twelve languages within a year of first publication.² Before the changes brought about by World War II, books about what we would now consider the environment were "Nature" books -- books about a natural world that was not a problem to be solved as "the

environment" is.

There were many postwar changes in the United States: an expanding economy, a baby boom, the growth of suburbs, the spread of technology, the increasing importance of science across many domains of activity -- military, medical, agricultural, industrial. There were increasing encroachments on nature as a result of population pressures and new methods of farming and forestry. In this era of progress, voices critical of "gains" produced by science and technology had small audiences. Carson was an exception. Trained in science, she wrote a book that warned of the heedless use of scientific invention and, at the same time, of the urgent need for scientific study of the effects of new methods of controlling insect and plant life.

Silent Spring is both a moral tale and a scientific commentary.³ Carson wrote an impassioned book, yet one committed to science and scientific evidence. Her description of the natural world shows a love of its beauty and its achievements; she combines this with a harsh account of the destruction of both life and balance that has resulted from an attitude of conquest toward nature. It is this interplay of lyrical and cold prose that gives the book much of its power. Silent Spring is an attention-holding tale of death and destruction at the hands of unthinking and unheeding conquerors; it is also a documented record of

environmental damage. At the end of the book, a chapter-length series of notes on the author's sources (for almost every page of the book) shows the thoroughness with which she has gathered her evidence, the spirit of science which underlies her effort.

The book begins with a vision of an Eden past -- of an imaginary town set among farms somewhere in America, in harmony with its natural surroundings. Here people notice and enjoy the beauty and variety of the life that surrounds them -- plants, animals, birds, fish. But a change takes place. Some "evil spell" settles on the community; people become ill, wildlife sickens, plants wither. No newly born life survives among domestic or wild animals, no plants bear fruit, no birds sing. Barely noticed, a white granular powder still lies in places where it had fallen on the town "like snow." Though the change seems incomprehensible, Carson explains that "No witchcraft, no enemy action had silenced new life... The people had done it themselves."⁴ This "Fable for Tomorrow," as Carson calls it, is based on a present in which pesticides are spreading death beyond their intended targets. It is a warning to us, a portent of a future in which the voices of spring are no longer to be heard. Though the town is imaginary, the past in which spring brought beauty and rebirth to towns across America is not. It is the desolation of the future which is fabled,

not the Eden of the past. And yet, though the future is an imagined one, it is imagined on the basis of scientific evidence.

In Carson's story of the imaginary town, the plants and animals are named or identified by familiar terms; they are specific lives to her. Not just trees, but "oak and maple and birch set up a blaze of color in autumn across a backdrop of pines." Not just roadside plants, but "laurel, viburnum, alder, great ferns and wildflowers delight... the traveler's eye through much of the year." This feeling for nature is the blood that courses through the body of Carson's argument.

The Scientific Report

Setting prophecy aside for reporting, Carson goes on to explain that while no one real town in the United States has suffered all the disasters of the fable, the disasters are real and have all occurred somewhere, with many towns suffering a substantial number of them. The "imagined tragedy may easily become a stark reality we shall all know," Carson warns, and her book, she says, will attempt to explain how the silencing so far has come about.⁵ It does that and more. It indicts the practices and attitudes that

have caused such damage, and urges other actions more cognizant and more appreciative of how nature works.

The chapter that follows the fable starts immediately with a direct attack on the way chemicals have been used to alter nature. In the long history of living things, change has occurred slowly as species were molded, in interaction, by their environment. No one species -- until now -- has alone had the power to change the networks and cycles of nature's interactions as man does with his interventions.

This power to change nature has already become what Carson calls an assault on nature. A "chain of evil and death" has been initiated with new, synthetic chemicals. The new postwar insecticides are made by rearranging molecules into new structures.⁶ The result is new substances, not known in nature. Most pre-war insecticides were inorganic, but the postwar synthetic insecticides are organic, or carbon-compound chemicals. Carbon has a high ability to link with other elements. This means that many new arrangements can be produced in the laboratory. While nature uses millenia of time to achieve balance, Carson observes, man is hasty and heedless in his introduction of new substances into the environment, and the quantity and variety of chemicals to which life must now adjust is staggering. Most of these synthetics not only act as direct poisons, but also alter the biological processes of

oxidation and enzyme production on which normal functioning of body organs depends.

The new synthetics fall into two main groups: chlorinated hydrocarbons (now sometimes also called organochlorines) and organophosphates. The residues from the spraying or dusting of hydrocarbons are long-lasting in their toxicity. Probably most well known among the hydrocarbons is DDT -- now banned in this country as a result of the outcry following Silent Spring but still manufactured here and exported to the third world; dieldrin and aldrin, more toxic, remain in use. Organophosphate residues decompose more quickly than those of hydrocarbons, but are poisonous in miniscule amounts. The organophosphate malathion was still being spread from the skies in California up until 1990, and is currently applied by spraying on the ground.⁷

Carson's writing gives a striking picture of insecticides in the hands of the "control men" as an active force in nature and in human life.⁸ Comparing the unrecognized threat of insecticides to the recognized danger of radiation, she warns that "Chemicals are the sinister and little-recognized partners of radiation in changing the very nature of the world."⁹ Throughout the book she uses phrases that repeat the theme of hovering danger unheeded: "chain of poisoning and death"; "impetuous and heedless pace

of man"; "a mesmerized state"; "tranquilizing pills of half truth"; "elixirs of death"; "ingenious manipulations"; "a menacing shadow"; "the enchanted forest of the fairy tales has become the poisonous forest"; "pollution is unseen and invisible"; "the shadow of sterility"; "habit of killing"; "mission of death"; "sinister touch of the poison"; "Their presence casts a shadow that is no less ominous because it is formless and obscure."¹⁰ "Poison," in this account of Carson's, becomes an actor in the drama of a threatened environment.

Carson warns that "insecticides" are in fact biocides, potential killers of any life, not just insect life. There is only a fraction of time in which to adapt not only to a great number of chemical poisons, but to an array never before experienced biologically. We are at great risk: Our health is threatened, and the natural world on which we depend is endangered. And yet our goals are unexamined, and even our immediate reasons for the use of these chemicals collapse upon examination, when we see that engineering our environment with pesticides has allowed the most troublesome insects to establish themselves in areas chemically stripped of their natural enemies. In Carson's judgment it is not that there is no insect problem, no need of control, or that pesticides are never justified, but that the destruction is out of hand.¹¹ We have much of the necessary ecological

knowledge for achieving balance, Carson asserts, but do not use it. We accept inferior solutions as though we were "mesmerized," and settle for a changed and unsatisfactory natural world. Control agencies and specialists show "fanatic zeal" and exercise "ruthless power" in pursuit of an insect-free world.¹² "This is an era of specialists... intolerant of the larger frame...." The use of chemicals has been indiscriminate and without advance investigation of their ecological effects -- an outcome of reliance on these specialists dominated by profit-driven industry. Yet it is the public that takes the risk of this use, and the public, Carson says, that should decide whether to continue in the same direction.¹³

Environment and Science

This basic argument of Carson's -- that the indiscriminate use of pesticides that we practice is ecologically unsound and a danger to human health -- is buttressed by chapters in her book which provide case studies of the postwar approach to nature, and which criticize that approach. The record of damage accumulates in one area of the environment after another: rivers and groundwater polluted by seepage and runoff of pesticides;

contaminated soil that kills plant-assisting organisms as well as passing on poisons to crops; fatal damage to trees and beneficial plants as well as, or even instead of, to weeds; kill-off of birds, fish, livestock, wildlife and pets along with insect pests; among humans, permanent damage to the nervous system and vital organs, sometimes resulting in death; alteration of life at the cellular level that threatens both human and non-human genetic heritages; changes in the environment as a result of chemical attacks on it that increase the populations of pests; the rapid evolution of insecticide-resistant insects that threaten food crops and human health as much as or more than ever before. Dangerous chemicals are everywhere, and no human beings can avoid contact with them. They are in the soil and water, in fish, insects, and animals; they are in our food; they are stored in most human bodies.

Throughout all of this, science has a dual role. It is both "good science" and "bad science," although Carson does not use these terms or outline an argument about science separate from her account of the misuse of its inventions, which follows the misdirection of the attitude of conquest toward nature. Science as good science does detailed ecological studies, and makes use of the environment itself and natural biological controls to manage pests. In exploring life in cells and at the molecular level, good

science is an effort of patience and ingenuity and an achievement of wonder. It is humble before nature and its awesomeness, and is itself awe-inspiring in its reach into nature's mysteries. It offers us the knowledge that we must have so that we may meet our "obligation to endure."¹⁴

As bad science, in a history that is not one to be proud of, it develops pesticides out of the death- and destruction-purposed chemical warfare research of World War II. (Insects were used to test the efficacy of the weapons, and the commercial development of insecticides followed after the war.) Bad science is more ingenious in devising poisons than in studying their effects. When research into effects is done, it is post mortem rather than precautionary. This inadequate science specifically neglects the ecology of the soil; in its narrow specialization of applications it ignores ecological principles in general. It is complicit in the profit-driven motives of the chemical industry. It announces "safe" levels of toxins as if they could be compartmentalized, and leaves "little understood" their "interactions, transformations, and summations of effect."¹⁵ This science acts as if it had no knowledge of its own theories of evolutionary change and adaptation and is taken by surprise by new generations of insects that no longer succumb to the killing chemicals science has synthesized.

It remains intractably in the "Stone Age" of scientific concepts when it arrogantly asserts that we can control nature.¹⁶

Responses to Silent Spring

The publication of Silent Spring set off a public debate on environment and health that engaged industry, government, nature lovers, and citizens worried about their safety. Silent Spring was not just a book; it was a public event. The first response to Silent Spring came from the chemical industry, before publication of the book in September, 1962, but after condensed excerpts had appeared in The New Yorker. A manufacturer of insecticides tried to discourage publication by telling the publisher that Carson's statements about chlordane and heptachlor were inaccurate and disparaging, and (matching the cold-war, anti-Communist temper of the times) added that the chemical industry was under attack from groups who wished to decrease the food supply in the United States to the same levels as in Iron Curtain countries.¹⁷

Silent Spring was widely sold, highly criticized, and highly praised. After its publication, there were many disparaging reviews from industry sources, and many positive

reviews in major newspapers. The book had a large advance sale and was a Book of the Month Club selection. It became a number one best seller, and since its first publication has been through several printings with the original publisher, been translated into at least a dozen languages, won at least eight awards, and has sold approximately two million copies.¹⁸ When Silent Spring first appeared, the chemical industry mounted a public relations campaign against it, sending out fact kits, press releases, and book reviews.¹⁹ In a rush to get its point of view known by the time of the book's publication, Monsanto had a parody written of Carson's "A Fable for Tomorrow," called "The Desolate Year," about destruction visited on the land by insects and plant diseases unchecked by pesticide controls.²⁰ It was, as feminist scientist Patricia Hynes later characterized it, "a hostile parody... written in a style which mimics and banalizes Carson's writing."²¹ In imitation of Carson's naming of the now silent voices that had once brought pleasure, it names the swarming, unopposed insects that deform and kill plant life. Carson writes, "On the mornings that had once throbbed with the dawn chorus of robins, catbirds, doves, jays, wrens and scores of other bird voices there was now no sound; only silence lay over the fields and woods and marsh."²² The Monsanto article reads, "[Insects] came creeping and flying and crawling into

the open.... They were chewers, and pierce-suckers, spongers, siphoners and chew-lappers, and all their vast progeny were chewers -- rasping, sawing, biting maggots and worms and caterpillars. Some could sting, some could poison, many could kill." As Hynes comments, this criticism of Carson exemplifies the view that "Women write life's poetry while men handle its hard prose."²³

The debate over Silent Spring was news. The documentary series "CBS Reports" planned a program on it for April, 1963. Before the program was aired, a thousand letters -- what executive producer Fred Friendly called an "unprecedented volume" of advance mail -- came in to the network protesting the forthcoming broadcast. Five of the program sponsors withdrew -- among them producers of food products, animal feed, and household disinfectants (all of which depend on the use of the types of chemicals Carson discusses). The program aired; Eric Severeid summarized the book and interviewed Carson, as well as government officials, and a spokesman for the large chemical corporation, American Cyanamid.²⁴ Countering official and industry claims that the book overstated the problems, Carson asserted that the public had heard very little about the hazards and failures of pesticide use, and that her information would make it possible for them to see the whole picture.²⁵

Silent Spring was the catalyst for Congressional reviews of federal programs related to pesticide use. The executive branch, under President Kennedy, had its own review, beginning in the fall of 1962. Carson testified to this committee as well as in the Senate. The President's Science Advisory Committee issued a report, The Use of Pesticides, in the spring of 1963, that recommended staged reduction of the use of persistent pesticides until their use was eliminated.²⁶ The report, coming after an initial period of strong attack on Silent Spring, was widely seen as vindicating Carson.²⁷

The debate that centers on Carson, let alone on pesticides, is not yet dead. A symposium on Silent Spring was sponsored by the American Chemical Society some twenty years after the book's publication, in 1984.²⁸ A participant, C. F. Wilkinson, a specialist in public health and toxicology, commented:

"In Silent Spring, Carson used pesticides symbolically to illustrate her view of the dire consequences of our continued efforts to master nature through technology. Despite numerous scientific inaccuracies and broad unsubstantiated conclusions, Silent Spring had an enormous impact on the way pesticides were viewed. For the first time, people were made aware of the hidden costs of pesticides and their potential for causing adverse effects on human health and the environment. The public felt betrayed, and science and technology, previously considered valuable allies, were seen as nature's enemies."²⁹

At the same symposium, Shirley Briggs, a longtime

colleague and friend of Carson's, now head of the Rachel Carson Council, recalled that

"Many reviews [of Silent Spring] included pat phrases, such as, 'Of course she exaggerated and made mistakes, but in general she was on the right track'. These face-saving phrases have taken on a kind of immortality; they turn up again and again from people who admit, when questioned, that they do not know of any inaccuracies or mistakes, but 'so many people said there were some'. We at Rachel Carson Council have yet to be shown a valid example, despite the sketchy state of much of the information available to her at that time. This accuracy shows the value of her very conservative approach...."³⁰

Changes Since Silent Spring

What changes have there been in pesticide use since Carson wrote her book? The use of DDT in the US was banned in 1972 (with exceptions)³¹, after years of litigation by the Environmental Defense Fund.³² Five basic chemical ingredients of pesticides have been banned for all use, and 26 have been restricted.³³ The testing of toxicity has increased in quantity of studies and precision of techniques.³⁴ But these gains are overshadowed by other developments. Fifteen years after Silent Spring (by 1977), pesticide use by American farmers and gardeners had increased two and half times.³⁵ David Pimental, an entomologist at Cornell University, notes that "on average,

crop losses due to insects have increased nearly twofold from the 1940s [to the late 70s] in spite of a 10-fold increase in insecticide use." Among the causes is a change in farming to monocultures and no-till methods that both require higher pesticide use and make crops more vulnerable to pests. Pimental's judgment is that "Progress has been made on pesticide problems, but Silent Spring is not entirely behind us."³⁶

The Environmental Protection Agency estimated in 1984 that approximately 600 basic pesticide chemicals have 45,000 to 50,000 formulations for market use.³⁷ As of 1986, eight years after the EPA review of the 600 chemicals was begun, preliminary assessments had been completed on just 124 of them; no final assessments had been completed.³⁸

Though chemicals may stay in use while under review, researchers with the EPA state that "the vast majority of pesticides produced and used for agriculture when Silent Spring was published have either been discontinued because of efficacy problems or environmental concerns or restricted to specific nonagricultural uses."³⁹ What is meant by this is that the DDT-type of insecticides (hydrocarbons or organochlorines), sometimes called the "old pesticides," are declining in use. But because they are persistent in the environment and in body tissues, they are not gone. And organophosphates, also dating from the 60s, are still in use

(e.g., malathion). The new pesticides (especially the carbamates introduced around 1970, similar in action to organophosphates), though less persistent than the old, have an increased potential of leaching into the groundwater through the soil.⁴⁰ There is a further possible effect on groundwater from the increasing practice of adding pesticides to irrigation water; effects have not been studied.⁴¹ Also, the organophosphates and the newer carbamates are more highly toxic in direct effect on humans and animals and more dangerous to users applying them.⁴² "When agriculture and public health services switched from the organochlorine to the organophosphate and carbamate insecticides, human and animal pesticide poisoning increased worldwide," concludes one of the scientists participating in the American Chemical Society symposium.⁴³

The agricultural chemist who notes this change also gives this summary: "Despite the continuing and spreading controversy over the use of pesticides, the use of such chemicals has increased since the publication of Silent Spring. The average annual increase in pesticide use [as of the mid-80s] has been about 4 to 5% on a global basis." The developed nations use more than half; exact amounts used in developing countries are difficult to determine.⁴⁴ But pesticides are relied upon in the third world for both the heavily agricultural economies, and for control of pests

even in urban areas because of their year-round presence in tropical climates, and pesticide use is increasing.

Although direct effects of pesticides on wildlife have been much studied since the 60s, less attention has been paid to effects on human health,⁴⁵ and according to Russell Hall, a researcher with the US Fish and Wildlife Service, "effects of pesticide use on ecosystems have scarcely been investigated."⁴⁶ Research that has been done concerning human health shows that, since Silent Spring, "the list of pesticides that have been recognized as a part of the human body burden has grown... All forms of life have been shown to contain trace amounts of DDT."⁴⁷

The Success of Arguments

Much of what Carson argued against -- the heedless use of pesticides, the lack of scientific studies of effects, the turning of a blind eye to ecological complexity, the overweighted influence of the chemical industry, bureaucratic self-promotion -- continues as before, and is quantitatively intensified.

Four major problems of pesticide use are sometimes identified: poisoning of humans and animals; persistence in the environment and as residues on food; resistance

developing among target species; disposal of wastes and containers.⁴⁸ Scientific knowledge of poisoning is limited mostly to direct effects, and much remains unknown about the "secondary" or indirect effects of interactions of different chemicals on organ function and neurophysiology. In addition, human health did not initially receive as much attention as wildlife poisoning, and there is an information lag in this area, particularly with regard to carcinogens, for which symptoms take years to develop and human testing is not ethically acceptable.⁴⁹ Information on persistence of pesticides in the environment is still coming in for the "old" pesticides; new pesticides can be used while their toxicity is still under review, and the contentious problem of what tolerances are safe in both direct application of pesticides and in residues on foods is at present an unresolved tangle of fact and assumption. Insect and plant species continue to develop resistance to insecticides and herbicides, and new and untested formulations are thus developed and introduced into the environment.⁵⁰ Disposal, and "Superfund" cleanup, has not progressed beyond the concept of "safe management" of hazardous waste to the intent to reduce, detoxify and destroy it.⁵¹

At best, the record is mixed; at worst it is alarming. But the tenacity of an argument, and the impact of it on the public consciousness, is not simply a matter of the success

achieved in reaching the intended goal. The technical nature of Carson's argument gave a new legitimacy to "speaking for Nature,"⁵² and its impassioned commitment set a high standard of moral purpose that attracted supporters of conscience, and those who believe that science has a moral responsibility to society.

Carson's main argument is that the unthinking use of new technologies derived from scientific knowledge endangers the balance of nature and the future of human health. What has been praised as a great advance in agricultural productivity she criticizes as a threat to life. She redefines the wonders of science as figures that cast shadows in which another, and frightening, effect of their efficacy emerges. She is technical in presenting her evidence, poetic in her description of the world that can be lost.

Two years after Silent Spring, a technical and thoroughly researched book by Robert L. Rudd, Pesticides and the Living Landscape,⁵³ also made a strong case that pesticides threaten all life, not just harmful insects. Rudd's book, written and completed at about the same time as Carson's, was delayed in publication as first a trade publisher and then an academic one wrangled over its controversial conclusions.⁵⁴ It is a much less passionate book than Silent Spring, drier and more conventionally

scientific. It contains information that Silent Spring does not, but was eclipsed by Carson's book, though it received many reviews and was published in four countries. Rudd was a wildlife biologist, a Professor of Zoology at the University of California, and did work on vertebrate pest control. His book cost him a position at the state agricultural experiment station.⁵⁵

What Rudd did not do that Carson did was redefine the meaning of science and its advances in the life of the ordinary citizen. Carson did this by touching the ordinary person's appreciation of nature. She allied her argument both with the scientific tradition and with a nature tradition; she is, like Müller in Mannheim's example of conservative thought, at a "juncture" of two ways of thinking.

Political and Scientific Frameworks

In Silent Spring, Carson emphasizes that it is the public that takes the risk of the indiscriminate use of chemicals, and the public that should decide whether to continue in the same direction. She insists that not all experts are "qualified witnesses," because some have specialties too narrow to enable them to assess damage to

wildlife, while others have specific interests in maintaining the very use of chemicals that needs alternative evaluation.

Carson's stand on public choice in this specific case lends support to the more general proposition (not stated by her) that in matters of science, the citizen may judge, if the citizen is given enough information. In fact she also suggests that the citizen must judge when it is the citizen's interests (and life) that are at stake. When experts disagree, who should we believe? Or as Carson puts it, "Which view are we to accept?" Her guiding principle is that "the credibility of the witness is of first importance." Entomologists specialize in insects, not in wildlife as a whole, and they are not "disposed to look for undesirable side effects" of their control programs. Wildlife biologists, however, do have the necessary broad view.⁵⁶ Many issues concerning choice are untouched here, but basically, citizens are to make rational decisions based on valid testimony. Since Carson wrote her book the environmental argument has expanded, and the question of what scientists to believe, what action to take, and who should decide on action has appeared across a great variety of situations.

The relationships between science, environment, and politics keep growing in complexity. For both scientists

and environmentalists, taking sides, being politically implicated or politically active, and trying to keep facts separate from values are issues for which the guidelines are unresolved.

Two frameworks of understanding contend when we try to resolve these issues as citizens, scientists, or environmentalists. We use one framework for our understanding of politics in a democratic society, another framework for our understanding of science as part of our modern, technologized world. The political framework has been in use for some two centuries, and has ancient roots in Greek thought and the Roman emphasis on law. The scientific framework is more recent, less well-formed, and though it occurs more and more frequently in our public discourse, its use is not as readily recognized. It is like a relatively new person who is efficiently active among an established group of people working together, but who has not yet established an identity with them -- it is not yet greeted as a known quantity or acknowledged as a given type.

Both the political and the scientific frameworks are conceptual frameworks -- one for thinking about politics and society, the other for thinking about science and its uses; both for handling information and making sense of events. Each framework can also be used (as here) more formally than in everyday life, as an analytical device to see change that

is occurring in society.

Because the frameworks are popular -- that is, used by people in general -- they have an element of consensus that means they are presentations of the way things are conventionally said to be, not necessarily the way they actually are. In order to hold a place in common understanding, each framework is a simplified model of things. Many elements of actual relationships are left out. For this very reason, a close look at the frameworks reveals the conflicts that we experience as a society when complex changes meet simplified expectations.

Take, for example, the issue in Silent Spring of whether goals shall be specialist-determined or citizen-determined. The idea of citizen participation fits in the political framework of understanding, in which the state and its citizens are linked by rights and obligations. In both the liberal (Enlightenment) and conservative views that have influenced American government, human nature itself determines the nature of this relationship. Depending on the conception of human nature, government is correspondingly either optimistic about or dubious of human goodness -- emphasizing, in today's terms, either social welfare or law and order. In this framework of understanding, material sustenance is provided through the economy, which supports the state, and which is in turn at

least partially safeguarded by the state. Each of us is a citizen in respect to the state, but an individual on his or her own in respect to the economy. Science per se is not in the framework; the framework pre-dates the central role of science. What the rights and obligations are between citizen and science are therefore not clear. Should science have a role like that of the state, in which it attends to the voice of citizens? Should it be a "representative government" wherein the public decides? Or are citizens not competent to judge scientific matters?

When the emphasis shifts to science itself in the question of how we shall use science, we are shifting to the science framework for understanding, in which the major relationship is between science and its users or recipients rather than between the citizen and the state. Human nature is sidelined, and the natural world replaces it as a determining force, but the natural world does not determine the relationship between science and its users or recipients as human nature determines the relationship between citizen and state. Instead, it determines only what science should be. Science must answer to the natural world (its truth must match that world), but it is not clear whether or not science must answer to those who receive its effects. The rights and obligations between science and its users and recipients are not clear. The economy remains as a flanking

force, with science providing technology to support it. The science framework does not include the state or government or their corollary, the citizen. The individual, as user or recipient, is entirely on his or her own with science as well as with the economy. Without the presence of the state, no institution is charged with safeguarding the citizen.

Of course, in real life, science and the state cohabit, and there are many restrictions, permissions, and assistances which connect them and redound on citizens and users. But no convenient conceptual framework ties together these arrangements for science matters, which have arisen pragmatically, and not also as a result of theory, as occurred in the political sphere. Thus there are heated arguments over what scientists do or do not owe to citizens who do not like what they do; confusion over whether scientists should give political opinions; debate over how government influences scientific endeavor and how it makes use of its fruits. The ground on which decisions about these issues should be made is not clear, and we switch between the political model and the scientific one, when neither one is adequate. We are in the midst of a conceptual shift, trying to find our way to a new framework of understanding in which science dominates as surely as the state, but in a different way. The intellectual awkwardness

of this situation is a sign that we are rearranging the concepts that guide our actions, under pressure from another guiding influence on those actions, events themselves.

NOTES TO CHAPTER SEVEN

1. Rachel Carson, Silent Spring (Boston: Houghton Mifflin, 1962)

{Hereinafter abbreviated SS}

2. Frank Graham, Jr., Since Silent Spring (Boston: Houghton Mifflin, 1970), p.81. Publication was in late September; by December, 100,000 copies had been sold. It became a Book of the Month Club selection, and Consumers' Reports produced a special paperback edition for subscribers. (Graham, p.69). Within six months, half a million copies had been sold (The New York Times, 12/2/90, VI, p.52). Nearly two million copies had been sold by 1987 (The New York Times, 10/11/87, IV, p.5).

3. Critics have said that the two modes of discourse -- moral nad scientific -- don't go together, because values compromise objectivity.

4. SS, p.3.

5. Ibid.

6. The new pesticides of the 50s and 60s are now considered "old" pesticides.

7. See Dean E. Murphy, "3 Strikes Mean Medfly May Be Out on Loose," Los Angeles Times, 10/22/91, p.B1.

8. SS, p.86.

9. SS, p.6.

10. In order, these phrases appear in SS on the following pages: 6, 7, 12, 13, 15, 20, 26, 33, 41, 108, 126, 126, 156, 186.

11. Although she states this clearly, critics often claimed that Carson was against the use of pesticides or implied that she was willing to see the damage of crops and the famines that would result if pests were not checked.

12. SS, p.12.

13. SS, p.13, and see Ch.8, Ch.17.
14. SS, p.13.
15. SS, p.39.
16. SS, p.297.
17. Houghton Mifflin had an independent toxicologist review Velsicol's complaints and Carson's statements, and reassured by that evaluation, went ahead with publication. (Graham, Since Silent Spring, p.49). Graham's book provided me with much basic information on Silent Spring and the responses to it.
18. See note 2 above, and Paul Brooks, The House of Life (Boston: Houghton Mifflin, 1972), Ch.21.
19. Major participants in this effort were the Manufacturing Chemists Association, the National Agricultural Chemicals Association, The Nutrition Foundation (with membership from the food production and chemical industries), Monsanto Chemical Company, and American Cyanamid Company (Graham, pp.57-61).
20. Five thousand sets of galley sheets were sent to newspapers and book reviewers around the country because regular publication in the company's magazine would not occur until after the book was out (Graham pp.64-65).
21. H. Patricia Hynes, The Recurring Silent Spring (New York: Pergamon, 1989), p.117.
22. SS, p.2.
23. Quoted by Hynes, pp.117-18.
24. Graham, pp.75-76.
25. Hynes, pp.136-37.
26. Graham, pp.76-80.
27. Graham, p.79, Hynes p.44. A still later report from the committee in 1965, Restoring the Quality of Our Environment, stated that "the corporation's convenience has been allowed to rule national policy," and concluded that pesticide pollution could be considerably reduced without loss of pest control efficiency using methods already available (Graham, pp.185-88).

28. The American Chemical Society is a large, century-old membership organization of chemists and chemical engineers, and the publisher of many specialized journals.
29. C.F. Wilkinson, "The Science and Politics of Pesticides" in Silent Spring Revisited, Gino J. Marco, et al., eds., (Washington, D.C.: American Chemical Society, 1987), p.27.
{The book title is hereinafter abbreviated SSR.}
30. Shirley Briggs, "Rachel Carson: Her Vision and Her Legacy" in SSR, p.8.
31. Hynes, pp.154-56.
32. Graham, pp.252-58; Hynes, pp.46-47, p.153.
33. Hynes, p.150.
34. See SSR.
35. Hynes, pp.88-89, referring to Zwerdling.
36. David Pimental, "Is Silent Spring Behind Us?" in SSR, p.183, p.184.
37. Wilkinson, SSR, p.26. The number 600 was established in 1978 as the number of basic active ingredients EPA would have to assess under federal law after it was realized that the agency could not handle a review (mandated in 1972) of the tens of thousands of individual products. (By another, nongovernmental estimate, approximately 1500 chemicals go into the manufacture of pesticides in the US, with 65 chemicals making up the major portion [Freed, SSR, p.146]).
38. Hynes, pp.149-50. (The five banned, and 26 restricted, chemicals referred to above were reviewed under a special process for "uniquely toxic" chemicals.) Hynes reports that the decision to ban a chemical or not is made on a cost-benefit basis -- benefit to the agricultural industry is weighed against pesticide-residue risks to wildlife and humans (but manufacturing and wider ecological risks are not considered). Chemicals stay in use while under review. "At its current pace, EPA will not finish its review and reassessment of the safety of pesticides in use until well into the twenty-first century."
39. Robert F. Carsel and Charles N. Smith, "Impact of Pesticides on Ground Water Contamination" in SSR, p.73.

40. "A 1984 review found pesticide leaching from agricultural fields more widespread than in 1974." (Ibid., pp.76-77.)
41. Ibid., p.81.
42. Virgil H. Freed, "Pesticides: Global Use and Concerns" in SSR, pp.147-148.
43. Ibid., p.152.
44. Ibid., p.148.
45. Graham, Part II.
46. Russell J. Hall, "Impact of Pesticides on Bird Populations" in SSR, p.105.
47. J.E. Davies and R. Doon, "Human Health Effects of Pesticides" in SSR, pp.118-119.
48. Ibid., p.114; Freed, in SSR, p.151.
49. See Graham, Hynes, SSR.
50. See SSR.
51. Hynes, pp.166-168.
52. This term is from the title of a book, Speaking for Nature: How Literary Naturalists from Henry Thoreau to Rachel Carson Have Shaped America, by Paul Brooks (San Francisco: Sierra Club, 1983).
53. Robert L. Rudd, Pesticides and the Living Landscape (Madison: University of Wisconsin Press, 1964).
54. See Graham, especially pp.167-68.
55. Ibid.
56. SS, p.86. Hynes notes that it can no longer be taken for granted that biologists will have a broad view.

CHAPTER EIGHT

SCIENCE, ENVIRONMENT, AND POLITICS

The previous chapter reviewed Silent Spring, the book that made environmental damage a public issue. This chapter continues consideration of the questions Carson raised about the uses of science in the context of today's environmental debate.

Scientists and Environmentalists

If (as suggested in the Introduction) environmentalism expresses the view that science should often be viewed with skepticism, and institutionalized science expresses the view that science should be trusted, are scientists and environmentalists opposed actors in our society?

Science and environmentalism can be distinguished along many lines -- institutional, political, ideological -- but scientists and environmentalists are not so easy to separate. An environmentalist is someone who has already taken sides in the debate over the seriousness of

environmental problems. The label 'scientist', by comparison, does not tell us where its owner stands on this debate or whether he or she has taken any position at all.

There are scientists whose work analyzes or even improves the environment, but who are not active environmentalists; scientists doing this kind of work who are active environmentalists; scientists who have been trained in a non-environmental area but who are active in arguing environmental causes; scientists who serve in environmental agencies of government; scientists who work for environmental organizations. Only some of these scientists go over a line that separates scientist from environmentalist. In the ethos of science, because objectivity resembles neutrality, non-neutrality casts doubt on objectivity. Understandably, scientists are not occupationally disposed to activism or outspoken stances.

Sometimes scientists and environmentalists stand apart on issues, sometimes together. Environmentalists rely on scientific data to give warning about the state of the environment. Conflicting interpretations can be found among scientists about the meaning of data, so that some scientists will be aligned with environmentalists on the direction in which the facts are said to be leading, and some will not. Scientific disagreement over the state of the environment, and what, if anything, to do about it, is a

constant in the environmental debate. But it is the exception rather than the rule for scientists to take activist stands.

Taking Sides

In a forum on man and nature sponsored by Harper's magazine, April, 1990, participants were given a hypothetical situation: an elderly resident has willed several hundred acres of farmland and woodland to a community with 15% unemployment, where there is pressure for land development. Most of the participants have tried to come up with ways to conserve much or all of the land as is. The discussion continues:

Michael Pollan [Executive Editor of Harper's]:
"Well, I have decided that you guys have your heads in the clouds. I am going to develop the entire square mile by selling five-acre plots. You've tried to stop me but everything -- petitions, lawsuits, protests -- has failed. The political process is over. It's America. It's democracy. Do you go home now?"

Dave Foreman [Founder of Earth First!, known for espousing "monkey wrenching," or sabotaging of construction or resource-use projects that are opposed by environmental groups]: "I never go home."

Pollan: "What do you do?"

Foreman: "Conservationists have a fully equipped toolshed and use the proper tool for the proper job at the proper time."

Robert D. Yaro [Senior Vice President of the New York City area's Regional Plan Association]: "Are hatchets in your toolshed?"

Foreman: "Lots of things are in there!"

Pollan: "And after politics are exhausted?"

Foreman: "Oh, you might start by pulling up survey stakes. And you might want to engage in some paper monkey-wrenching, to slow things down."

Yaro: "Paper can be one of the most effective tools. You know, this society can't do things very quickly, but it is brilliant at slowing things down."

Pollan: "Suppose Dave called you the night before the bulldozers showed up. He's planning to pour something in the gas tanks. Will you help him?"

Frederick Turner [Founders Professor of Arts and Humanities at the University of Texas, Dallas]: "People do what they are best equipped to do. I'm not a politician. My inclination would be to use art, theater, poetry, and song. The power of a good song, like the coal miners' strike songs, is terrific."

Daniel B. Botkin [Professor of Biology and Environmental Studies at the University of California, Santa Barbara]: "I agree with Fred. What I bring to the environmental area is my reputation as an objective scientist who can evaluate the land. To pour something in a gas tank --"

Foreman: "-- grinding compound --"

Botkin: "-- would destroy my credibility. We all must play different roles."

James Lovelock [Biologist who developed the Gaia theory that the earth as a whole fine-tunes the balance of minerals, plants, animal life, and atmospheric chemicals in the manner of a self-regulating system]: "Dave, it just so happens that my main line of work is as an inventor. I can think of a lot of things I could do to those bulldozers."

Foreman: "Let's talk."

Lovelock: "See, if I really felt strongly about this issue, I would be obliged to act, even at the risk of losing credibility."¹

In this discussion, one scientist says radical action would compromise his objectivity; another says he might take that risk for issues he feels strongly about. One is willing to mix science and social values under certain conditions; another is not. According to the conventional view, science must be free from supporting this value or that one in order to maintain its objectivity; by extension, so must individual scientists. Scientists, as this brief example indicates, are not of one mind about what appropriate scientific behavior is under all circumstances.

And on environmental issues themselves, scientists also take different positions. For example, a scientific conference gives an alert on environmental peril:

"At a forum on 'Global Change and Our Common Future' organized by the National Academy of Sciences and the Smithsonian Institution, speakers repeatedly urged that major economic, scientific and political resources be immediately committed to solving problems like global warming and the depletion of the earth's protective ozone layer...

[Also mentioned were] prospective food shortages, possible on a catastrophic scale...

A main message of the forum, said Martin Holdgate, director of the International Union for the Conservation of Nature and former chief science advisor to the British Government, was that 'we would be incredibly stupid not to take these dangers as real.'²

But Dixy Lee Ray, former head of the Atomic Energy

Commission, former Governor of Washington, and a marine biologist by training, takes another stance as a strong proponent of technological development. In an article entitled "Who Speaks For Science?" she gives her views on environmental threats:

"Repeatedly... the American public has been subjected to a litany of catastrophe -- to predictions of impending disaster...: The oceans are dying, the atmosphere is poisoned, the Earth itself is losing its capacity to support life...

It's all pretty heady stuff, but is it true?.. False, exaggerated, or misleading information persists... [through] dissemination of... factoids. Examples... are: PCB's cause cancer; any level of radiation is harmful; acid rain is caused by sulfur dioxide from burning coal...

It is up to good scientists to weed... [scientific] phonies out, but we don't do it. Rather, we allow, by our silence, such renegade organizations as the Union of Concerned Scientists to present itself as the 'voice of the scientific community'. They back up the Helen Caldicotts, Barry Commoners, Paul Ehrlichs, Amory Lovinses, and other pretenders."³

The named "pretenders" have warned, respectively, of the health hazards of nuclear radiation, of technology-driven poisoning of the environment, of overpopulation leading to famine and possibly war, and of the misguidedness of "hard" fossil-fuel and nuclear energy production compared to "soft energy" alternatives.

The Voice of Science

Are these contrasting scientific opinions 'science' speaking? If there is a voice of science, is it scientific organizations, scientific conferences, government agencies? Or is it individual scientists? Is the voice of science in pronouncements on issues, or is it in the day-to-day work and the highly specific and technical reports that never reach a general, layperson public? Is science a collectivity that is more than the sum of its parts, or is it a collection of disparate pieces that just happen to go by the same name?

Science obviously does not have one voice, because it does not have just one character. Science is an ideal in the sphere of knowledge as well as an economic undertaking. It has locations in the worlds of business, government, and academia. It is present in our technology and (accurately or not) in our science fiction. The voice of science that reaches the general public comes through many channels: newspapers and news magazines; news, science, medical, and nature programs on TV; popular science and environmental magazines; newsletters; books; events such as Earth Day and entertainment benefits with environmentally-committed movie stars and musicians; and person to person through medical practitioners. This voice of science is not primarily the

voice of scientists, yet scientists themselves are the original source of this mediated information. It's therefore important to find out what happens to the voice of the scientist.

Scientists

What is a scientist? Miriam Rothschild is a self-taught naturalist known for her research on fleas. She writes: "Looking back on my childhood, I am convinced that naturalists are born and not made. My father was a keen naturalist, but although we all shared the same upbringing [in her early childhood, in pre-World War I Hungary], my siblings were not hooked on plants and insects in the way I was." Her father died when she was young, and Rothschild was educated at home by a governess "with absolutely no knowledge of the natural world. At the age of 17, I insisted on attending evening classes at the Chelsea Polytechnic, but up to then I was entirely self-taught." After "75 years as a passionate naturalist," she concludes:

"I am a naturalist, not a scientist. I have a vivid emotional love of the natural world from rain clouds to tapeworms, and my enthusiasm has lured me into varied investigations. Furthermore, I love discussing my favorite topics, be they birds or flowers, trees or fleas, and burning the midnight oil, enthralled, while reading about other people's observations and discoveries. This

has resulted in my publishing 300 papers and books, which some might glorify with the title of scientific research.

But have no illusions -- curiosity, a keen eye, a good memory and boundless delight and enjoyment of the animal and plant world, with perhaps a little intuition thrown in, do not make a scientist; one of the outstanding and essential qualities required is self-discipline, a quality I lack. A scientist requires not only self-discipline but hard training, perseverance, energy, determination, judgment and a goal. If you can combine the two, you get the best of both worlds."⁴

Another view on what a scientist is comes from the joint writings of Richard Levins, a population biologist, and Richard Lewontin, a zoologist, both at Harvard University. "Modern science," they state, "is a product of capitalism" and its needs to expand and to transform production. And

"scientists have become 'scientific manpower'... The creative parts of scientific work are more and more restricted to a small fraction of the working scientists, the rest are increasingly proletarianized."

"The class divisions that plague our society as a whole also cut across the ranks of science... In between [class] extremes [of proletariat and bourgeois investors] is the group of petty bourgeois professionals working alone or in small groups in universities and research institutes. Although they may be motivated by a great diversity of concerns, their activity depends increasingly on obtaining funding from government agencies, private foundations, or corporations."⁵

Despite the diversity of concerns and beliefs among scientists, Levins and Lewontin say, there is an implicit ideology that all scientists receive. Among its characteristics is the separation of thought from feeling.

Their comments on this separation throw additional light on Rothschild's self-description:

"The supposed superiority of thinking over feeling implies that those who withhold feelings are superior to those who express them. One result is that women, socialized in our society as the custodians of feeling, must either suppress themselves in order to do science or must be systematically underestimated, as if 'more emotional' meant less rational."⁶

The non-scientific-ness of emotion is a repeated theme of the criticism Rachel Carson received for her book, Silent Spring, and it reoccurs in a comment made by the editors of Silent Spring Revisited, a volume based on a symposium sponsored by the American Chemical Society.⁷

"In one respect at least, our book is likely to fail: we cannot match Rachel Carson's language and imagery. These chapters were written by practicing scientists, schooled in the need to be conservative in their interpretation of data, to write directly, and to avoid emotionalism."⁸

By this the authors imply that Carson, who was trained as a marine biologist, was, because of her passionate commitment to a cause, not a scientist, or not scientific.⁹ It may be that Miriam Rothschild is right, and that naturalists are born, and scientists are made, but scientists are made not just by characteristics of their personality (such as the self-discipline Rothschild cites), but by a social process. This process includes educational opportunities and a division of labor in which class, race and gender are implicated.¹⁰ The state of the economy and the politics of

funding for scientific research are equally part of the process. Science is not just scientists carrying out their research.

Science and Politics

The possibilities of social action on environmental problems necessarily involve all parties in politics, but in a politics that is being redefined by science. To see what science is doing to politics (and politics to science), we can first take some vignettes from events on the environmental front from the past few years.

Joshua Lederberg is a Nobel laureate in biology and past president of Rockefeller University. In a newspaper-sponsored roundtable discussion in 1983, he talked about science and politics:

"Q: To what extent do you think that science today has been politicized? There was, for example, the trial in Salt Lake City where scientists disputed whether radioactivity from atomic tests in the 1950s caused subsequent disease among Utah citizens. It seems that science asks people to believe in the reliability of results. Yet here was conflict.

Dr. Lederberg: Why do you call that politicization?

Q: Radioactivity is a politically charged issue.

Dr. Lederberg: In Utah, at least, a large part of the controversy concerns the amount of

radioactivity released and the extent of human exposure to it. The answers have a lot to do with the records that were kept and the credibility of the institutions involved. Of course, people's institutional affiliations will have a lot to do with what they say about the authenticity and veracity of records of past events.

Q: Isn't that politics?

Dr. Lederberg: Yes, but it may not be politicizing science.

Q: There is an interesting conflict here, since policymakers must pass legislation... and they turn to scientists for a basis for rulemaking.. But scientists don't always have the experimental data to provide such a basis. How should they deal with the legislators' demands?

Dr. Lederberg: The scientists' job is to tell them the health risks; value judgments belong to a larger sphere. That's a naive theory of separation, but it's something we ought to aspire to."¹¹

Whatever the merits of Lederberg's aspiration to the separation of fact and value, scientific findings and political policy do interact. The debate over global warming provides an example of a political attempt to change the meaning of findings presented by a scientific researcher. James Hansen is an atmospheric physicist who is the director of the National Aeronautics and Space Administration's Goddard Institute for Space Studies. Rolling Stone put him in their Earth Day Hall of Fame because he "first called America's attention to the greenhouse effect with his dramatic testimony before Congress during the torrid summer of 1988."¹² That

testimony included the statement that he was "99%" sure that the warming trend he found in the 80s was not a chance event, and that it was time to stop "waffling" about the contribution of greenhouse gases, mostly the product of human activity, to global warming. His certainty became a media event.¹³

The year after his Congressional testimony on global warming, in 1989, Hansen charged the Office of Management and Budget (part of the executive branch of the U.S. government) with changing his written testimony before it was delivered to Congress. The change was made "over his protests, making his conclusions about the effects of global warming seem less serious and certain than he intended."¹⁴ Hansen's computer models of the global environment sparked disagreement within the scientific community as well as within the Administration.

Stephen H. Schneider is a climatologist and head of Interdisciplinary Climate Systems at the National Center for Atmospheric Research, which is sponsored by the National Science Foundation. He is a publicly active scientist who has testified before many government committees, and written books on global warming for the layperson. Commenting on Hansen's assertions about global warming, he says that Hansen's statistical methods don't warrant a "99%" certain conclusion. "Despite these qualifications," he says, "I

fully agree with Jim that it is much more likely than not that the greenhouse gas buildups in this century have contributed to the observed global warming. It is simply impossible to assign formal probabilities without making intuitive assumptions."¹⁵

Schneider draws this distinction for scientists who advise the government: it was not acceptable for the Office of Management and Budget to alter Hansen's scientific conclusions, but it would have been acceptable if they had altered his policy opinions.¹⁶ Also, Schneider observes, scientific conclusions require full disclosure about uncertainties and what is not known; policy conclusions often require simple and dramatic statements in order to capture media and thus public attention.¹⁷ Simplification leaves plenty of room for misunderstanding, and "Scientists who go public with their work, particularly if it could potentially affect policy, often meet with a mixed reception from their own colleagues."¹⁸

Hansen himself has had this to say:

"I am not an environmentalist... I think an environmentalist knows what his objectives are and tends to cite evidence that supports his conclusions. Environmentalists are not interested in evidence that minimizes these conclusions. A scientist has to report his results whether they support his conclusions or not. A scientist has to give the full relevant caveat. I am and want to be a scientist who looks at problems without a prior inclination. But on the other hand, I also think I should be allowed to say what I believe without interference."¹⁹

Separate Frameworks

Because we have two separate frameworks for thinking about scientific matters and political matters, while in actuality science and politics combine, we have difficulty establishing how it is that science should 'be' in our society. This difficulty is equally caused by conflicting events. Both intellectually and materially, science and politics are in a contradictory relationship as well as an interconnected one.

The ambiguous role of science in the public arena (Is it separate from politics or not?), and the conflicts this ambiguity engenders are not a major theme of the first best-seller environmental warning, Silent Spring. It appears that for Carson good science is half the solution to the problem: science that is comprehensive and thorough, science that is not held hostage to bureaucratic promotion of government programs and economic self-interest. Yet Carson knows (and comments) that science is not independent from government funding and government manipulation of scientific intentions in specific programs, so citizens must take up the other half of the solution. The framework for thinking about science is as much a part of her analysis as the political framework is: Citizens have been made passive recipients of scientific ingenuity, and there's no mechanism

in place for making either scientists or the government take responsibility for the effects of scientific invention. But if citizens speak and government acts, things can be righted; the political framework is still a major point of reference. Yet this political framework alone is not enough; the word of science must be added to it. Such an addition raises difficulties, however.

Citizens must hold the state to its promise (or its contract) to behave according to certain values given to human life, liberty, and well being. In the framework for politics, values reside with the state as well as with the citizen, and both are expected to carry out appropriate actions. In the science framework, however, values do not reside in science, although it occupies a position like that of the state (central to collective action). Science fends off the explicit attachment of values to its purpose and activities; it separates itself from value-motivated action. There is supposed to be a separation between fact and value, between science and public policy. Values are located only in the public policy sphere, not in the domain of science. So Stephen Schneider could say it would be alright to change James Hansen's public policy recommendations, but not his scientific conclusions, and Joshua Lederberg can aspire to separate fact from value in the matter of assessing the risks of radiation. But in actuality, science supports

prevailing bureaucratically-established values by not examining them when it gives its findings and accompanying recommendations to government panels. In this respect it loses its voice.²⁰ As guides to understanding and explanation, the political and scientific frameworks remain separate, and scientists cannot speak across the gap.

The Direction of Scientific Activity

Because of the political and economic supports of and restrictions on science, even though many leading voices of environmental concern are those of scientists, the direction and outcome of scientific activity in modern society does not work toward ecological balance in the natural world. Rather, scientific activity is channeled toward environmentally destructive technologies and policies, toward an environment that is considered to be external to the science and productive activities that are, in fact, within the environment and part of its ecology. Scientific-technological activity is still directed more toward manipulating and dominating the natural world than toward the responsiveness to it that is necessary to prevent environmental destruction. Manipulation of the natural world has been the source of much human power and progress,

but this manipulation is now up against natural limits. Our power to change nature now includes the power to destroy the web of life that supports our own life, totally.

This recognition of possible impending death for humankind is a scientific recognition, but whether we are close or far from such a fate is much argued in the world of science, and out of it. Not everyone shares a sense of alarm, but some individual scientists would like to see the current direction of scientific activity changed. Some twenty years ago, on the occasion of the first Earth Day (1970), René Dubos, a microbiologist and author of many popular books with scientific themes, indicated the need for a means by which individual concern could act. In a handbook prepared for an environmental teach-in on Earth Day, Dubos wrote:

"I do hope that [the teach-in] will help alert public opinion to the immediacy of the ecologic crisis... I know that many scientists and technologists would welcome a form of public pressure that would provide them with the opportunity to work on problems of social importance.

The colossal inertia and rigidity -- if not indifference -- of social and academic institutions makes it unlikely that they will develop effective programs of action or research focused on environmental problems. Two kinds of events, however, may catalyze and accelerate the process. One is some ecological catastrophe that will alarm the public.... Another... is the emergence of a grassroots movement, powered by romantic emotion as much as by factual knowledge, that will give form and strength to the latent public concern with environmental quality..."²¹

Science and Social Goals

An argument for the environment is not simply either scientific or 'environmental'; it is likely to be both. The differences come over how science is to be used or to be done. Few scientists would disagree that science should be used to the benefit of society, but when it comes to directing scientific activities to specific social goals, scientific caution intervenes. While it is a social goal to find a "cure" for cancer, this social goal can be worked toward through specific scientific activities -- for instance, research into the structure and behavior of cells. "Society" will then put the findings to use, reducing the incidence of cancer and stopping or slowing the course of the disease once it occurs in the individual's body. It will do this through care given by private physicians, through public health clinics, through education of the public, use of medicinal drugs, and possibly, lifestyle changes.

The scientist provides the information; society goes into action. This is the model which accompanies the objective or ideal of separating fact from value. Of course, society must make the research possible through private and government funding, and provide the institutions of education and communication that support scientific work.

But the scientist, in this model, does not do the follow-through, and does not even push hard for the follow-through to happen, although she or he may make recommendations to government panels and private-sector nonprofit organizations. The scientist continues to do still more scientific research, while other specialists -- politicians, lobbyists, administrators, social workers, outreach people -- provide funding to disseminate recommendations, put health programs into place, and make the new therapies available. This separation enables the scientist to maintain the stance of objectivity through silence. But sometimes scientists do speak out. Why?

Voices are raised to be heard where issues are contested; American society is already committed to fighting cancer (although researchers in the field probably feel it is not committed enough). It is not committed to environmental action (although it has become politically popular to act as though it were), and is inactive on the environment at a time when inaction itself is seen as a threat. The danger of inaction provides scientists with the condition for speaking out.

The question of how science should 'be' in society -- connected to our values or totally separate from them -- is also a question of how scientists should act in society and, conversely, a question of what society should demand of its

scientists or allow them to do. We come here to the problem mentioned in Chapter One, that of speaking of society as though it were a unitary actor, and of scientists as if they also amounted to a unitary actor. To phrase the situation as if it were this way is only to use a shorthand. The polarity of science-skeptic and science-truster which is found in contemporary American society cannot be understood simply as antagonistic actors located in specific occupational and social positions. Theoretical abstractions, centered on concepts which guide thought and influence action, are necessary to identify the polarity, both in thought and in society.

The question of whether science should (or can) remain separate from social values is sometimes expressed as the question of scientific autonomy: Is science to remain autonomous, free from the political sphere of social values, or must it, in the face of the environmental threat to our survival, adopt specific social goals (for example, population control) as also priority scientific goals?

Is science to be autonomous science or servant science? At the National Academy of Sciences conference on Global Change and Our Common Future, mentioned above, speakers said that the economy, science, and politics must all be committed to solving environmental problems. This is science serving society, but it is not science in service to

society. It is science bestowing the gift of knowledge, not science forced to adopt a political ideology. Science in this role is not a servant; it is master in its role of solving the problems of material life. In a very broad sense, science that serves society by bestowing knowledge is some form of servant science, but there is an ideological debate about autonomous science/servant science in which the issue is not this type of service.²² The debate is about ideal types, about a particular kind of autonomy and a particular kind of servant role. The argument for autonomy ignores the dialectical complexities implied in the autonomous/servant dichotomy, and assumes that science can stand solely on one side of the relationship, having only the characteristics of that side. The argument that denies either the possibility or the desirability of autonomy claims that science is dependent on the society from whose values it wishes to stand aloof, even while it is dominant in that society epistemologically and institutionally. "Science," as objectivity, is itself a value in society, and science wants to be valued by society in this way. By this argument there is no complete autonomy from social values for science, only a particular kind of autonomy, autonomy in respect to certain requirements and not others.

Tacit Trust in Science

Environmental issues are conventionally debated on the level of specific problems and remedies, and not on the level of underlying issues. Some of the topics from a collection of "opposing viewpoints" on the environmental crisis exemplify this positivist approach of only dealing with the facts in front of us: "Environmental Pollution Causes Cancer"/"Environmental Pollution Does Not Cause Cancer"; "Rigorous Testing Protects Consumers From Pesticides"/"Rigorous Testing Does Not Protect Consumers From Pesticides."²³ There are many arguments of this type being constantly offered in reports, books, news, and conferences. There are other arguments made about the roles of industry and government, about population growth, and sometimes about the global interconnections of economy and environment. There are very few arguments directly about science, however. Such arguments still circulate mostly in the academic world; some reach a wider, nonfiction-reading audience.²⁴

These arguments are, for the most part, critique and response to critique. There are few scientists outside of the academic debate who feel it necessary to speak in support of science. There is no need; science already has legitimating power. It is particularly difficult to find

scientists urging trust in science in the environmental debate. In the terms that I have used, there are few prominent science-truster voices. One could take this to mean that there are few scientists who have that argument to make, but the seemingly inexorable movement of science along the path that science skeptics warn against suggests that that is not the case. Instead, these voices are few to be found because of the characteristics of science in society, and because of the fact-centered level of the debate.

The relevant characteristics of science in society are that, first, since science bestows legitimacy on action, the stance of trust in science is implicit, rather than articulated. Second, as already noted, scientists are occupationally disposed to silence (in public) in the interests of neutrality. Third, they are themselves well aware of the complexities and imperfections of science as practice and as institutional pursuit, and unless thrust into a polarizing situation, have little reason to mount an argument for the public which glosses over those complexities. And finally, when scientists do speak, they confine themselves to the specifics of their specialty, again being professionally inclined to restrict their speech. Only as the public's challenges to the uses and direction of science become more insistent will voices that urge trust be as prominent as the ones that now warn against

the course our science and technology are now taking. That this challenge will increase, and that the debate will sharpen, is indicated, I believe, by the growing centrality of science to our collective and personal concerns.

Skepticism of Science

A fully-developed argument about the directions, uses and epistemological suppositions of science, and their intersection with politics, is not yet evident in public debate. There is no argument centered on science which is yet comparable to the conservative style of thought as retrospectively analyzed by Mannheim -- an argument developed over time with many individual contributors, which coalesced within a group with a particular social location. That argument about science is still developing; it is most noticeable in its public form, I maintain, in environmental arguments that I call (following Mannheim) an environmental style of thought. Murray Bookchin and Barry Commoner, to be discussed in later chapters, have both contributed to building an argument which penetrates through surface issues to the underlying dynamics of environmental crisis. Bookchin finds the root of our problems in hierarchical society: where man dominates man (and particularly,

dominates woman), man will dominate nature. Commoner argues that the reductionist direction of today's life sciences atomizes our knowledge of the environment and our action toward it, in contradiction with the holistic requirements of ecological balance. The developing field of environmental ethics will also contribute to a science-centered argument, as will debates over medical technologies and genetic engineering.

The first crack in the picture of a perfect science -- perfect in neutrality and beneficial effect -- came with the atomic bomb. The next came with the environmental crisis. The perfect picture, of course, was never held by those who were knowledgeable, but it was held by the public, and it was environmental warnings that reached the public which began to build, directly and indirectly, a case for skepticism about science in society.

NOTES TO CHAPTER EIGHT

1. Excerpted from "Only Man's Presence Can Save Nature: Toward a Truer Understanding of the Environment," Harper's, April, 1990, pp.37-48.
2. Philip Shabecoff, "Urgent Help for Environment Is Plea at Forum," The New York Times, 5/4/89, p.A23.
3. Dixy Lee Ray, "Who Speaks for Science?" 21st Century Science & Technology, January-February 1990, (Vol.2, No.1), pp.6-7.
4. Miriam Rothschild, "Essay," Scientific American, August, 190, p.116.
5. Richard Levins and Richard Lewontin, The Dialectical Biologist (Cambridge, MA: Harvard University Press, 1985), pp.197, 202, 204.
6. Ibid., p.207.
7. Gino J. Marco et al., eds., Silent Spring Revisited (Washington, D.C.: American Chemical Society, 1987).
8. Gino J. Marco, Robert M. Hollingworth and William Durham, "Many Roads and Other Worlds," ibid., p.192.
9. In her career with the U.S. Fish and Wildlife Service, Carson worked on publications, rather than doing field or laboratory research. She was one the first two women to be hired in any non-clerical position by the agency (see Paul Brooks, The House of Life: Rachel Carson at Work (Boston: Houghton Mifflin, 1972), p.71). As a woman starting her career in the 1930s, her opportunities to be the practicing scientist she was trained to be were severely limited.
10. The relation of the division of labor in turn to an ideology of science, particularly of pure science, is pointed out by Aronowitz, op. cit. (Ch.1, note #12).
11. "Roundtable: Kuhn and Lederberg on Scientific Thought - A Meeting of Biological and Philosophical Minds," The New York Times, 3/13/83, IV, p.8.

12. Rolling Stone, May 3, 1990, p.59.
13. Stephen H. Schneider, Global Warming (San Francisco: Sierra Club Books, 1989), pp.195-96.
14. Philip Shabecoff, "Scientist Says Budget Office Altered His Testimony," The New York Times, 5/8/89, p.1.
15. Schneider, p.197.
16. Ibid., pp.34-35.
17. Ibid., p.xi.
18. Ibid., p.199.
19. Quoted in "The Prophet of Global Warming," by David Goeller, Environmental Action, November/December 1989, p.24.
20. This is the theme of Chandra Mukerji's A Fragile Power: Scientists and the State (Princeton, NJ: Princeton University Press, 1989). Scientists are an elite reserve labor force for the government, Mukerji says, and "the state needs their detachment to serve its interests. They are left the world of science to govern internally.... But.... the quid pro quo can be costly. And in the relationship between science and the state in the United States, the scientific establishment routinely gives away one of its greatest assets: its voice (pp.202-03).
21. René Dubos, "The Environmental Teach-In" in The Environmental Handbook, Garrett de Bell, ed. (New York: Ballantine Books, 1970), pp.8-9.
22. Sir Karl Popper, long the most outspoken champion of scientific autonomy, discusses philosophical and political aspects of it in The Open Society and Its Enemies (Princeton, NJ: Princeton University Press, 1966, 5th ed.; orig. pub. 1945) and in Conjectures and Refutations (New York: Harper and Row, 1968; orig. pub. 1962, Basic Books). An iconoclastic view of the value of science is given by Paul Feyerabend in Science in a Free Society (London: Verso, 1982; orig. pub. 1978, NLB)
23. The Environmental Crisis - Opposing Viewpoints, Neal Bernard, book editor (San Diego: Greenhaven Press, 1991).
24. E.g., David Dickson, The New Politics of Science (New York: Pantheon, 1984) a thorough account of the politics of science in the United States from the 1950s through 1970s.

CHAPTER NINE

SCIENCE QUESTIONED

The previous chapter discussed the voices of science and the question of how science should 'be' in society. This chapter reviews a book that followed a few years after Silent Spring, which warned of scientific ingenuity misapplied to the environment. This later book questioned science itself, and claimed that environmental problems were in part the outcome of a theoretical bias in the biological sciences and of trends in scientific practice which threatened scientific integrity.

Science Out of Hand

Barry Commoner's Science and Survival, published in 1966 but including writings going back to 1963, begins: "The age of innocent faith in science and technology may be over."¹ Throughout the book Commoner develops the argument that science, though it has brought us many benefits in medical knowledge, new products, and innovative methods of

production, is getting out of control. Commoner wants to make science more responsible; in particular he wants scientists to take the responsibility to provide information to the public about new scientific knowledge.

One of the reasons for having doubts about science and technology is that our ability to build sophisticated automatic systems has outstripped our ability to control them. As example, Commoner recalls the electric power blackout of November 1965 in the northeastern United States and Canada. A complex network linking power facilities over an 80,000 square-mile area enabled one facility to take over when another failed. But when the failure of a relay switch at one station sent power surging to another, safety switches there shut it down; in a chain reaction, safety switches shut down one plant after another as power surged through the system. As each part of the system shut down, another part of the northeast was abruptly covered in darkness.

Commoner does not bother to paint the picture that many of his readers would remember: Traffic lights stopped functioning, street lights went out; elevators halted in their shafts and passengers remained immured in the dark for hours; lights went out and refrigerators went off in homes and businesses; emergency generators switched on in hospitals, and staff nervously wondered if the emergency

electrical supply would be adequate. TV was gone; you got your news from a "portable" radio or from people who had heard the news on the car radio as they drove home from work in a darkened world. The constant activity of modern life was brought to a dead stop in some places; it went crawling on in others. Most people had no idea that such a total blackout could happen; power failures were usually local, the result of damage from storms. Clearly, the designers of the power network had not foreseen the possibility that the system that was designed to prevent just such an occurrence had instead speeded its happening.

But Norbert Wiener, the cybernetician who had died just the year before, would not have been surprised, Commoner says. In 1960, Wiener stated that machines could be built which "'escape from the complete effective control'" of their makers.² The power failure was a "blunder," as Commoner puts it, and he goes on to tell of another of equal magnitude, although its chain reaction took place over years rather than minutes. Radioactive fallout from nuclear tests in the atmosphere in the western states in the 1950s, in which the Atomic Energy Commission saw no hazard, by the late 1960s appeared to be the cause of thyroid problems in the region's children. The AEC had overlooked the possibility that radioactive iodine, though only lightly deposited on the ground, would be concentrated in the milk

of the dairy cows that grazed the area, and further concentrated in the developing glands of young children who drank the milk. "In both cases," Commoner observes, "the process was over and the damage done before we understood what had happened."³ Both cases

"have cast a shadow -- small, but deeply troubling -- over the brilliance of... scientific successes. Is it possible we do not know the full consequences of the new power grids and the new bombs? Are we really in control of the vast new powers that science has given us, or is there a danger that science is getting out of hand?"⁴

Twenty-five years later we are well aware that we did not know the full consequences of many of our new, postwar technologies, but in the early 1960s this awareness was not widespread.

Commoner titles his second chapter "The Sorcerer's Apprentice." He is not alone among scientists in referring to the story in which new found expertise practiced without wisdom and foresight brings serious trouble. As he sees the post-war world, advances in scientific knowledge have been great, but simple necessities of life are becoming problematic. The environment is polluted. The burning of fuels is producing a greenhouse effect in the atmosphere; automobile exhausts are creating smog. Leaded-gasoline auto exhaust also contaminates water and crops. Despite the nuclear test ban treaty of 1963, as Commoner writes this book nuclear explosions are still occurring in the

atmosphere and spreading radiation across thousands of miles; people are found to have radioactive strontium-90 in their bones and teeth. Groundwaters in the United States are polluted by industrial wastes, sewage, and fertilizer runoff; detergents choke streams and foam out of water taps until a ban on their non-biodegradable, synthesized hydrocarbon ingredient in 1965. Insecticides such as DDT kill more life than they are intended to, again in chain reactions. Commoner cites the case of a Bolivian town where DDT killed most of the domestic cats as well as the malarial mosquitoes; with the cats gone the town was invaded by a rodent that carried black typhus, which killed several hundred villagers before cats were once again brought in.

Again and again, Commoner cites examples of ecological complexity and interrelationships where harmful consequences of chain reactions are not foreseen. Some, such as the indiscriminate killing by DDT, are foreseeable; some, like the effects of radiation could, for lack of knowledge or its dissemination, not be foreseen. Detergents were another "massive intervention into nature" which were a technological mistake.⁵

The problems engendered by detergents, nuclear tests, automobile exhausts, pesticides and fertilizers "have a common scientific background. Each of them springs from a useful technological innovation."⁶ Should we then pull

back from this type of scientific development? The scientific revolution at the turn of the century, coming from the discovery of the physics of the atom, brought

"the great flowering of modern science -- including the new energy sources and synthetic substances which have covered the earth with pollution. We are today witnessing the inevitable impact of the tidal wave created by a scientific revolution more than half a century old. It is simply too late to declare a moratorium on the progress of science. The real question is not whether we should use our new knowledge, but how to use it."⁷

Further,

"Since the scientific revolution which generated modern technology took place in physics, it is natural that modern science should provide better technological control over inanimate matter than over living things. This disparity is evident in our environmental problems."⁸

There have always been risks in the advance of science, Commoner allows, but with the increase of the power of science there is also an increase in risk, from local and brief events -- such as exploding steam boilers -- to global and persistent problems -- such as fallout. The "margin for error has become very much reduced."⁹ In all the examples Commoner cites, he points out, risk was taken before it was fully understood what the risk was. We are in danger, he says, not just from the hazards we risk, but from "an incipient abdication of one of the major duties of science - - prediction and control of human interventions into nature."¹⁰ Both scientist and citizen should be concerned

about this duty, and we must understand how it is that this near-abdication has occurred.

Commoner is already, in the first pages of his brief book, discussing science itself, and its role in society, much more than was done in Carson's book -- though she also stresses the lack of prediction and foresight.

The Direction of Science

"Many of our recent technological mistakes crop up as an unexpected biological aftermath of a new advance in physics or chemistry," observes Commoner. Yet at the same time there are claims of "sweeping advances in our basic understanding of life."¹¹ This paradox is the outcome of the practice of two kinds of biology: classical -- the study of the cell as the basic unit of life; and molecular -- which "assumes that the separate. chemical constituents of the cell.... account for life."¹² Commoner notes that molecular biology is considered new, and cell biology old, with the implication that the old must give way to the new as science advances. But both types of biology, he says, have nearly 200-year old histories.

Classical biology began with description and classification; this classificatory achievement still

stands. With the development of the microscope, the cell was found to be the "universal unit" of living things.

"Separated from the organism the cell still retains the features of vitality: metabolic transformations of food substances, responsiveness to environment, energetic activity, reproduction, and inheritance. But when the cell is dismembered, these capabilities are lost, even though certain isolated parts, such as enzymes, are able for a time to carry out one or another chemical reaction."¹³

While classical, or cell, biology studies the structure of the cell, another approach, in which most constituents must be removed from the cell for analysis, studies its chemistry. The biochemistry of the cell, which has branched off in one direction into molecular biology, has gone from the discovery of hemoglobin (a protein which enables blood to carry oxygen throughout the body) to the discovery of DNA (nucleic acids whose molecular structure encodes 'instructions for life'). Molecular biology has achieved great discoveries, but in its necessary procedure which kills the cell, Commoner says, a subtle property is lost. Commoner is not making a claim for vitalism -- the idea of a life force added to "otherwise lifeless substance"; he is presenting a systems-view of emergent properties of the whole not discernible in isolated parts.

In the argument between molecular and cell biology, cell biology considers itself holistic, and molecular biology atomistic. Molecular biology considers cell biology

dated; the cutting edge and the funding money is in molecular biology. In 1966, when Commoner's book was published, the discovery of DNA was thirteen years old, and the field that was built on it was still new. Commoner argued that the results of experiments with DNA and RNA had been too greatly generalized, to come to mean that DNA by itself controls heredity. Commoner claimed that the whole cell does this, in complex interactions of its constituents.

The debate still continues, but at a muted level, with molecular biology the current winner. The "central dogma" (the scientists' own term)¹⁴ of molecular biology is that DNA determines the structure (order of amino acids) of proteins, but not the other way around -- proteins can't affect the structure (order of nucleotides) of DNA. Commoner says that "experimental observations deny... this assumption."¹⁵ But the hierarchical image of the master DNA molecule is mirrored in the theoretical dominance claimed by molecular biology; DNA is what counts, the cell is only an accessory. DNA alone determines heredity, and heredity is a defining element of life, the subject of biology. Molecular biology, then, owns the essential knowledge of the discipline. "There is, I believe," says Commoner

"a crisis in biology today. The root of the crisis is the conflict between the approaches to the theory of life."¹⁶

One of the outcomes of the conflict is that

"The dominance of the molecular approach in biological research fosters increasing inattention to the natural complexity of biological systems."¹⁷

This is especially true, Commoner feels, of "the living environment into which all animals, plants, and man must fit or perish."¹⁸ Since the "free inquiry into nature that we call basic science" is the source of the knowledge which gives us technological innovation, Commoner observes, a basic theoretical crisis in biology "may help to explain why new technological innovations are so frequently troubled by biological failures."¹⁹ Commoner goes behind the problem to find causes at a theoretical level.

In an interview given a few years after the publication of Science and Survival, Commoner refers to himself as a "biologist, a biochemist, and a biophysicist" whose research "has been to do with the way chemical processes take place in living cells."²⁰ As he became concerned about environmental problems, he proposed the Center for the Biology of Natural Systems at Washington University in St. Louis. He recalls:

"The university administration thought I was off my rocker. At that time everyone was saying, the wave of the future is molecular biology, we don't have to worry about organisms in their natural state any more because it's all going to be done with test tubes. Now, I am a molecular biologist; I organized the first training programme in the United States in molecular biology.... But while all that was going on, I realized that was not

really where its at. We're learning more and more about smaller and smaller parts of the cell, while terribly important things were happening out there in nature about which we were totally ignorant."²¹

Commoner is also critical of ecologists at this time, for not speaking out about environmental problems, and he points to himself and René Dubos as non-ecologists who did.²²

Commoner goes on to speak of holding a philosophical conviction in holism which conflicted with the mechanistic approach of molecular biology. It was around 1960, he says, when

"although I had been doing essentially molecular biological work, I realized that it was going the wrong way so I began marching the other way. But I did not give up or reject my molecular work. I tried to find ways of relating data about the part to the properties of the whole."²³

Scientific Integrity

There are other difficulties in basic science now, Commoner states in his book; the problem of diverging biologies is only one. While scientific research is growing to be a very large endeavor, important traditional scientific practices are on the decline. The free dissemination of knowledge is being blocked by military and profit incentives; competition for national prestige is overcoming the principle of being blind to national

boundaries; the scientist's freedom to choose his own problem is being limited by patterns of research support. These are "serious disparities between the traditional principles of science and modern realities."²⁴

Commoner sees an erosion of scientific integrity. That this erosion was taking place was also the conclusion of the American Association for the Advancement of Science in a report by the Committee on Science in the Promotion of Human Welfare, in 1965. The integrity of science, by their definition, is the totality of its processes of discovery and discussion, and the organization which makes it possible for these processes to take place. The "pressure of insistent social demands" has eroded the process, the report stated.

"Under these conditions, the laboratory of basic science inevitably loses much of its isolation from cultural effects, and becomes subject to strong social demands for particular results. Despite reducing the time between discovery and application.... this. has resulted in technological application before the related basic scientific knowledge was sufficiently developed to provide an adequate understanding of the effects of the new technology on nature...."²⁵

As Commoner reminds us, examples of this premature application occurred in nuclear explosions in the atmosphere and in the intensive marketing and use of detergents and pesticides.

The Nuclear Question

In a chapter entitled "The Ultimate Blunder," Commoner discusses the possibility of nuclear war -- an issue that was intensely debated during the cold war era in which the book appeared. The question he puts is whether having nuclear weapons is a real defense of a nation's security. A full-scale nuclear attack on this nation, he states, would destroy a large proportion of its people, animals, vegetation, and what is now called infrastructure. The economy would be largely destroyed, survivors would be ill and doctors and hospitals few. At the same time, water would be contaminated, sanitation facilities destroyed. Rebuilding under such conditions would be extremely difficult. Effects on fertility would bring birth rates down while cancer rates would go up. Soil would be contaminated, and the kill off of birds would mean an increase of the insect population (which dies only at higher doses of radiation than birds); agriculture could not achieve the levels of production that existed before the attack.

The intricate system of the biosphere would be disrupted. Pine trees, being especially vulnerable to radiation, would die, and the soil protected by their watersheds would erode -- causing loss of retained water,

floods, and finally, the lack of enough soil for new trees to grow in. Even if people can be protected, "agriculture, the biological balance of the land, and the climate" cannot.²⁶ Thus, like the New England power grid, a war machine with its automatic targeting and release of missiles, and the subsequent retaliation, could have unexpected reactions and effects once it is set into motion.

Such arguments about advanced weaponry, familiar now, were hotly contested in the 1960s, and a source of great tension in American society. Much information about nuclear weapons and the effects of nuclear fallout had been kept military secrets, and only piece by piece did the complete picture of a possible nuclear holocaust become public.

Commoner deplores this secrecy:

"Had the nature of nuclear warfare been fully described in the scientific literature, biologists could have explained to the generals -- long before 1961 -- that they could not guarantee that the delicate balance of life-relationships on the earth's surface would survive a major nuclear war."²⁷

Scientist, Citizen and Government

The dissemination of information, Commoner stresses, is especially important. With Commoner, as with many other scientists, recognition of the immense power of the atomic

bomb and becoming alert to the horrors that would follow in the train of a nuclear war was a decisive experience.²⁸ There will always be risk in the application of scientific knowledge; what we need to do, Commoner argues, is to balance risk and benefit in a way acceptable to the public. Scientist and citizen should communicate with each other. Commoner believes that questions of risk and benefit are all "subject to objective scientific and technological analysis"; it is the balance between them that science can't decide.²⁹

"Scientific method cannot determine whether the proponents of urban superhighways or those who complain about the resultant smog are in the right, or whether the benefits of nuclear tests to the national interest outweigh the hazards of fallout. No scientific principle can tell us how to make the choice, which may be forced upon us by the insecticide problem, between the shade of the elm tree and the song of the robin."³⁰

Science can't make the balance, because that is a "value judgment" -- not based on science. Pollutant levels, for instance, are social problems (Commoner's emphasis) which "must be resolved by social processes." Scientists must be involved in these judgments, but they must also "reflect the demands, opinions, and ethics of citizens generally."³¹

This brings in the government as mediator, in a triad of scientist, citizen, and government (or, as Commoner calls it, administration). The relationship between government and citizen doesn't come in for any special discussion in

Commoner's work, but the role of scientist in relation to government does. The scientific community, Commoner says, is divided about what this role is. Some scientists

"try to keep their political views separate from their scientific duties. To other scientists such rigorous objectivity seems to imply a disregard for the nation's defense, or for the numerous ways in which science can serve human welfare. They seek to play a part in directing the power that they help to create.

The second of these positions is relatively new and originates in scientists' intense concern with such dangerous issues as nuclear war."³²

Scientific issues, Commoner observes, now "appear with a strong admixture of political views."³³ Is there harm in "exploiting political interests to further a scientific goal?" he asks.³⁴ His judgment is that there is, that the pressure of political goals damages the ability of science to understand nature in the ways he has already discussed. There is already a problem of knowing which scientist to believe. This is the most troubling question for the citizen, in Commoner's experience. "The citizen has begun to doubt what he used to take for granted -- that science is closely connected to the truth."³⁵ Commoner connects this problem with the position, taken by some, that scientists have a special competence for judging social issues -- because they are in possession of the facts and are trained in analysis and rationality. Commoner rejects this position. He does not favor

"a statement in which a number of distinguished scientists argued for a particular space experiment partly by supporting its scientific value, and partly by describing its special usefulness as a vehicle of international propaganda for the United States."³⁶

"When scientists voice their social judgments with the same authority that attaches to their professional pronouncements, the citizen is bound to confuse the inevitable and insolvable disagreements with scientific disputes. If scientists attach to their scientific conclusions those political views or social judgments which happen to provide support for these conclusions, scientific objectivity inevitably comes under a cloud."³⁷

Commoner believes strongly in an informed citizenry. The scientist, he affirms, has a "profound duty to impart as much knowledge as he can to his fellow citizens."³⁸

Science and Social Action

What is at issue for us now, Commoner warns, is survival. About all the related problems, he says, he can speak only for himself. As a scientist, he arrives at his own judgments about scientific and technological issues. As a citizen he decides what course he wants his government to pursue, and acts to get that course taken. As a human being he thus expresses his moral convictions.

"As a biologist, I have reached this conclusion: we have come to a turning point in the human habitation of the earth. The environment is a complex, subtly balanced system, and it is this

integrated whole which receives the impact of all the separate insults inflicted by pollutants. Never before in the history of this planet has its thin life-supporting surface been subjected to such diverse, novel, and potent agents... I believe that continued pollution of the earth, if unchecked, will eventually destroy the fitness of the planet as a place for human life."³⁹

Most urgently, there is a need for the scientific community to establish a way to report on hazards in advance (Commoner's emphasis).

"The costs of correcting past mistakes and preventing the threatened ones are already staggering, for the technologies which have produced them are now deeply embedded in our economic, social, and political structure."⁴⁰

The problems of pollution can be technologically corrected, but the effects of nuclear war cannot -- the biosphere could not be protected from catastrophic effect that would be unrepairable. Nuclear war "would be a blunder from which there would be no return"; prevention by disarmament offers the only solution to its problems.⁴¹

We must find a way to use science intelligently. Our ignorance of the effects to come from our innovations is a fault which

"signifies that the capability of science to guide us in our interventions into nature has been seriously eroded -- that science has, indeed, got out of hand."⁴²

To restore the integrity of science, "scientists need to find new ways to protect science itself from the encroachment of political pressures."⁴³

"If science is to perform its duty to society, which is to guide, by objective knowledge, human interventions with the rest of nature, its integrity must be defended."⁴⁴

Scientists have a responsibility for the technological use of scientific developments that they carry out when they inform the public. This is an "involuntary obligation"; to ignore it is to withhold information from fellow citizens. Because much of the substance of science is not understood by most citizens, "the technical content of the issues of the modern world shields them from moral judgment."⁴⁵

Commoner concludes with a strong statement:

"The political crisis generated by scientific and technological knowledge is upon us.

Science can reveal the depth of this crisis, but only social action can resolve it. Science can now serve society by exposing the crisis of modern technology to the judgment of all mankind. Only this judgment can determine whether the knowledge that science has given us shall destroy humanity or advance the welfare of man."⁴⁶

* * *

Commoner takes on science directly in this book, and connects a practice and a worldview to environmental consequences. The main argument of Science and Survival is that postwar technology is destroying the environment, and that the science associated with that technology is on the way to being out of control. Commoner defines postwar

technology differently from the conventional wisdom of the time, as a threat rather than as unalloyed benefit and progress. Change in the scale and power of science make it mandatory for us to take control of its direction.

Otherwise, the continued intervention into nature through technological innovation without awareness of future effects will damage the environment to the point where it is no longer fit for human survival. This analysis rests on an understanding of complex systems, both human and man-made, and the chain-reaction effect of small changes in them. Events in the natural and social worlds are explained as expressions of cycles, not as outcomes of linear developments. This systems view, in turn, is a part of Commoner's commitment to and experience with studying whole organisms, and organisms in the context of their environment, rather than analyzing solely their molecular structure as discovered through methods that must destroy the functioning of the whole.

Scientific knowledge, in Commoner's appraisal, is powerful and is risky (meaning that it can lead to both benefit and harm). Science is under political pressure and must maintain its objectivity and integrity by resisting this pressure, by maintaining its apartness. Yet scientists are not separate from their society, and have a responsibility to fulfill both the demands of science and of

citizenship by disseminating information and by making that information understandable and accessible to the public. When science does not resist political pressure, and when scientists do not communicate with the public, the integrity of science is diminished, the connection between science and truth is doubted, and science, unrestrained by the cross-checking processes among scientists themselves, gets out of control -- generates technological interventions and proceeds with atomistic assumptions that damage the livability of our world. The need is to control what is happening in science; the issue is survival.

Because science guides our interventions into nature, a divided science -- physics and chemistry unattentive of biology, biology itself theoretically split -- results in the disregard of needed information and counterbalancing views to the detriment of the environment and our health. In this book Commoner thus traces the problems of the environment not simply to the demands of the profit-driven economy -- although he emphasizes the reliance of the economy on environmentally-destructive technologies -- but to a theoretical division in scientific knowledge. He does not develop this argument at length, but in a 150-page book that mostly describes environmental problems in detail, he gives it a significant place. Commoner criticizes the lack of foresight on the part of both scientists and government

administrators, and relates that lack of foresight to a split in the life sciences which encourages a reductionist and narrow focus which gives little attention to far-reaching effects of current technological developments. He speaks out against the loss of scientific integrity which results from the mixing of science and politics.

Commoner repeatedly states that social problems require social solutions -- not technological, and not biological ones. In this he is referring to what he conceives of as a necessary separation between scientific knowledge and social values, in the interests of objectivity. Scientific conclusions should not be socially colored; science itself does not have the answer to questions of social values. This is the conventional view, which Commoner takes despite his criticism of the course of science. His solution to the inevitable intersections of science and social issues is the cooperative involvement of scientist and citizen on issues of public concern.

In Commoner's examples, citizens, afraid for their lives, demand better information of government and scientists, and then decide what they want. He hasn't an answer for what happens when they don't get it -- that is, hasn't an analysis of their limited power of intervention -- nor does he speculate on citizens stopping scientific development, as in the case of the movement to close nuclear

power plants. What he's doing is suggesting a grass-roots start to change.

Science here is the traditional science -- a body of objective knowledge -- distorted by growth and by outside pressures but not fundamentally unrepairable. Its epistemological possibility of objectivity is not in question, and its institutional capacity for it, though damaged, is recoverable. The sorcerer's apprentice, after all, is in trouble because his knowledge is truly effective; his problem is that it is partial. The wise sorcerer -- good science -- will restore the balance. Though Commoner acknowledges the doubt the public has formed about the wisdom or accuracy of science, he does not go so far as to suppose that the public may suspect that all the sorcerers are apprentices.

NOTES TO CHAPTER NINE

1. Barry Commoner, Science and Survival (New York: Viking Press, 1966), p.3.

(All page references that follow are to this title, except as noted.)

2. Quoted on p.5.

3. p.7.

4. p.8.

5. p.22.

6. p.23.

7. pp.24-25.

8. p.25.

9. p.28.

10. p.29.

11. p.30.

12. p.32.

13. p.34.

14. It was so named by Francis Crick, the co-discoverer, with James Watson, of DNA. See John Maynard Smith, The Problems of Biology (New York: Oxford University Press, 1986), p.20.

15. p.40.

16. p.44.

17. p.45.

18. p.46.

19. p.47.

20. Anne Chisholm, Philosophers of the Earth, (New York: E.P. Dutton & Co., 1972), p.123.
21. Ibid., p.128.
22. Ibid., p.126.
23. Ibid., p.129.
24. p.49.
25. Quoted on p.62. Rachel Carson stressed this point in Silent Spring.
26. p.84.
27. p.88.
28. See Chisholm interview of Commoner, passim, and especially pp.102-04 . Rachel Carson had a similar recognition; see her comments quoted in Hynes, The Recurring Silent Spring, p.7.
29. p.99.
30. p.101.
31. p.102.
32. p.104.
33. p.105.
34. p.106.
35. p.107.
36. p.106.
37. p.107.
38. p.109.
39. p.122.
40. p.124.
41. p.126.
42. p.128.
43. p. 128
44. pp. 128-29
45. p. 131
46. p. 132

CHAPTER TEN

THE LOGIC OF NUMBERS -- POPULATION

The previous chapter reviewed a book that critiqued science and warned of the environmental danger of scientific knowledge applied without caution. This chapter reviews a book that warns of the environmental danger of government inaction in the face of a global population explosion.

Population Growth

Paul Ehrlich's The Population Bomb was published in 1968¹; a paperback edition made it widely available, and it sold nearly a million copies in its first two years in print², three million by 1990.³ Ehrlich, a biologist known for his field research in ecology, was then (and is still) a professor at Stanford University, specializing in population biology. He had previously written books on his ecological research. The Population Bomb is written in a direct, punchy style, with chapters broken up into short sections. The organization of the book is simple: "The Problem" --

overpopulation, in Ehrlich's view; "The Ends of the Road" -- possible (and horrible) outcomes if population growth goes unchecked; "What Is Being Done" about it; "What Needs to Be Done"; "What Can You Do?"; "What If I'm Wrong?". Like Carson, Ehrlich opens his book with the vision of a frightening future, and like Carson he works from what is happening now. Unlike Carson, however, he does not have to imagine one place that will experience overwhelming problems in the future. He finds it now, in India, on a "stinking hot night in Delhi" in a crowded slum.

"The temperature was well over 100, and the air was a haze of dust and smoke. The streets seemed alive with people. People eating, people washing, people sleeping. People visiting, arguing, and screaming. People thrusting their hands through the taxi window, begging. People defecating and urinating. People clinging to buses. People herding animals. People, people, people, people."⁴

"Old India hands will laugh" at his shocked reaction, Ehrlich acknowledges, but all the same, he says, "since that night I've known the feel of overpopulation."⁵

In underdeveloped countries, Ehrlich states (in the late 60s), food production falls behind population growth a little more each year. The "logical conclusion: mass starvation." The rich will get richer, the poor poorer. Three and a half million poor will die of starvation in the year that The Population Bomb is published; most of them will be children. In a decade or so, this number will look

like a "mere handful."⁶ The basic fact of population growth is that the more people there are, the more rapidly population doubles, other things being equal. Doubling time varies with the economic status of the population: poor agricultural populations add to their numbers more quickly than industrialized urban ones, but overall the world's population in the late 1960s doubles about every 37 years (approximately 35 years in poor countries, 50-100+ years in rich ones). At that rate, after 900 years, Ehrlich observes, there would be sixty million billion people on Earth. He dismisses the possibility, discussed in the popular press, that large populations could be moved to other planets. Even if all planets were habitable (and logistical problems overcome), as population continued to grow, it would take only about 250 years to fill up the solar system. Also, since it would take generations to reach the outer planets, passengers would have to practice strict birth control. "Thus we would have to export our responsible people, leaving the irresponsible at home on Earth to breed."⁷ The irresponsibility of overbreeding (more than two children per couple) is a continuing motif of Ehrlich's book.

Even in developed countries, population growth causes problems, and Ehrlich attributes to it the "headaches" of "garbage in our environment... overcrowded highways,

burgeoning slums, deteriorating school systems, rising crime rates, riots, and other related problems."⁸ On population growth, he repeatedly emphasizes that it is the relationship between the birth rate and the death rate that is the most important, since if births exceed deaths then population will grow.⁹ With about 40% of the population of the underdeveloped countries being under the age of 15 in the late 1960s, the likelihood of the "greatest baby boom of all time" is an "ominous" fact.¹⁰

We got to this brink of a population explosion, Ehrlich says, because the urge to reproduce has been fixed in us by billions of years of the evolution of all life in the direction of reproductive success, and because human culture has developed around human biological needs. "Our urge to reproduce is hopelessly entwined with most of our other urges."¹¹ For most of human life on earth, the prevalence of death from disease, starvation and accident kept total numbers low. Ehrlich dates the first population increase to a time when agriculture replaced hunting-gathering. Changes that came with industrialization, along with later medical advances (particularly "victory over malaria, yellow fever, smallpox, cholera and other infectious diseases"¹² in the underdeveloped countries) greatly decreased the death rate and contributed to population growth. "Death control" of population has decreased, but birth control has not

increased correspondingly. Biologically and socially, Ehrlich says, "death control goes with the grain, birth control against it."

"In summary, the world's population will continue to grow as long as the birth rate exceeds the death rate; it's as simple as that... Basically, then, there are only two kinds of solutions to the population problem. One is a 'birth rate solution', in which we find ways to lower the birth rate. The other is a 'death rate solution', in which ways to raise the death rate -- war, famine, pestilence -- find us."¹³

At the time of writing, Ehrlich felt that the next nine years would tell the extent of the population crisis, primarily because of the likelihood of famine in underdeveloped countries. World wide, food production kept pace with population increase until about 1958 when (as others estimating the approach of famine put it), "the stork passed the plow." In 1965-66, because of agricultural disasters, there was no increase in worldwide food production at all, although world population kept growing.¹⁴ Ehrlich and others saw escalating food problems in India and Latin America. Ehrlich finds India too reliant on American food aid, Latin America too much in the grip of Roman Catholic doctrine that the rhythm method is the only acceptable method of birth control. He refers to a report on Colombia, where population doubling time is 22 years, which (although he does not draw attention to it) counteracts his references to irresponsible overbreeders:

"The average mother goes through a progression of attempts to limit the size of her family. She starts with ineffective native forms of contraception and moves on to quack abortion, infanticide, frigidity, and all too often to suicide. That's the kind of misery that's concealed behind the dry statistic of a population doubling every 22 years."¹⁵

Before World War II, such a woman "could expect two or three children to survive to reproductive age if she went through ten pregnancies." Now seven or eight will live, and 80% of the family's income will be spent on food.¹⁶ There is not enough food today, Ehrlich states, and there will be even less tomorrow.

The Environment

Food production that doesn't keep up with population is a massive problem in itself, "but in the long view the progressive deterioration of our environment may cause more death and misery than any conceivable food-population gap."¹⁷ Population growth places a great pressure on the environment: erosion as the result of poor farming practices, destruction from strip mining, salinization from overirrigation, decreased productivity of soils where huge dams stop silt-rich annual floods (as with the Aswan on the Nile), pesticide use which changes the ecological balance and persists throughout the food chain.

By such intervention in the environment we change complex ecosystems to simple ones, and "one of the basic facts of population biology," Ehrlich tells us, "...is that the simpler an ecosystem is, the more unstable it is."¹⁸ Complexity in an ecosystem allows one element to take over the function of another when change occurs. If most of the foxes who hunt a forest die of disease, their role can be taken over by weasels or owls. But when we use pesticides, we destroy complexity. Pest insects, which have large populations, are statistically likely to contain pesticide resistant strains, but animals higher up the food chain, with smaller populations, can be significantly killed off by pesticides. Fewer of them will be available to eat the insects, and again more pesticide will be used, killing other life along with the non-resistant insects. Pesticides also reduce diversity of life in the soil. The simplified ecosystem becomes less stable -- that is, less able to deal with change. Some simple ecosystems are directly created -- fields of single crops, for instance, like wheat or corn. These are highly vulnerable to insect attack, not only because they present a large, attractive target to feed rapidly reproducing insects, but because their natural insecticides have been bred out to improve their taste. "One could go on with pesticide horror stories galore," Ehrlich states. "The scientific literature is replete with

them... It is a record of ecological stupidity without parallel."¹⁹

As a result of our productive activities even the vastness of the ocean is being poisoned, and the air is becoming depleted of oxygen. Air pollutants kill vulnerable plant life, and can disrupt climate by affecting the amount of heat from the sun that both comes to the earth and is radiated back from it. Rivers and lakes are deteriorating rapidly. Ehrlich tells of reminiscing with a friend about field research they had been doing together ten years earlier: a study of natural selection in water snakes living at the western end of Lake Erie. Still fascinated by the question, they would like to continue the research, but cannot, because most of the snakes are gone, as are the fish on which they fed. "The once beautiful lake is now a septic tank," Ehrlich states bluntly, and while a few years prior to their research, 75 million pounds of fish were taken from the lake, "no one in his right mind would eat a Lake Erie fish today."²⁰ This loss of edible fish, a familiar story now, could still raise incredulous responses in the 60s. A deteriorating environment threatens us physically and perhaps mentally as well, and may have something to do, Ehrlich suggests, with "rising crime rates, disaffection of youth, and increased drug usage."

Ehrlich points out to his readers that he's taking a

limited piece of the environmental problem to talk about:

"You will note that my discussion of man's environment has not dwelt on the themes that characterize the pleas of conservationists. I haven't discussed [redwoods]... I've shed no tears here for the passenger pigeons, now extinct, or the California condors, soon to join them. No tears for them, or for the great auk, or the mammoths, or the great herds of bison, or the California grizzly bears, or the Carolina parakeet. I haven't written about them, or of the pleasantness, beauty, indeed glory of many natural areas. Instead I have concentrated on things that seem to bear most directly on man."²¹

The conservation battle, says Ehrlich, is being lost, first because nothing can remain undeveloped under the pressure of population growth, and second because "most Americans clearly don't give a damn." Ehrlich's evaluation of most Americans may or may not have been accurate in 1968; twenty-five years later most Americans say they are worried about the environment. Ehrlich concludes his review of environmental problems with this analysis of their cause:

"Too many cars, too many factories, too much detergent, too much pesticide, multiple contrails, inadequate sewage treatment plants, too little water, too much carbon dioxide -- all can be traced easily to too many people."²²

Disaster Scenarios

Too many people brings us to the "verge of the 'death rate solution'," and Ehrlich outlines both general

possibilities and more specific scenarios for how that solution might work. Generally, disease could increase as population density does, especially malaria, yellow fever, and typhus. Or, viruses (still not fully understood, he says) may become more potent with large populations to circulate in. In 1918-1920, a flu virus killed 25 million people in a global epidemic. A more lethal flu would do still worse; the virus could occur naturally or escape from biological warfare research strains. Death and incapacity from illness would disrupt all areas of society, including food production and transportation. As many as one out of every seven people might die (which Ehrlich compares to one out of 200 people dying in battle in World War II).²³ Any crisis would exacerbate differences between rich and poor nations, especially the balance of food.

Specifically, Ehrlich offers Scenario I, in which China has catastrophic floods and famine in the early 1970s, and is shaken by food riots. The United States, at war in Thailand, is blamed for Canada's refusal to sell wheat to China, and Chinese troops move into Thailand as anti-American feeling increases. Escalating war leads to rationing of food and water at home for the United States; pressure to end the war quickly leads the U.S. to use tactical nuclear weapons. China strikes back from nuclear submarines along the U.S. west coast, and more than 100 million Americans die

from fallout.

Scenario II has all of Latin America under the grip of communism at the end of the 70s, a decade in which it has suffered repeated famine, as have Asia and Africa. "Food riots have often become anti-American riots, as our enemies claimed we were withholding food from the starving."²⁴ Continuing war in Southeast Asia has brought massive casualties and economic crisis. Americans and Soviets would be at war in the Mediterranean if it were not for "a particularly virulent strain of bubonic plague killing 65% of the starving Egyptian population...." India has fallen apart into "starving, warring minor states."²⁵ Food and water rationing are standard throughout the U.S., and riots are common in the cities. Ninety-thousand people have died in Los Angeles as the result of two years of killer smog. The decline in Atlantic and Pacific Ocean fishing due to pollution is found to be irreversible. Government advisors recommend compulsory restriction of births to one per couple to prevent famine in the United States by the year 2000. As 1980 begins, the Chinese and Russians establish missile bases in Latin America. America makes a pre-emptive nuclear strike; there is nuclear war. Monster fires, high radiation levels and climatic change follow. Sterilized soil and erosion make the northern two-thirds of the Earth uninhabitable. Squeezed into the Southern hemisphere,

posioned by radiation, human beings die off as crops fail, livestock perish and plagues spread. Only the cockroach survives.

The third and more "cheerful" scenario still has shortages, rationing, and population control. In the mid-1970s the United States withdraws from war and also from sending food aid abroad. It decides its food production will be increased only so much as can happen without "damage to the environment of the North American continent."²⁶ The Pope gives his blessing to birth control and abortion; cheap, long-term contraceptive drugs become widely available. But famine and food riots are sweeping Asia, the Arab world, Africa and Latin America. Governments fall in China and India, local warfare breaks out in other famished countries. The United States, Canada, the Common Market, Russia, Japan and Australia formulate "area rehabilitation" plans to be carried out, beginning in 1985, in "selected sections of Asia, Africa, and South America... The plan will eventually cover the entire world"; its goals include reduction of world population to 1.5 billion by 2100.²⁷ In this scenario, as many as half a billion people -- one-fifth of the world's population -- die from starvation. Ehrlich challenges his readers to create a more optimistic scenario than this.

Population Control

In Ehrlich's evaluation, next to nothing is being done to control population growth. The United States budgets very little money for population control at home or abroad: "The population budget of all the agencies would not buy more than a dozen sophisticated military jets. It is roughly the same amount as the government appropriation for rat control."²⁸ Meanwhile, biomedical research on cancer, circulatory diseases, and organ transplants amounts, in Ehrlich's words, to "preoccupation with death control."²⁹ "The establishment in American biology consists primarily of death-controllers..."³⁰ Successful death control without successful birth control, he repeats, must lead to disaster. The underdeveloped countries are ahead of the developed ones in recognizing the problem, but "In summary, the world population control situation is dismal."³¹

Can improvements in agricultural production help fend off the problems of growing population? Ehrlich doesn't hold out much hope. Most arable land is already under cultivation; irrigation of dry lands to the extent necessary is economically impossible. Desalinization of ocean water, 'farming the sea' for food, and food from petroleum, popular futuristic remedies, are disposed of by Ehrlich with technical and economic arguments. More promising is the

development of grains with favorable amino acid balances, and the manufacture of high protein food and beverage mixes. Getting people to alter their eating habits, however, is as difficult as getting them to change their views on family planning.

Most hopeful is the development of high yield crops which give more food per acre on land already being farmed. However, many of these require more irrigation and fertilizer than existing grains, so only a limited number of farmers in underdeveloped countries will be able to adopt their cultivation. In addition, they present ecological problems: new and simplified varieties of plants can be very susceptible to disease and insects; the increased use of pesticides and fertilizers degrades the environment. They are a risk we need to take, and we can only hope for positive results in the long run. But "we already know that it is impossible to increase food production enough to cope with continued population growth." Even positive results "can do no more than delay the day of reckoning unless population control is successful."³²

A Sick Environment

Ehrlich makes a strong, in fact an exaggerated,

evaluation of the state of the environment. His exaggeration is in keeping with the colloquial style that marks many pages of the book. "It is pretty hard," he says,

"to ignore the stench that exudes from most of our open bodies of water, or the tears streaming down our cheeks as we inhale the mixture of poisonous gases and solid particles that passes for air in many of our cities."³³

He quotes newspaper headlines and journal titles on the environment; they sound like those of today: "'Clean Air, Water Possible at a Price'; 'Pollution Called Multiple Peril'; 'Toxic Substances and Ecological Cycles'."³⁴ He reviews the problems of smog and the automobile, of pesticides, of tolerance levels for toxic substances and of synergistic combinations of effects. We need to weigh risks and benefits, he says, and the risks must be made clear. But the government agencies that are responsible for protecting us are at best inadequate, at worst on the wrong side. In particular, "the Department of Agriculture (USDA) has had a long history of pushing pesticides, displaying a high level of ecological incompentence in the process."³⁵ The Department of the Interior, under Stewart Udall in the Johnson administration attempts to clean up lakes and rivers, but laws are inadequate.

Ehrlich recalls the Mississippi fish kill of the early 60s (another subject treated by Carson). The unexpected killing of an estimated 10 to 15 million fishes between 1960

and 1963, after a highly toxic insecticide was used on the cotton and cane fields along the river, put Mississippi fisheries out of business. Like the Mississippi, the Missouri suffers from pollution, but from slaughterhouse wastes rather than from pesticides. New Jersey's Raritan River is polluted by sewage, and the clamming industry in Raritan Bay is shut down. Lake Michigan, New York's Hudson River, and Pennsylvania streams are similarly afflicted. Ehrlich says of our "sick environment": "The patient continues to get weaker."³⁶

The Cure

What needs to be done? "A general answer... is simple. We must rapidly bring the world population under control, reducing the growth rate to zero or making it go negative."³⁷ Ehrlich envisions an international program "to set optimum population-environment goals for the world and to devise methods for reaching these goals."³⁸ The United States, as the most influential superpower and the richest nation in the world, must take the lead. It "cannot remain affluent and isolated." It is part of a global economy, and has an "inflated position," using over half of the world's raw materials every year, although it has less

than 1/15th of the world's population. Its proportion of world population will go down as population grows, but its share of raw materials is likely to increase. "Will other countries," Ehrlich asks, "many of them in the grip of starvation and anarchy, still happily supply these materials to a nation that cannot give them food?"³⁹

As well as being part of a global economy, we are part of a global ecology. Every attempt to increase food production, as population grows, will have an attendant environmental cost, and/or an economic one. And there could be other costs that we should think about. We have to see the reality of the threat, Ehrlich insists, and he provides a homely example: "Will we be willing to slaughter our dogs and cats in order to divert pet food protein to the starving masses in Asia?" To avoid coming to such choices, "Obviously our first step must be to immediately establish and advertise drastic policies designed to bring our own population size under control."⁴⁰ This will provide us with the kind of future we want, and set an example for others.

What kind of measures would reduce population? Ehrlich offers some suggestions. Reverse tax policy, and tax children rather than granting exemptions for them. "Parents... who had ten children would pay for their reproductive irresponsibility" Impose luxury taxes on

cribs, diapers, and expensive toys, "always with the proviso that the essentials be available without penalty to the poor (just as free food now is)."⁴¹ Give "Responsibility prizes" to couples for each five years of childless marriage, or to each man who accepts irreversible sterilization after fathering no more than two children. Have lotteries which only the childless can win. Subsidize adoption and make it simple.

Once on the right track at home, the United States must take international action. Ehrlich recommends the 'triage' system of classifying other nations.⁴² Some nations will make the transition to self-sufficiency without drastic aid from us (e.g., Libya); others may become self-sufficient with our help (Pakistan); finally, the "tragic category -- those countries that are so far behind in the population-food game that there is no hope that our food aid will see them through to self-sufficiency" (probably India).⁴³ Using such a system of classification, the United States can proceed to lead the way in the "area rehabilitation" Ehrlich mentioned earlier: "simultaneous population control, agricultural development, and where resources warrant it, industrialization of selected countries...."⁴⁴ "Needless to say," Ehrlich acknowledges, "the sociopolitical problems of initiating such a program would be colossal."⁴⁵ There are no sugarcoated solutions, he says; "the time for them is

long gone. A cancer is an uncontrolled multiplication of cells; the population explosion is an uncontrolled multiplication of people."⁴⁶ Surgery is necessary.

What optimum population is, is yet to be decided, but it should allow, Ehrlich feels, both the choice to be crowded and the choice to be alone, and be within the limits set by nature. Natural limits are not known, any more than social ones are, but Ehrlich estimates that a population of one to two billion people could be "sustained in reasonable comfort for perhaps 1,000 years."⁴⁷ (This number is, of course, less than the approximately 3.5 population existing at the time that Ehrlich wrote his book.) If we stabilize at four or five billion, we still have a chance, but our lives will be less pleasant.

* * *

Ehrlich's main argument is that population growth threatens human survival. He presents the logic of numbers as inescapable. He traces social and environmental problems, not to social causes, but to a biological one -- the urge to reproduce. His argument is monocausal rather than multicausal. The types of social policies he favors are top-down government regulation, extending to an

international scale, but he does also recommend that everyone lobby both friends and officials for control of population, beginning at home. His recommendations favor industrialized nations with a large middle class that can carry out and benefit from birth control; the triage approach to aid eliminates the world's poorest people from even being considered to receive help.

Ehrlich criticizes existing government policies, keep-quiet scientists, voluble politicians, 'family planning', Catholic dogma, "reproductive irresponsibility", attitudes of the developed world toward the need for population control and toward use of resources. He emphasizes sheer numbers, likely disasters, current dismal situations, deteriorated environment, and the social problems of crowding. He favors hard-line government population policies, birth control, availability of abortion, sex education, worldwide effort on population control, support for population control from biologists, and the environmental evaluation of economic actions. He predicts famines, riots, wars, disease. He recommends as necessary a neoimperialism under the name of "area rehabilitation." Ehrlich's desired world is one in which situations are evaluated realistically rather than ideologically. It is a world in which individuals may choose their living space, and can, when they want, get away from it all to a world of

nature which is still intact.

Science Trust and Science Skepticism

Ehrlich and Commoner had an ongoing and sometimes acerbic debate during the 60s and part of the 70s, particularly after Commoner formulated his argument in The Closing Circle that it is not population pressure but our choice of productive technologies that is the source of our environmental problems. They differ also on the politics of solutions. Ehrlich supposes solutions through top-down regulation by government agencies; Commoner supposes solutions through citizen-scientist cooperation. Ehrlich takes his regulatory view even though he finds existing government action entirely inadequate because it is uninformed and misdirected. Like Commoner, though, he believes that scientists should speak out. Unlike Commoner, he seems to think that scientific expertise is necessary for solving social problems. Ehrlich is critical of scientists for their aloof stance, and does not (unlike Commoner) hesitate to mix his scientific opinions with his social policy ones.

Ehrlich's analysis of how science is directed in society cannot bear much weight; he simply does not theorize

much in The Population Bomb about science. Ehrlich offers no critique of the scientific enterprise as a whole, nor does he suggest that it needs to be defended. He does not analyze why we have a technology that gives us environmental problems, though he does cite Lynn White, who traced an attitude of subduing Nature to doctrines of the Christian church. His argument needs no such explanation, because the root of our environmental problems, in his analysis, is too many people. In my terms, Ehrlich is a science truster, not a science skeptic; Commoner is a science skeptic.

Ehrlich's is a warning voice. He startled the public, and made the previously dry topic of population growth a topic of immediate interest and everyday conversation. The condition of society and the condition of nature are inseparably linked through the pressure of human numbers.

Ehrlich is not a theorist in this book;⁴⁸ he is, or presents himself as, a pragmatist, as a man of action much more than as a scientist. Bomb is a polemic. Its overall theme is the inevitability of disaster if the current course is followed. Ehrlich, as an ecologist, knows that "human beings are embedded in and supported by natural ecosystems," and he knows that human beings can destroy these systems and thus themselves.⁴⁹ Out of concern, he speaks out. As a population biologist, he uses his specialty to make a very focused argument, meant to have political impact.⁵⁰

Ehrlich gives his readers dramatized doom. His scenarios for the future seem in retrospect to be extremist fantasies, but they were matched by other cold-war scenarios at the time.⁵¹ And he made the public aware that the balance of food and population could easily be upset by natural disaster or social disturbance. He uses simple statistics to show the inexorable logic of numbers (recalling Malthus), and buttresses his argument with scientific legitimation: it is evolution that has fixed in us the urge to breed. His argument is reductionist -- overpopulation is the root of all the most pressing social and environmental problems, and there are only two solutions: birth control or death control. Ehrlich recognizes and describes complex interactions in the natural world, but not in the social world. He often uses a colloquial style to get his point across quickly and directly. Like Carson, he is dramatic in his presentation of material.

Science and Survival and The Population Bomb share some characteristics that could be called (using Mannheim's term) "authentic manifestations" of the environmental style of thought: a reliance on quantification and facts, speaking out as a moral response, giving warning (predicting). These derive from the occupational experience of science and from its ethos. Both Commoner and Ehrlich express the

ecologist's feel for system complexity and interrelationships in the natural world, but Ehrlich does not extend this understanding to the social world.

Epistemologically, in relation to the key problem of holism vs reductionism, Commoner exemplifies an anti-reductionist stance: wholes replace parts as elements of analysis, and causes are cyclical and multiple rather than single and linear. Ehrlich is holistic about ecosystems but reductionist in his perception of and solutions to social problems.

The Ability to Speak

Commoner and Ehrlich, as university-situated scientists, in what is not yet in the 1960s and 70s a 'big ticket' scientific discipline (biology) heavily subsidized by federal funding, are relatively independent scientists who can speak out. Carson, as a trained but non-practicing scientist, was in a similar position. A comment on this type of position was made by Alice Stewart, a British epidemiologist who found statistical evidence (in the 1970s) that radiation was killing workers at the Hanford nuclear plant in Washington state. As reported on years later

[Dr. Stewart's published finding] drew immediate and vitriolic criticism from other scientists,

many of them under contract to the weapons industry... Even before the Hanford finding was published, the Government cut off funds for the study, prompting a Congressional committee to investigate allegations of a scientific cover-up...

At hearings in 1988 and 1989, [Dr. Stewart] told Senate and House committees that the Energy Department's program for assessing radiation hazards at nuclear weapons plants was badly flawed, hindering the free exchange of scientific ideas...

'If I was a coward and afraid of my job,' [she said], 'I wouldn't say a thing. But I am retired. I have no department that anybody's dependent on for work. I speak out because I think there are not a lot of people in such a good position. I have nothing to lose. A lot of people do. This area of research can be shut down. I've watched it happen.'"⁵²

The most widely read environmental books of the 60s and 70s were science-based, and the authors were scientists who by virtue of structural position or reputation were able to speak out. In this freedom, they are something like Mannheim's free-floating intellectuals, but unlike them, they do have their own goals, their own desired world.

NOTES TO CHAPTER TEN

1. Paul R. Ehrlich, The Population Bomb (New York: Ballantine Books, 1968).
(All page references that follow are to this book, except as noted.)
2. Tony Kaye, "The Birth Dearth," The New Republic, January 19, 1987, p.20.
3. John Tierney, "Betting on the Planet," The New York Times, 12/2/90, VI, p.52.
4. Bomb, p.15.
5. p.16.
6. p.17.
7. p.21.
8. pp.24-25. Other causes of these problems -- government policy, market activity -- are not mentioned. Most of the "headaches" of the 1960s are still with us in the 1990s, but riots were a phenomenon of the 60s that has not carried over, although the Los Angeles riot over the Rodney King verdict in 1992 indicates that they could happen again. The 60s riots occurred in the context of activism on civil rights and on the Vietnam war; attributing them to population growth relies on assumptions that Ehrlich does not spell out. Ehrlich's explanation of population growth is simple and clear, while his sociological analysis is simplistic.
9. But Ehrlich does not go into the circumstances that affect human birth and death rates, other than 'breeding' activity and war, famine and disease; he doesn't really explain human population dynamics, which are affected by economic and cultural factors.
10. p.28.
11. p.31.
12. p.33.

13. p.34.
14. pp.37-38.
15. p.42.
16. Ibid.
17. p.46.
18. p.49.
19. p.55.
20. pp.61-62.
21. p.65.
22. p.67.
23. If he had included related civilian deaths, which add 20 million to the 15 million battle deaths, then one in 100 of the world's people (then 3.5 billion) died as a result of World War II -- 1%, compared to the approximately 14% he envisions dying as a result of a virus.
24. p.74.
25. p.75.
26. p.78.
27. p.79.
28. p.89.
29. Ibid.
30. p.92.
31. p.94.
32. p.108.
33. p.110.
34. p.111.
35. p.115.

36. p.130.

37. The movement for Zero Population Growth, in which Ehrlich was actively involved, followed on his book.

38. p.131. This unconscious imperialism of America's heyday has been brought to an end by the Rio Conference (The United Nations Conference on Environment and Development, 1992), at which third world countries have strongly resisted the American stance, which world opinion generally judges to be environmentally backward. Population, however, was not a major official topic at the conference; it was to be discussed separately later. The political problems of population control in an international context were too great to be negotiated into the conference.

39. p.133.

40. p.134.

41. p.137. Again, Ehrlich's population computations are better than his grasp of social policy.

42. Suggested, Ehrlich says, by William and Paul Paddock in their book, Famine -- 1975! (Boston: Little, Brown, 1967).

43. p.160.

44. p.162.

45. p.164.

46. p.166.

47. p.172.

48. Mannheim, in analyzing conservative thought, dealt with theorists, even if polemical ones. Analyzing work that eschews theory, like Ehrlich's popular book, extends Mannheim's method to where it is in some ways ill-suited to go. More is said about this in chapter sixteen.

49. Paul Ehrlich, The Machinery of Nature (Simon & Schuster, 1986), p.5.

50. In a New York Times Sunday magazine article, John Tierney says he rushed to finish the book in time for the 1968 presidential election (John Tierney, "Betting on the Planet," The New York Times, 12/2/90, p.76). In the book, Ehrlich recommends a Department of Population and

Environment, which would establish policies for reducing population growth at home and abroad. Among other things, he recommends sex-determination enabling first-born children to be male, the right of physician-approved abortion, a challenge to Catholic doctrine on birth control and abortion, sex education, the taxing of children, and awards to the childless.

51. By comparison, Carson's fears for the future have found confirmation in the effect of pesticides on subtle and long term aspects of human health.

52. Keith Schneider, "Scientist Who Managed to 'Shock the World' on Atomic Workers' Health," The New York Times, 5/3/90, p.A20.

More information is coming out about Hanford (1990), an early atomic weapons plant from which material came for the Nagasaki bomb. An article by historian Michele Stenehjem ("Indecent Exposure," Natural History, September, 1990, pp.6-22) summarizes how the combined industry (General Electric) and government management of the Hanford plant withheld important scientific data on radioactive wastes from public view. The article lead reads: "For forty years scientists knew that radionuclides from reactors along the Columbia River accumulated in body tissue. They decided to keep it to themselves." (p.6) Other, airborne, wastes were taken in by plants, ingested by cows, concentrated in their milk, and passed on to children in the farming area around the plant, who thus became a high-exposure group.

Science magazine reports that the U.S. "Department of Energy confessed that leaks from its plant in Hanford, Washington, may have seriously affected U.S. citizens." Sources were airborne leaks from fuel tanks in the 1940s, and radionuclides in the river, contained in drinking water from the river and concentrated in its fish. The "reconstructed estimates" of radiation doses haven't been correlated with sickness rates, but Centers for Disease Control and DOE studies will be made. (August, 1990, p.474).

A preliminary study of Hanford radiation, released in 1992, affirms that in the 1950s and 60s, the plant dumped radioactive water, used to cool the reactors, into the Columbia River. "The radiation reached the Pacific Ocean 200 miles away, contaminating fish and drinking water along the river and exposing as many as 2,000 people to potentially dangerous doses." ("Radiation Flowed 200 Miles to Sea, Study Finds," (AP), The New York Times, 7/17/92, p.A21.

CHAPTER ELEVEN

HOBBSIAN, ANARCHIST, AND HISTORICAL ARGUMENTS

Of the many books and articles written on environmental problems in the 60s and 70s, three works which were not best-selling books, but which were influential in the environmental debate, stand out. They are discussed in this chapter.

The Tragedy of the Commons

Originally published in Science magazine in December, 1968, Garrett Hardin's "The Tragedy of the Commons" has been much cited and reprinted since.¹ Hardin, a biologist, takes population to be the key factor in a finite world, and provides a rational-choice type of analysis of the interaction of people and resources.

The article opens with the question of whether there is a class of problems with no technical solutions, affirms that there is, and puts the population problem in this class. Technological solutions to overpopulation, like

farming the seas, developing new strains of wheat, or escaping into space, will not really solve the problem, Hardin asserts. In 1968, it is still necessary for Hardin to ask if ours is a finite world; this is not yet a given in the discussion of global problems. It is finite, Hardin says, and "A finite world can support only a finite population; therefore population growth must eventually equal zero."² But even then, our difficulties do not end, and the 'greatest good for the greatest number' still cannot be realized.

Hardin cites von Neumann and Morgenstern's game theory to explain that the first reason we can't have the greatest good for the greatest number is that it is mathematically impossible to maximize for two or more variables at the same time. Then,

"The second reason springs directly from biological facts. To live, any organism must have a source of energy (for example, food). This energy is utilized for two purposes: mere maintenance and work... Work calories are used not only for what we call work in common speech; they are also used required for all forms of enjoyment, from swimming and automobile racing to playing music and writing poetry. If our goal is to maximize population it is obvious what we must do: We must make the work calories approach as close to zero as possible. No gourmet meals, no vacations, no sports, no music, no literature, no art."³

Avoiding such sacrifices means that the optimum population is less than the maximum population. If the maximum good per person is wanted for an optimum population, there must

be a way to weigh the value of goods, despite different values -- for example, some want land to be used for factories, some want land to be kept as wilderness. Differences in values, however, according to Hardin, are only a theoretical problem; "in real life incommensurables are commensurable," as when in Nature, natural selection makes survival the criterion for having one thing rather than another.⁴ "Man must imitate this process,"⁵ and to do so, we must stop believing in Adam Smith's idea of an invisible hand that leads individuals pursuing their own interest to contribute to the common good.

Following this introduction, Hardin goes on to the "Tragedy of Freedom in a Commons."

"Picture a pasture open to all. It is to be expected that each herdsman will try to keep as many cattle as possible on the commons."

At first this presents no problem, for

"tribal wars, poaching, and disease keep the numbers of both man and beast well below the carrying capacity of the land. Finally, however, comes the day of reckoning, that is, the day when the long-desired goal of social stability becomes a reality. At this point, the inherent logic of the commons remorselessly generates tragedy."⁶

Each herdsman still, "as a rational being... seeks to maximize his gain." Hardin calculates two results, or utilities, of adding one more animal to the land. One is the proceeds of the sale of the additional animal, almost all of which goes to the herdsman, so the positive utility

for him is almost +1. The other is the overgrazing created by one more animal; however, the effects of this are spread among all herdsman, so the negative utility for the example herdsman is only a fraction of -1.

"Adding together the component partial utilities, the rational herdsman concludes that the only sensible course for him to pursue is to add another animal to his herd. And another; and another... But this is the conclusion reached by each and every rational herdsman sharing a commons. Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit -- in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons. Freedom in a commons brings ruin to all."⁷

Hardin says that although we learned this thousands of years ago, "natural selection favors the forces of psychological denial," which benefits the individual even though the society of which he is a part suffers. National parks provide another example of the tragedy of the commons, Hardin observes, being (at that time) open to all without limit. As a result, "the values that visitors seek in the park are steadily eroded." (National parks are still open to all to visit on a day basis, but campsites and trailer sites for overnight and longer stays are limited, and quotas are imposed on trips into wilderness areas of the larger parks.)⁸ Pollution is another example, but rather than something being taken out of the commons, something noxious is added in. "The pollution problem is a consequence of

population," Hardin states, for in earlier times "how a lonely American frontiersman disposed of his waste" did not matter.⁹

This leads Hardin on to a section titled "Freedom to Breed is Intolerable." "If each human family were dependent only on its own resources," Hardin speculates, then overbreeders would leave fewer descendants, not more, because some of the children would starve. But because we are committed to the welfare state, we face another tragedy of the commons. "To couple the concept of the freedom to breed with the belief that everyone born has an equal right to the commons is to lock the world into a tragic course of action."¹⁰ Appeals to conscience won't work to control population growth, because "Those who have more children will produce a larger fraction of the next generation than those with more susceptible consciences. The difference will be accentuated, generation by generation." This assumes hereditary transmittal of conscience, Hardin allows, but "only in the most general formal sense," not necessarily through germ cells -- it could happen "exosomatically," he says, borrowing a term from A.J. Lotka, a mathematical biologist. Conscience is thus "self-eliminating." Hardin speculates a little on the "pathogenic effects of conscience," brought on, he believes, by a double bind of being damned if one does the wrong thing, but also damned as

a simpleton who can be exploited if one doesn't." So conscience is really of no use. Definite social arrangements are more useful.

Thus we must mutually agree to coercion, that is, to laws against certain actions and penalties for transgressions of the law. "An alternative to the commons need not be perfectly just to be preferable," Hardin states. For example, we have such an alternative in private property, which "as a genetically trained biologist," Hardin says,

"I deny [is just]. It seems to me that, if there are to be differences in individual inheritance, legal possession should be perfectly correlated with biological inheritance -- that those who are biologically more fit to be the custodians of property and power should legally inherit more... We must admit that our legal system of private property plus legal inheritance is unjust -- but we put up with it because we are not convinced, at the moment, that anyone has invented a better system. The alternative of the commons is too horrifying to contemplate."¹²

"The commons," Hardin says, "if it is justifiable at all, is justifiable only under conditions of low-population density." He gives a brief historical sketch of how the commons has had to be abandoned as population has grown: first we enclosed land for farming, pastures and hunting, and 'enclosed' the sea for fishing -- abandoning the commons in food gathering. We have begun to abandon the commons as a place for waste disposal. "In a still more embryonic state is our recognition of the evils of the common in

matters of pleasure" -- e.g., blaring radios and mindless piped music in public areas, billboards, commercials, the planned supersonic transport.¹³ Enclosing the commons infringes on personal liberties,

"But what does freedom mean? When men mutually agreed to pass laws against robbing, mankind became more free, not less so. Individuals locked into the logic of the commons are free only to bring on universal ruin; once they see the necessity of mutual coercion, they become free to pursue other goals."¹⁴

Freedom is the recognition of necessity, and what is necessary now is to abandon the commons in breeding, for "Freedom to breed will bring ruin to all."¹⁵

The Theme of Rational Calculation

Hardin, in this essay, is the technician whose technical analysis shows him there is no technical solution; technique is up against the limits of a finite world. In the environmental problem as he presents it, population is the key to the solution, but because population is an outcome of human behavior, it cannot be managed by technology in the way that the environment (in Hardin's view) can be. The population/environment problem is a quantity/quality problem -- the quantity of people vs the quality of life.

On the issue of individual choice vs common survival, morality, Hardin believes, is "system-sensitive"; ethics are situational. (At this point, the text of Hardin's argument has gone from seemingly objective analysis of mathematical certainties to criticism of morality; the population issue has moved to the background.) As an alternative, he proposes biological fitness as a basis for the ethics of ownership.

Hardin's argument relies on the application of a scientific outlook to questions about population growth, to which he takes a mathematical (and Malthusian) approach, but which he does not explicitly characterize as either biological or social. The issue is taken to be one solely of numbers, of the distribution of goods across numbers of people, with an assumption that any kind of good can be quantified. The essay has the tone of inescapable facts and unarguable mathematical calculations. The difficult issue of competing human values is dealt with by making a direct analogy to the operation of a single criterion -- survival - - as the determining force in natural selection. A scientific theory -- evolution -- is thus applied to the social world as if the social world were not different in any relevant respect from the natural world. A rational analysis that calculates costs and benefits -- a scientific weighing of alternatives -- is the way to determine the solution to our environmental and social problems; science

shows the way to society.

Hardin's central image, that of the commons, is constructed more for the purposes of his argument than in the light of history. His commons is an unenclosed space to which individuals apparently have unlimited access, from which they can derive benefit without paying out obligations. Overuse of the space grants short-term benefit to the first overusers; late comers get no benefit at all, because the commons has been depleted. Overuse is bound to happen, because it has positive utility for the rational calculator (so called). This dynamic, Hardin claims, has caused us to progressively abandon the commons throughout history, to fence in land, make rules about the sea, legislate protection of the environment.

Another View of the Commons

Hardin's understanding of the commons, I think, is backwards. His misappropriation of this term, and misrepresentation of the concept behind it, disregards a tradition of intelligent land use. The commons, historically, is not governed by rational choice -- individual calculators do not hold sway. The commons was never a free-for-all space like the mythical American

frontier, and its use was regulated precisely because its limits were understood. It was not unowned land, nor land owned jointly by its users, but was land with one owner, a person or a corporation -- an English landlord or an American town. There were a variety of legal and customary rights giving access to the commons. The commons are used in common, within commonly understood limits; they are not an anarchic space. In medieval Britain, the peasants who had tenancy rights administered the commons through a council. The number of animals that could graze was jointly decided upon.¹⁶ Where open land (not necessarily a commons) has been subjected to the type of overuse that Hardin describes, it is not because common people have been rational calculators bent on ever-increasing gains, but because the unequal distribution of wealth has made no other resource available to them. For them, it has been use or starve, not use and gain. In more modern examples -- strip mining, deforestation, overfishing -- it is not common use, but individual use by the modern individual, the corporation, that has caused depletion. The mismanagement of resources is not a tragedy of the commons, it is a policy of individualistic profit-seeking.

Hardin is closer to the mark on the overuse of parks, the particularly American version of the commons, yet here

again it is not rational calculation for profit that is at work for the individual user, for the users have no direct control of use the way herdsmen have control of -- or rights and obligations regarding -- commons use. The inexorability of every person's calculated use of common space for gain, a central idea of Hardin's, does not evenly apply to public open spaces historically or contemporaneously, and lacks any reference to economic structure. But the idea that the environment as a whole is a commons -- the air, the water, the soil, and their interactions -- is a powerful one, for in fact we are all affected by the uses made of the environment by others. The problem, though, is not that we must abandon the environment as a commons; instead, we must in fact treat it like one. Subjecting the use of space to regulation is not the abandonment of the commons -- it is the making of the commons.¹⁷

Hardin's use of the terms "positive utility" and "negative utility" scientizes the discussion, as does his appeal to the word "exosomatic" for his claim that conscience can be, in the most general way, hereditary. His equation of the commons with the welfare state politicizes it; in Hardin's world, social interdependency did not appear until the welfare state did. He then scientizes his politics: The current system of property ownership is unjust, not on a social or economic basis, but on a

biological one -- those biologically "more fit" to own property do not inherit more than those less fit. Yet private property ownership is preferable to the alternative of the commons (read socialism), which is too horrifying to contemplate. Freedom is the rule of law, and law, in another of Hardin's historically inaccurate constructions, is "mutual coercion." Hardin's argument is Hobbes with genetics -- not only are his hypothetical social actors driven only by self interest, they are biologically unworthy.

Post-Scarcity Anarchism

Around the same time that Commoner was writing Science and Survival, and Ehrlich was writing The Population Bomb, Murray Bookchin was writing Post-Scarcity Anarchism, a group of essays dating from 1965 to 1968.¹⁸ An earlier book, Our Synthetic Environment, appeared in 1963.¹⁹ Bookchin's work is deeply searching; it takes on theoretical questions that are absent in Commoner and Ehrlich. Bookchin's left analysis has kept him from being a widely published author, and he has never achieved the popular fame of Ehrlich in the late 60s or the widespread recognition of Commoner since the 70s. Additionally, he is not a scientist, so his work is

not in the category which is being most closely analyzed here. However, because Bookchin addresses central issues in the environmental debate (and has often been the first to do so), and because he has responded to arguments made by other environmental thinkers, it is valuable to take a brief look at his work.

The starting point for Post-Scarcity Anarchism is that the world is changing profoundly; instead of developing around scarcity, society is on the threshold of post-scarcity -- a condition that offers not just material abundance but social and cultural abundance. Bookchin observes an increasing tension "between actuality and potentiality," evidenced by black, women's, youth, children's, and gay liberation movements. Liberals, he notes, call this tension "rising expectations." Bookchin connects this social agitation with ecology: "The tension between actuality and potentiality, between present and future, acquires apocalyptic proportions in the ecological crisis of our time." He argues that the environmental crisis can't be saved "within the bourgeois framework"; "Capitalism is inherently anti-ecological"²⁰ because it is production for the sake of production.

We are schizoid about technology, Bookchin says, because it could liberate us in a society organized around the satisfaction of human needs, but destroy us in a society

organized around production for the sake of production. It's not technology itself that has this dualistic character, but hierarchical society, with its negative and positive features. Marx may have been right that hierarchical society was historically necessary to dominate nature, Bookchin allows, but "we should never forget that the concept of 'dominating' nature emerged from the domination of man by man. Both men and nature have always been the common victims of hierarchical society."²¹ This is a key idea of Bookchin's -- that human beings dominate Nature because they already dominate each other; it is not that they must come to dominate each other in order to dominate nature as argued by Marx and Engels.

"The notion that man must dominate nature emerges directly from the domination of man by man." ...
 "The patriarchal family planted the seed of domination in the nuclear relations of humanity"²²

We are at the end of hierarchical society's development, Bookchin says, and its positive and negative aspects can no longer be reconciled. Its historically necessary functions are over -- property, classes, monogamy, patriarchy, hierarchy and authority, bureaucracy and the state.²³ Its domination of man by man has brought us competitive capitalism's inequality of wealth and the domination of nature. The time has come for us to build a communitarian and ecologically balanced society.

Environmental problems are not new, but "the very nature of the issues has changed... [for] the decay of the environment is directly tied to the decay of the existing social structure"; the ecological crisis is a social crisis -- thus the need for revolutionary change.²⁴

The environmental problem is rooted neither in technology nor in population growth.²⁵ Technology can improve or degrade human life -- the attitudes associated with it are what's important. On population control,

"It is supremely ironic that coercion, so clearly implicit in the neo-Malthusian outlook, has acquired a respected place in the public debate on ecology -- for the roots of the ecological crisis lie precisely in the coercive basis of modern society."²⁶

Social Ecology

The coming revolution and its utopia "can leave no area of life untouched that has been contaminated by domination." This utopia can be described as "anarchism" or "anarcho-communism" -- a "stateless, classless, decentralized society in which the splits created by propertied society are transcended by new, unalienated human relationships."²⁷ In anarchist praxis (compared to socialist) "all action... is based on voluntarism and self-discipline, not on coercion and command."²⁸ And it emphasizes spontaneity -- praxis as

inner process, not external manipulation. "Every development must be free to find its own equilibrium." With spontaneity comes "authentic order and stability." Then "spontaneity in social life converges with spontaneity in nature to provide the basis for an ecological society." "Natural ecology [which shaped organic societies] becomes social ecology [which shapes utopia]."²⁹ "Social ecology" is the concept for which Bookchin has become best known, the idea that attracts his young followers among the Greens.

Bookchin further argues: "The very development of the material preconditions for freedom makes the achievement of freedom a social necessity."³⁰ When we reach the point where scarcity can be eliminated, we find that a post-scarcity society is necessary for our survival.

In a chapter on "Ecology and Revolutionary Thought," Bookchin asserts that "Ecology is intrinsically a critical science."³¹ Air pollution, heat pollution (now called global warming), pollution of the earth's waterways and groundwaters, are now on a different scale from historical examples, which were local in extent. Modern society has logistical problems of urbanized and centralized form, but these problems go even deeper than problems of the physical structure of mass society. Their roots are in the presumption that hierarchy is a necessity, and in the dynamics of capitalism. "Owing to its inherently competi-

tive nature, bourgeois society not only pits humans against each other but also pits the mass of humanity against the natural world."³² We see how we have set ourselves against the natural world in problems of wastefulness (the consumer society) and waste disposal. Bookchin's alertness to these linked consumption and disposal issues was unusual in the 60s -- this analysis would not become mainstream for another twenty years.

Bookchin argues against great urban centers because they destroy quality of life, and against the simplification and chemicalization of modern agriculture because of it is ecologically destructive. He takes the physical form of society today be a "reversal of organic evolution," a reversal that is the result of contradictions between town and country, state and community, industry and husbandry, between the bureaucratic scale and the human scale.³³ The ancient Greeks, he says, would have been horrified by a city whose size would have precluded a face-to-face relationship between citizens. He believes that telephones, telegraphs, radios, TVs should be used as little as possible to mediate relations between people. Bookchin sees an "intuitive anarchism" among young people who react against the synthetic quality of urban life with a love of nature, against standardization with informal dress and manners, against centralization with a predisposition for direct

action. In their tendency to drop out to avoid the rat race, he finds a de facto decentralization of social life.

Bookchin notes that it is a principle of ecology that stability is a function of diversity. Diversity was lost when the industrial revolution overwhelmed and destroyed regional energy patterns, which used different resources, such as wind and water power, and a variety of fuels -- wood, peat, coal, animal fats. The industrial revolution replaced these fuels first by coal and then by coal and petroleum. "Regions disappeared as models of integrated energy patterns."³⁴ If we are going to make ecological use of energy resources, he argues, we're going to have to decentralize and have truly regional social organization.

The diversity that is a part of natural ecology suggests for Bookchin the "free interplay" of elements, which in a social situation, means diverse possibilities for the individual to develop his potential.

"Just as the ecologist seeks to expand the range of an ecosystem and promote a free interplay between species, so the anarchist seeks to expand the range of social experience and remove all fetters to its development."³⁵

In our schizoid society, Bookchin observes, some goals seem mutually exclusive, such as urban and agrarian life, physical and mental activity, sensuality and spirituality, communal solidarity and individual development. However, it is our social logistics that divide these things, not

inexorable contradictions.

In the ecological community to come,

"the cast of mind that today organizes differences among humans and other life-forms along hierarchical lines, defining the external in terms of its 'superiority' or 'inferiority', will give way to an outlook that deals with diversity in an ecological manner. Differences among people will be respected, indeed fostered..."

"Freed from an oppressive routine, from paralyzing repressions and insecurities, from the burdens of toil and false needs, from the trammels of authority and irrational compulsion, individuals will finally, for the first time in history, be in a position to realize their potentialities as members of the human community and the natural world."³⁶

Technology, Biology, Society

Bookchin's utopianism is coupled with a well-informed analysis of the causes of environmental crisis. His thought is directed toward social justice and harmony with the natural world as the certain outcome of human spontaneity and human-scale living and working. He has a harsh critique of modern society and economy.

By comparison, Commoner criticizes the choice we have made of technologies, but does not critique (in Science and Survival) the fundamental goal of our capitalist economy -- endless growth and profit. He offers a solution suiting the prevailing circumstances. Ehrlich ignores social and

economic structure almost entirely -- he sees our environmental problems as the outcome of a basic biological activity, reproduction. Bookchin does not rely on quantitative data and appeals to scientific fact, as do the Commoner and Ehrlich, but he does share with them a holistic view about inter-relationships -- in his case, in society rather than in the natural world.

Commoner's argument is about technological choices, Ehrlich's is about biological behavior, Bookchin's is about social structure. Bookchin defines the root of the environmental crisis differently from those, like Commoner or Ehrlich, who single out particular aspects of economic or social activity as the ones that get us most into trouble. These aspects, for him, are just surface phenomena of the underlying social structure, whose dominative basis, unless changed, will continue to produce environmental and social problems even if (or especially if) controls of various kinds are placed on particular activities.

Bookchin criticizes the liberalism which hides the structure and dynamics of hierarchical and ecologically destructive bourgeois society. He allies his argument with Marx on the dialectic of change through development by opposition, and in his critique of propertied society, but does not agree with Marx that the domination of man by man is fundamentally necessary for the productive use of nature

(although he allows it a historical role). His desired world is (as expressed in later writings) that of "libertarian municipalism" -- a return to face-to-face citizenship, but with the recognition that there is a new possibility of abundance through technology that can make the natural world flourish.

The Historical Roots of our Ecologic Crisis

Another non-scientist, Lynn White, Jr., then Professor of History at UCLA, writing in 1967, finds a different reason for environmental problems. In his much cited essay, "The Historical Roots of Our Ecologic Crisis,"³⁷ he traces the ecological crisis to the Christian view that Nature was made to serve man.³⁸ This view, White claims, provided ground for a Nature-dominating technology in medieval Europe even before the scientific revolution, at a time when the Christian religion shaped thought. Because the environmental crisis is rooted in a religious worldview, it cannot be solved simply by the application of more science and technology. Instead, a religious change, or a rethinking of values is needed.

"People have often been a dynamic element in their own environment," White observes. He is commenting on Aldous

Huxley's description of the loss of grassy English glades to unsightly brush because the rabbits that kept them clear have been killed by a disease purposefully introduced by the local farmers. The grassy glades themselves are a human-influenced artifact, however, White notes, since rabbits were introduced in the 12th century to improve the diet of the peasants. The Romans and the Crusaders denuded Mediterranean hills of forests; the Egyptians tamed the Nile; the Frisians and Hollanders pushed back the North Sea.

"...but in the present state of historical scholarship we usually do not know exactly when, where, or with what effects man-induced changes came."³⁹

We have an "ecologic crisis" and many calls to action, but we don't know what to do.

"Specific proposals... seem too partial, palliative, negative: ban the bomb, tear down the billboards, give the Hindus contraceptives and tell them to eat their sacred cows... The 'wilderness area' mentality invariably advocates deep-freezing an ecology... as it was before the first Kleenex was dropped... But neither atavism nor prettification will cope with the ecologic crisis of our time."⁴⁰

To begin with, White suggests, we should take a historical look at "the presuppositions that underlie modern technology and science." The fusion of science, previously aristocratic and speculative, with technology, lower class and action-oriented (in White's summation), is related, he says, to "democratic revolutions which, by reducing social barriers, tended to assert a functional unity of brain and

hand."⁴¹ What is historically noticeable are two things: the certainty that "Both modern technology and modern science are distinctively occidental," despite borrowings from China and the Islamic world; and the less-recognized fact that

"the leadership of the West, both in technology and in science, is far older than the so-called scientific revolution of the seventeenth century or the so-called industrial revolution of the eighteenth century."⁴²

Water power was applied to "industrial processes other than milling grain" as early as A.D. 1000; wind power was harnessed in the late 12th century; the weight-driven mechanical clock, "the most monumental achievement in the history of automation," was a 14th-century development. Alongside this technological progress there was an intellectual movement:

"The distinctive Western tradition of science, in fact, began in the late eleventh century, with a massive movement of translation of Arabic and Greek scientific works into Latin. A few notable books... escaped [notice]... but within less than 200 years effectively the entire corpus of Greek and Muslim science was available in Latin, and was being eagerly read and criticized in the new European universities.... By the late thirteenth century Europe had seized global scientific leadership from the faltering hands of Islam."⁴³

Since it was the Middle Ages that saw this development, it is the Middle Ages we must examine for assumptions underlying science and technology.

Both technological developments and religious thought

supported the exploitation of nature in the Middle Ages. The 7th-century invention of a plow that cut and turned over the soil, rather than just scratching it, made possible much more efficient and extensive cultivation and meant that "Man's relation to the soil was profoundly changed. Formerly man had been part of nature; now he was the exploiter of nature."⁴⁴

Judeo-Christian teleology gave the West an "implicit faith in perpetual progress" that still dominates our daily actions (or at least seemed to do so in the late 1960s when this essay was written). Christianity, White asserts, is the world's most anthropocentric religion, especially in its Western (as compared to Eastern/Greek) form. Man is not just part of nature, but is made in God's image, and so shares in God's transcendence of nature. Besides having "established a dualism of man and nature," Christianity "insisted that it is God's will that man exploit nature for his proper ends."⁴⁵

Nature, having been made by God, could reveal His purpose, and White notes that the study of this purpose in the discipline of "natural theology" turned away from the symbolic -- "the ant is a sermon to sluggards" -- to the empirical investigation of how the natural world operates, by the 13th century. Yet the connection to divining God's purpose was sustained into the 18th century, and though one

can wonder whether such claims are "real reasons or merely culturally acceptable" ones, White says, still

"The consistency with which scientists during the long formative centuries of Western science said that the task and the reward of the scientist was 'to think God's thoughts after him' leads one to believe that this was their real motivation. If so, then modern Western science was cast in a matrix of Christian theology."

And further, since "somewhat over a century ago science and technology... joined to give mankind powers which, to judge by many of the ecologic effects, are out of control," then "Christianity bears a huge burden of guilt."

"Despite Darwin," reflects White, "we are not, in our hearts, part of the natural process. We are superior to nature, contemptuous of it, willing to use it for our slightest whim."⁴⁶

"The fact that most people do not think of these attitudes as Christian is irrelevant. No new set of basic values has been accepted in our society to displace those of Christianity. Hence we shall continue to have a worsening ecologic crisis until we reject the Christian axiom that nature has no reason for existence save to serve man."⁴⁷

Saint Francis, "the greatest spiritual revolutionary in Western history," tried to replace this view with one in which all creatures are equal; though he failed, his purpose should be taken up again.

"Since the roots of our trouble are so largely religious, the remedy must also be essentially religious, whether we call it that or not. We must rethink and refeel our nature and destiny."⁴⁸

The call to rethink, to change our attitudes, has become a ubiquitous chorus in the environmental literature in the twenty-five years since White offered his analysis. Others, too, in the 60s, were making similar judgments of (Western) society's imperious bent on technological progress without regard to other values -- human and/or ecological. Jacques Ellul and Herbert Marcuse became available in English; Barry Commoner and Murray Bookchin critiqued American science, economy, and social goals.

Linking Action and Thought

White, a historian, is as aware of the complexity of ecosystem interrelationships as are the scientifically-trained Carson, Commoner, Ehrlich, and Hardin. Historians, like ecologically minded scientists, are inclined to see multitudinous causes and effects playing off of each other in a larger system. But (like scientists) they also try to link a particular cause and a particular effect. Unlike scientists, they can carry out their investigations at a high level of generality. Writing large (or doing macro analysis, in today's terms) White links Christian theology to the domination of nature and the consequent environmental crisis. White has a different version of the out-of-

control argument -- we started steering in this direction, not with the atomic bomb, not after World War II, not at the onset of the Enlightenment, but in the Middle Ages, and because of the Church. He, like the scientists, has a warning -- it will get worse -- but his is not a specific and detailed warning; it doesn't name pollutants and their quantities, or count population and its geometrical growth. He does not lay out inescapable facts; he offers what will certainly be seen as an interpretation subject to argument and competing interpretation. Although scientific data is also open to interpretation, as different evaluations of environmental danger show, there is at least theoretically a resolution point at some future time. Not so with such matters as whether Christianity must bear the guilt of responsibility for environmental destruction.

But just as the success of an argument does not depend on the successful realization of its recommended course of action (as in the case of Carson), neither does it depend on its provability -- at least not outside the narrowest confines of science. Carson's argument succeeded because it uncovered and explained a world of actions unknown to most of the public but vitally important to all of them, and did so in a way that engaged both intellectual concern and emotional attachment to nature. White's argument provided an explanation for academics of relationships between the

social and the natural world at a level of generality that made it useful across a variety of concerns. It linked action and thought in a historical framework and tied them to present consequences that were a frequent topic of investigation and debate. At a time when alternative lifestyles and Eastern religion were providing Americans with an implicit critique of the Western approach to life and nature, White had a compelling explanation of where the loss of our connection to nature (and thus ultimately to self) came from.

It helped that White's analysis was itself in the tradition of philosophizing about the relationship between man and nature, of wondering how and when we had lost our Edenic self. It could even be said that White's analysis was in the Christian tradition of reflecting on the expulsion from paradise, of turning back on to Christians the maxim that in Adam's fall we sinned all, and turning it into a historical account of Christianity's responsibility for, and thus guilt for, the wrong behavior in the garden. (It thus had a ready made audience in both guilt-accepting Christians and anti-religionists.) The success of White's article must also rest on its being one of the most clearly presented and skillfully condensed arguments for the influence of ideas ever made available for the general reader.

In an article written six years later, White comments on his earlier essay:

When I published this hypothesis in 1967, a bishop wrote to me: 'I agree with you completely, and I am deeply troubled by it.' Others were less acquiescent. I was denounced, not only in print, but also on scraps of brown paper thrust anonymously into envelopes, as a junior Anti-Christ, probably in the Kremlin's pay, bent on destroying the true faith. The most common charge was that I had ignorantly misunderstood the nature of 'man's dominion' and that it is not an arbitrary rule but rather a stewardship of our fellow creatures for which mankind is responsible to God....

The Christian wants to know what Scripture says to him about a puzzling problem. The historian wants to know what Christians in various times and places have thought Scripture was saying to them.... So, if one points to the fact that historically Latin Christians have generally been arrogant toward nature, this does not mean that Scripture read with twentieth-century eyes will breed the same attitude."

White cautions that "no sensible person could maintain that all ecologic damage is, or has been, rooted in religious attitudes...." but maintains that "a man-nature dualism is deep-rooted in us" and that it is "a change of value structures that will make possible measures to cope with the growing ecologic crisis. One hopes that there is enough time left."⁹

The 1960s

Besides Silent Spring, Science and Survival, and the

works mentioned in this chapter, the 1960s saw the publication of many other books about environment, technology, man and nature, and ecology. It was not until the 1970s, however, that many such works would be indexed under the heading "environment" in standard reference guides; "environment" was still an emerging category in the 1960s. Notable books included Marston Bates' The Forest and the Sea (ecology and the biosphere for the ordinary reader) in 1960, and the Sierra Club's Wilderness: America's Living Heritage (promoting wilderness preservation) in 1961; these books present nature as it was before the environmental warning.

Nineteen-sixty-two saw the beginning of environmental warnings with Carson and Bookchin, followed by Stewart Udall's The Quiet Crisis (a statement by the Secretary of the Interior) in 1963, Rudd's Pesticides and the Environment, Leo Marx's Machine in the Garden (technology and the pastoral ideal), Herbert Marcuse's One Dimensional Man (man dominating nature means man dominating man), and the English translation of Jacques Ellul's The Technological Society came out in 1964. By this time the warning was gaining acceptance; Commoner had summarized the warnings in 1966, and there was a search for underlying causes, heralded by White's article in 1967. That same year saw Roderick Nash's Wilderness and the American Mind (history of ideas of

nature and wilderness) and Clarence Glacken's Traces on the Rhodian Shore (nature and culture in Western thought).

There was a mass-market hit in the combination of Eliot Porter's photography with Thoreau's words in In Wildness is the Preservation of the World (the aesthetics and scarcity of wilderness, also published in 1963, but now made popular in a coffee-table format).

In 1968, René Dubos responded to the critical trend in the man-nature argument by emphasizing the benefits of human activity to the environment in So Human an Animal. That year, Ehrlich and Hardin reintroduced Malthus and offered lifeboat choices as a result of population pressures; Lynn White published essays on technology and Western values in Machinica ex Deo; Aldo Leopold's classic of nature writing, Sand County Almanac, which sets the terms of a land ethic, was reissued after some twenty years; and a new type of nature writing appears in Edward Abbey's Desert Solitaire, to become a classic on wilderness solitude for the dropout generation. The change continued in 1969 in Theodore Roszak's Making of a Counter Culture (youth against technocracy), Ian McHarg's Design With Nature (the aesthetics and practice of being in tune with nature), and Gary Snyder's Earth House Hold (New Age alternative lifestyle nature poetry).⁵⁰

NOTES TO CHAPTER ELEVEN

1. Garrett Hardin, "The Tragedy of the Commons" in The Environmental Handbook, Garrett De Bell, ed. (New York: Ballantine, 1970). Originally published in Science 162 (December 13, 1968): pp.1243-48. It was reprinted in several journals and more than thirty anthologies.
2. De Bell, Handbook, p.33.
3. Ibid.
4. I find this a poor example. There is no evidence that beings in Nature (animals or plants, for instance) have different values in the way that humans do, and it is values that are incommensurable in Hardin's argument. Also, to assert that survival is the single criterion of selection in Nature is a worldview, not an unassailable scientific fact.
5. De Bell, p.34.
6. Ibid., p.36.
7. Ibid., pp.36-37.
8. One of the best known discussions of this problem, presented as the balancing of recreation and preservation, and evaluating how recreation might be redefined, is Mountains Without Handrails: Reflections on the National Parks, by Joseph L. Sax (Ann Arbor: University of Michigan Press, 1980).
9. Commoner disputes this type of argument in The Closing Circle, arguing that it is not so much the number of people disposing of waste as the type of waste that is being disposed of that causes environmental problems.
10. De Bell, pp.41-42.
11. Ibid., p.43.
12. Ibid., pp.46-47. Given the cold war temper of the times, this reads very much like a caution against socialism.

13. Ibid., p.48.

14. Ibid., p.49.

15. Commoner comments that, instead, the freedom that should be restricted is the freedom to use a social good for private gain. The Closing Circle, p.296.

16. For a brief discussion of the commons and its enclosure, see Jeremy Rifkin, Biosphere Politics (New York: Crown, 1991), Chapter 4.

17. Hardin speaks of the tragedy of rational decisions, but these are rational so-called; the "logic of the commons" and "tragedy of the commons" are loaded terms which require that commonality stops short of responsibility for actions. Hardin's scenario could just as well be called the tragedy of individual greed. Along the same lines of unacknowledged hyperindividualism is the idea that natural selection favors a mechanism (psychological denial) which benefits the individual but harms the society. The conclusion is not only unsubstantiated (in biology or sociology), it is highly partial in reflecting a masculinist view of human relations -- a view which asserts that competition is the dominant mode of those relations.

18. Murray Bookchin, Post-Scarcity Anarchism (Berkeley, CA: Ramparts Press, 1971).

19. Our Synthetic Environment was first published under the pseudonym Lewis Herber (New York: Knopf, 1962), and later reissued under Bookchin's name (New York: Harper & Row, 1974).

20. Bookchin, Post-Scarcity, p.16.

21. Ibid., p.17.

22. Ibid., p.63.

23. Ibid., p.17.

24. Murray Bookchin, "Toward an Ecological Solution" in Eco-Catastrophe, by the editors of Ramparts. San Francisco: Canfield Press, 1970, p.43.

25. Here, Bookchin's argument is not against Commoner on productive technologies so much as it against those who assume a dynamic of technology that is inevitably associated with anti-human values.

26. Bookchin, "Toward...", p.48.
27. Bookchin, Post-Scarcity, pp.18-19.
28. Ibid., p.20.
29. Ibid., p.21.
30. Ibid., p.27.
31. Ibid., p.58.
32. Ibid., p.63.
33. Ibid., p.68.
34. Ibid., p.73.
35. Ibid., p.78. Ecologists generally adopt a more hands-off stance, not seeking to expand ecosystems.
36. Ibid., p.82.
37. The source for page numbers cited here is De Bell, The Environmental Handbook. The essay was originally published in Science magazine, March 10, 1967; it is also reprinted as Chapter 5 of White's Machina ex Deo (Cambridge, MA: MIT Press, 1968).
38. It is described by Keith Thomas in Man and the Natural World (NY: Pantheon, 1983) as "a brief article blaming the medieval Church for the horrors of modern pollution, [which] became almost a sacred text for modern ecologists." [p.23]
39. White, "Historical Roots...", pp.13-14.
40. Ibid., p.15.
41. Ibid.
42. Ibid., p.16.
43. Ibid., p.17.
44. Ibid., p.19.
45. Ibid., p.20.
46. Ibid., p.23.

47. Ibid., p.25.

48. Ibid., p.26.

49. Lynn White, Jr., "Continuing the Conversation" in Western Man and Environmental Ethics, Ian Barbour, ed. (Reading, MA: Addison-Wesley, 1973). Excerpted in the January 1990 issue of Sanctuary magazine, publication of the Massachusetts Audubon Society, pp.7-9.

50. See the Bibliography for references to these works.

CHAPTER TWELVE

TECHNOLOGY QUESTIONED

The 1970s saw environmentalism ascendant as an issue and increasing in reach as a social movement. April 1, 1970, Earth Day -- an environmental celebration, protest, and teach-in -- brought the environmental movement to nationwide notice. In 1970, Charles Reich wrote about youth, alternative lifestyle, and a new consciousness transcending technology in The Greening of America; Scott and Helen Nearing, from the previous generation of alternative voices, rejected technologized society, went to live self-sufficiently in the country, and told others how to do the same in Living the Good Life.

In 1971, Francis Moore Lappé connected the environment and personal decisions through a critique of the production and consumption of food in Diet for a Small Planet, a guide still in print in the 1990s; Stewart Brand's marriage of technology and caring for nature in The Last Whole Earth Catalog started on its way to becoming a best-seller; Commoner and Bookchin reiterated the need to rethink economy and society -- Bookchin in Post-Scarcity Anarchism, Commoner

in The Closing Circle; economists entered the picture with Kenneth Boulding's The Economics of Pollution.

The global dimension of the environmental crisis was detailed in Barbara Ward and René Dubos' Only One Earth, and the industrialized nations were startled by the predictions of Meadows et al in The Limits to Growth, both books appearing in 1972. In the remaining years of the decade, E.F. Schumacher went against the political and technological current with Small is Beautiful; Herman Daly rethought economic growth in Toward a Steady-State Economy; William Leiss examined attitudes toward nature and critiqued theories about them in The Domination of Nature; Horkheimer and Adorno's critique of instrumental rationality was published in English as Dialectic of the Enlightenment; Ernest Callenbach imagined the political and lifestyle consequences of the emerging environmental movement in Ecotopia; James Lovelock gave a new vision and a scientific explanation of the earth as a living system in Gaia.¹

The Circle of Life

The Closing Circle: Nature, Man, and Technology (1971)², was Commoner's best known book until his recent Making Peace With the Planet.³ In it he argues that it is

the type of productive technology we have that causes our environmental problems. Commoner begins by listing the different ways in which the blame has been laid for the environmental crisis: on population, on affluence, on poverty, on the public's demands, on man's innate aggressiveness, on learned inhumanity, on profits, religion, technology, politicians, capitalism.

At the same time, he identifies some of those who gave the warning on the environment while attributing the crisis to different causes; several are biologists, as is Commoner. But cause, Commoner points out, is not a simple linear phenomenon: "in the ecosphere every effect is also a cause...." This cyclical nature of events in the ecosphere, however, has become unfamiliar to us in a technologized age; in synthesizing new products we have converted natural cycles into man-made linear events, at the end of which are toxic chemicals, sewage, and heaps of rubbish. "We have broken out of the circle of life," he says, and the purpose of his book is to try "to discover which human acts have broken the circle of life, and why." He indicates that he will trace "ecological stresses... to... faults in productive technology -- and in its scientific background... and finally to... economic, social and political forces...."⁴

To explain what he means by the circle of life,

Commoner offers a brief version of the basic scientific account of life: An organic soup developed out of atmospheric gases billions of years ago under the influence of light and/or heat. The first living things simply used the store of organic food; this would have been a nonrenewable resource (and no future for life) if photosynthetic organisms had not evolved to convert inorganic matter and carbon dioxide to fresh organic matter using sunlight. With this development, the circle of life is established -- the materials of the planet can be cycled through different states to sustain life. All living things are now part of an interdependent network, and have within them other interdependent networks. But science is not dealing with this complexity, Commoner asserts; it is atomistic in outlook and method. Its specializations and disciplinary divisions do not foster an ecological outlook. There is the simple example of soil humus. This one substance can have two roles: it supplies nitrogen (a nutrient) to the plant; it gives porosity to the soil, which aids the efficient absorption of nitrogen by the plant. One of these cycles describes the movement of nitrogen atoms; the other is a more abstract set of dependencies. Biologists may be experts on plant nutrition or on soil structure, but do not specialize in both. But

"the natural tendency to think of only one thing at a time is a chief reason why we have failed to

understand the environment and have blundered into destroying it." ⁵

The Laws of Ecology

Commoner names the three "great global systems" -- the air, the water, and the soil -- and calls the study of their relationships to life the "young science" of ecology. Ecology does not have the same kind of cohesive generalizations about the processes it studies as physics does, but Commoner offers an "informal set of 'laws of ecology'."

First Law: Everything is connected to everything else.

Second Law: Everything must go somewhere.

Third Law: Nature knows best.

Fourth Law: There is no such thing as a free lunch.⁶

For examples of the first law, the connectedness of everything, Commoner briefly describes the theory of cybernetic systems: energy which precipitates a certain behavior is counterbalanced by effects of that behavior. (Standard engineering examples are simple feedback systems like thermostats and steam-engine governors.) A classic example in a natural system is predator-prey fluctuations of population. When there are many rabbits, their predator,

the lynx, prospers; in time, there are so many lynx that there are not enough rabbits to feed them; the lynx begin to die off, the rabbits begin to increase as their predators decrease, and the cycle begins again. Oscillations that swing too far, however, may destroy the balance of the system and bring about its collapse. (Too many lynx or too many rabbits die to be able to reproduce on the next swing of the cycle.) This is particularly likely to happen with effects introduced from outside the system, for then the cycle's self-governing mechanisms will not apply to the effect. Effects from outside the system become new and ungovernable causes in the system. This is an important recognition in cases of technological intervention into nature.

The second law, everything must go somewhere, is another version of the "matter is indestructible" of physics.

"One of the chief reasons for the present environmental crisis is that great amounts of materials have been extracted from the earth, converted into new forms, and discharged into the environment without taking into account that 'everything has to go somewhere'."

Harmful materials accumulate.

On the third law, Nature knows best, Commoner observes that if you take the back off your watch and poke a pencil into it with your eyes closed, you will almost certainly damage the watch. This is because the watch is a very

restricted selection of a large number of possible arrangements, most of which do not work as well as the chosen one. Any random change in the watch will probably fall into the large class of non-useful or harmful arrangements. So it is with nature's ecosystems.

"The third law of ecology suggests that the artificial introduction of an organic compound that does not occur in nature, but is man-made and is nevertheless active in a living system, is very likely to be harmful."⁸

The fourth, no-free-lunch law, Commoner says, comes from economics. Every gain has a cost, and whatever we extract from a natural ecosystem must be repaid to it. "Payment of this price cannot be avoided; it can only be delayed."⁹

The four laws express ideas that have been widely held by non-scientists, Commoner notes, including poets and writers. But while in an earlier time, understanding of the natural world could be gained from personal experience (the Walden type), now, with nuclear bombs and pollution, understanding "needs help from the scientist."¹⁰

Air, Soil, and Water

Having given a basic description of life and of the ecological study of it, Commoner goes on to a discussion

organized by ecosystem categories: air, soil, water. A chapter on "Nuclear Fire" recounts how awareness of the danger of radiation grew during the 1950s. Nuclear explosions were being made in the atmosphere at the time, with resulting fallout and the deposit of strontium 90 in human bones. Until this time Commoner, though a biologist, had "taken the air, water, soil and our natural surroundings more or less for granted."¹¹ He had no training in ecology. Word of high "background" radiation counts first circulated among scientists; then an accident in 1954 in which Japanese fishermen in their boat got a high dose of fallout from a U.S. test, some dying from it, made the danger known to the public.

"It became clear that tests of nuclear weapons had unwittingly set off the first global environmental experiment in human history."¹²

Scientists spoke out repeatedly about the dangers of fallout, and the need for citizens to get involved in evaluating their risk. Commoner refers to the St. Louis Committee for Nuclear Information, the beginning, he says, of the scientists' information movement, in 1958. In 1963, unexpectedly, the U.S.-U.S.S.R. Limited Nuclear Test Ban Treaty was approved by the Senate; Commoner considers this a result of the scientists' efforts to inform the public. He calls it "the first victorious battle in the campaign to save the environment -- and its human inhabitants -- from

the blind assaults of modern technology."¹³

To explain air pollution, Commoner traces the history of Los Angeles air pollutants, beginning in the 1940s with dust from smokestacks. The later occurrence of smog was caused by the interaction of nitrogen oxides (from automobile engines, power plants and oil refineries) with other organic compounds already in oil, gasoline, or coal (hydrocarbons, also in car exhaust-pipe emissions) when activated by sunlight. The main polluter was automobiles, a major industry in both consumer and military sectors, and politically difficult to bring under control. After emissions controls were placed on new cars in 1966, (yellow) smog went down, but (brown) nitrogen dioxide pollution went up, because auto exhaust controls were on hydrocarbons, but not on nitrogen oxides. The nitrogen oxides that had combined with hydrocarbons still had to go somewhere, and the result was smog in another color. Commoner uses this course of events to illustrate the inadequacy of studying chemical reactions in isolation. "Nevertheless," he says, "'scientific method' is, at present, closely bound to the notion of a singular cause and effect, and most studies of the health effects of air pollution make strong efforts to find them." The poor, young, and old suffer most from air pollution, Commoner observes, and therefore "air pollution destroys social progress."¹⁴

A chapter on "Illinois Earth" explains how fertilizer nitrates in the soil were becoming poisonous nitrites in the body, especially in infants, in the 1950s and 60s. As news of pollution and health hazards came out in the late 60s, there was much controversy over the use of fertilizers, and agricultural scientists who had developed fertilizers did not like the criticism. Commoner emphasizes that the objectivity of science can not come out of personal objectivity when a lifetime of research has been spent in a certain direction; it must come from open discussion and publication, and from more data (which in this case was the chemical analysis of nitrates in the water supply to determine if their origin was natural or synthetic).

The agricultural consequences of fertilizer were higher yields, but the ecological consequences (to make Commoner's distinction) were damage to water supplies. Why weren't the ecological consequences foreseen? Scientific research, Commoner says, is not directed toward finding out. The problem with research in agricultural universities is that it is aimed at agricultural rather than ecological gain. The problem with basic research in other universities is that, (as of the early 70s), it has gone to finer and finer detail, which in biological research, cannot be studied in living systems, but only in test tubes. But this molecular biology approach may be "inapplicable to the actual

biological processes that occur in nature."¹⁵ In fact, at the independent university where the Illinois nitrates were studied, there were departmental objections that "pure" research was not being done in this work.

Commoner's example of the environmental state of water is Lake Erie, "the most blatant example of the environmental crisis in the United States."¹⁶ Algae-clogged and mucky water, and dead fish decaying on the shore are the (early 70s) symptoms of its impending death. The lake is so polluted that one of its tributary rivers caught fire after an oil spill. A huge, glacier-created lake that used to have clear waters, just enough algae to support a variety of life, and many kinds of fish, Lake Erie began changing at the turn of the century. A complex interaction of waste disposal (industrial and agricultural) into the waters, the stratification of waters in the lake, and chemistry of algae growth resulted in an oxygen deficit in the lake, and in the lake's becoming a waste trap rather than a channel for taking wastes to the sea. Some said Lake Erie was naturally "aging"; Commoner disposes of this argument. "Human intervention, " he argues, is responsible. "The guilt is all ours."¹⁷ He then recounts instances of people trying to find first one and then another possible single cause of algal growth as a way of evading interconnected responsibility among detergent manufacturers

(phosphates), agriculturalists (fertilizer nitrates), and producers of carbon dioxide in the air. At the time of writing, no one knew if Lake Erie could be restored; it seemed it might become an example of irreversible environmental degradation.¹⁸

Ecosphere and Social Sphere

Commoner argues that the environmental crisis is not only an ecological problem, but a social one. We inhabit both an ecosphere and a social sphere.¹⁹ In both the ecosphere and the sphere of human activities, modern science is poorly prepared for the task of finding the cause of the crisis, because the task is "the analysis of an intrinsically complex system."²⁰ In the ecosphere, production depends ultimately upon the ecosphere itself. Since the ecosphere doesn't grow, human activity must accomodate to it.²¹

Some of a chapter on "Population and 'Affluence'" is a response to Ehrlich's arguments about population. Commoner's basic position is that pollution is not primarily a problem of too many people unavoidably fouling too small a nest. Instead, it is a problem of how we manage our productive system. He reminds us that "Many pollutants...

made their environmental debut during the war years: smog... man-made radioactive elements... DDT... detergents... synthetic plastics...." There was a postwar revolution in science and technology preceded by a prewar "revolution in basic science, especially in physics and chemistry, upon which so much of the new productive technology is based."²² In physics, understanding of the atom led to nuclear weapons and the hazards of radioactivity, and also to solid state electronics and thus computers. In chemistry, understanding of the molecular composition of natural organic substances led to their synthesis in the lab, and then to the further synthesis of theoretically possible combinations not found in nature.

"Only later was the potentially fatal flaw in the scientific foundation of the new technology discovered. It was like a two-legged stool: well founded in physics and chemistry, but flawed by a missing third leg -- the biology of the environment."²³

The burst of technological innovation and the upsurge in environmental pollution both came in the postwar years, and so Commoner puts the question: "Is it possible that the new technology is the major cause of the environmental crisis?"²⁴ The asking of this question indicates a difference between the 70s and now, when this idea is too commonplace to appear as a question.

Besides technology, Commoner allows, another possible major cause is increase in population. However, pollution

has risen much more sharply than population since the war, and Commoner argues that it has not risen as a result of demands on production by greater numbers of people.

Although the country produces more pollution for the size of its population than it used to, it is misleading to think of this as pollution produced per person, as if it were greater affluence per person that is responsible. GNP per person has increased, but not as much as pollution, and per capita production of food, clothing and shelter has increased little; per capita energy use is up, but again, not enough to account for the rise in pollution. So it is neither population nor affluence that explains the environmental crisis.

It is how the economy has grown that has made environmental problems. For instance, the product with the highest postwar growth rate, as of 1970 (Commoner's analysis, with others) is the nonreturnable soda bottle, up 53,000%. Synthetic fibers are up 5,980%, mercury for chlorine production up 3,120%, fertilizer nitrogen and electric housewares both up a little over 1000%, etc. Growing more slowly than the population, or declining, are railroad freight, cotton fiber, wool, soap, work animal horsepower. It is kinds of goods, and technologies used to produce goods that have changed drastically, not overall output. Detergent replaces soap; truck freight replaces

rail freight; synthetic fibers replace natural ones; aluminum, plastic and concrete replace lumber and steel; nonreturnable bottles replace returnable ones. Herbicides replace the cultivator for controlling weeds; feedlots (and their waste disposal problems) replace range feeding.

"This pattern of economic growth is the major reason for the environmental crisis."²⁵ Its sudden emergence is no longer a mystery, Commoner states, if you look at postwar technology pollutant by pollutant. Levels of environmental pollution have increased about ten times faster than growth of GNP (itself about 126% in postwar years). Agribusiness has been a big contributor to the crisis: inorganic fertilizers, synthetic pesticides, feedlots. Its economic success has been ecological failure. Thus Commoner sets up the theme of ecology vs economy.

Feedlots, detergents, and fertilizers pollute; the production of synthetic fibers does also, because chemical processes at high temperatures release pollutants to the air. Also, the fibers do not biodegrade like natural ones, and they come from nonrenewable resources. Automobile emission pollution is the outcome not just of more automobiles, but of engine design, fuel type, political preference to roads over rails (railroads require heavy initial capital investment, but haul freight much more cheaply and with more energy efficiency). The energy cost

of producing aluminum and concrete is far higher than that for steel and lumber. Additionally, overpackaging of consumer goods results in a waste disposal problem. Commoner concludes we are "blind... about the environmental effects of modern technology."²⁶ The "chief reason" for the postwar environmental crisis is the postwar change in productive technology.

Scientific Knowledge, Public Knowledge

The environmental crisis, Commoner argues, is not the result of natural catastrophe or human biological activities (population growth and nest-fouling behavior) but is social in origin. "[The] same fault lies behind every ecological failure of modern technology: attention to a single facet of what in nature is a complex whole."²⁷ (Among examples of such failures, Commoner cites the building of the Aswan dam and the resultant schistosomiasis contracted from snails in waters deprived of free flow.) It is not inadequacies in the new technologies that has produced problems, but their successes. If the failure of technology lies in its success, then the fault, Commoner reasons, is in its aims. But it is not that we need to abandon technology; rather, technology needs to be derived from an appropriate

scientific analysis. Technology's present fault derives from "the fragmented nature of its scientific base."²⁸

The fault in science is reductionism. Molecular biology is an example; it tries to understand life by finding a molecular event that is the mechanism of a biological process. Soil biology or the nitrogen cycle, "which are not reducible to simple molecular mechanisms, are now often regarded as uninteresting relics of some ancient craft." Reductionism is not limited to biology but is "the dominant viewpoint of modern science as a whole." It results in isolated specialties that cannot communicate with one another. Science is also isolated from society's problems because scientists are attempting to maintain their intellectual independence by avoiding "all problems that do not arise in their own minds."²⁹

But scientists must make known information that bears on society's environmental problems. "Public knowledge is essential to the solution of every environmental problem."³⁰ The hidden costs of our technologies are social, they are met by the public. In the attempts to balance benefits and hazards of technology, who will do the balancing? Scientific experts can evaluate benefits and hazards, but scientific principles cannot guide moral choices. "No scientific principle can guide the choice between some number of kilowatt hours of electric power and

some number of cases of thyroid cancer...." These are value judgments, matters of morality. "In a democracy, they belong not in the hands of 'experts', but in the hands of the people and their elected representatives." Scientists must get and give information to the public; that is their "unique responsibility."³¹ Here, the conventional scientific separation between fact and value is affirmed.

Commoner reiterates that scientist-citizen interactions can work. Successful scientist-citizen partnerships have helped lead to the Limited Nuclear Test Ban Treaty of 1963; the detoxification of nerve gas in Colorado which was at first stored near the Denver airport and then slated for transport to the Atlantic Ocean; the abandonment of biological weapons production; the end to the use of DDT in the U.S.; the defeat of the ozone-layer-threatening U.S. version of the SST; various local environmental watchdog victories; legal actions by various conservation groups, Ralph Nader's consumer protection information.

Concerning the idea that the public can't evaluate risks, Commoner says the public already has a notion of what risks it wants to take -- it doesn't like to take involuntary risks from pesticides, fertilizers, power production, air pollution, etc. Involuntary and voluntary risks, some studies indicate, fall on separate curves of similar shape, but with the acceptable level for involuntary

risks 10,000 times lower. The public now rejects a risk from environmental pollutants that it previously accepted because, Commoner believes, it now understands that it is not only involuntary living victims who suffer, but future generations.

Commoner questions the rationality of an economic system that forces people to fight for jobs to support production processes that can damage their health and the health of their children. The influence of Marxist and critical analysis can be seen in this stance. Environmental crisis is not just a safe "motherhood" issue (motherhood was still a safe issue in the 1970s) or a diversion from social problems; it is linked to war and peace by nuclear weaponry, by the use of herbicides (ecological warfare) in Vietnam; it "reach[es] to the core of our system of social justice and challenge[s] basic political goals."³²

Population

When Commoner was writing, concern about worldwide overpopulation was high. Paul Ehrlich's 1968 book, The Population Bomb, had published the message that too many people was the single most influential cause of environmental deterioration. Commoner, however, argues that

technology has a much greater effect on the crisis than population does. Conservatively, he estimates, technology has five times the effect of rising population on pollution. To prevent the postwar rise in pollution we could have allowed population to grow (as it did from 1914 to 1968) by 43%, while reducing the environmental impact of productive technology by 30%. On the other hand, if we allowed the environmental impact to increase (as it did) by about 600%, to prevent the rise in pollution would have required an 86% reduction in population. (Since the environmental impact of production has increased six-fold, population must drop by about five-sixths if total pollution level is to remain constant.)

Clearly, Commoner argues, technology is the more effective factor. Reducing the population would help, but that argument can be used for all social problems, Commoner says: with fewer people we could have less unemployment, more adequate jails, etc. Reducing births is an alternative to altering the economic, social and political priorities that have led to our problems. However, if birth control is not voluntary, population control can only be by political repression, a solution that is no advance over the misguided politics we already have. Commoner asserts that the environmental crisis penetrates the screen of "evasions, excuses, and... technical details" that has long obscured

the social crisis of the United States -- its inability to use its great wealth to give all citizens a decent life.

We have an environmental crisis so extreme that the question has become, how much time do we have? Commoner's own judgment is that if the present course (1970s) of environmental degradation continues, civilized human society will not be possible. This is a strikingly pessimistic warning.

Commoner reiterates that population control is often a political rather than a scientific response to social problems. The view that the United States should insist on population control in the poor countries it aids is not simply a scientific judgment, but is also a political judgment about relationships between rich and poor nations. Population growth in the third world was encouraged under colonialism for a supply of labor to extract raw materials; the extracted wealth was transferred to the colonial powers, which were then able to undergo the "demographic transition" of lowered birth rates that accompany a raised standard of living, while the colonized countries were not able to reach this transition (Commoner's example is the Dutch and Indonesia). Commoner calls this "a kind of demographic parasitism."³³ Now former colonial powers use synthetics rather than raw materials, further limiting the chances of the third world for wealth and transition. But a change in

productive technology for ecological reasons could change this. Then we would require the third world's natural products rather than their requiring our technology.

Population control looks like an easy solution, Commoner says, but it is another reductionist attempt to get around complex problems, this time social ones, that will not work. It is an attempt to solve a social problem with a biological process -- the control of reproduction. War is a similar biological solution, Commoner points out, another kind of population control. Neither form of population control is an acceptable goal. Commoner sees the main lesson of the environmental crisis and population problem to be that to survive and maintain our humanity we must solve social problems by social means.

Ecology and Economics

Environmental concerns have been far removed from the "central problems of conventional economics," Commoner observes, and only now is a change occurring.³⁴ Environmental factors have been referred to as "external economies and diseconomies" (benefits or harms received). "Externality" is a concept for dealing with exchange that is neither mutually beneficial nor voluntary (i.e., not meeting

the paradigm of the basic economic process of the market). The critique of externality is that the cost-benefit analysis which decides that the beneficial outcome "growth" has occurred, fails to measure actual costs. Furthermore, the costs are "shifted to the shoulders of others... [and] the traditional cost-benefit calculus serves as an institutionalized cloak for large-scale spoilation...."³⁵

Pollution is linked to profit through the productivity of modern technology. And profit accrues especially to innovation, because of the innovative producer's early-stages monopoly over process; when competition increases, edge decreases, price drops, and a new innovation must be found. In general, new technologies have been more polluting than old, and pollution costs have not been borne by producers but by society as a whole, so private free enterprise is free but not private. These relationships, Commoner affirms, must be changed. Economics should pay attention to its own 'no free lunch' law. Production processes will have to be governed by social thrift -- which will conflict with private gain. Ecology gives a logic of an economic system where production meets social rather than private criteria. However, the need for new, ecologically acceptable technologies could transform reductionist science/technology and in turn speed the transformation of the productive system.

The economics of ecology will require radical change. Economic readjustment would have to spread beyond the industrialized nations; thus there would have to be sweeping political changes. The huge capital resources needed will not be available unless we give up our large-scale military spending.

"The lesson of the environmental crisis is, then, clear. If we are to survive, ecological considerations must guide economic and political ones."

"The world will survive the environmental crisis as a whole, or not at all."³⁶

The Closing Circle

While the environmental crisis is palpable in the air, water, and rubbish heaps, it has a kind of unreality, Commoner says, because the ecological explanation of all the interconnections that cause it remains in the realm of concepts. The inertia of the economic and political system is, in contrast, real in our lives.

"Everywhere in the world there is evidence of a deep-seated failure in the effort to use the competence, the wealth, the power at human disposal for the maximum good of human beings. The environmental crisis is a major example of this failure."

"The present system of production is self-destructive; the present course of human civilization is suicidal."

"Now that the bill for the environmental debt has been presented, our options have become reduced to two: either the rational, social organization of the use and distribution of the earth's resources, or a new barbarism."³⁷

These are severe warnings, but Commoner still finds cause for optimism in the new view that ecology will give us, offering new solutions for productivity and international economic relations. Another source of optimism is that the cause of the environmental crisis is not the product of our biological capabilities (which could not change in time to matter) but of our social actions. Commoner refers back to the beginning of the book, and the beginning of life, which was at first embarked on the linear course of consuming its nutritive base as it grew, but then evolved into a new life form, which instead of converting organic matter into unusable wastes, converted wastes into fresh organic matter. "By closing the circle, they achieved what no living organism, alone, can accomplish -- survival." The parallel is clear: "Human beings have broken out of the circle of life.... to survive, we must close the circle."³⁸

* * *

In The Closing Circle, Commoner contrasts linear and

cyclical views of how things work. He quickly establishes that, cyclically, effects are causes. Yet science takes an atomistic approach to the study of the world, suited to a linear notion of cause and effect, not a cyclical one. Another type of science, however, shows us that life is a cycle of interdependencies. In his examples of interdependencies in the living world, Commoner consistently refers to "the environment," saving "nature" for occasions when he wants to make a contrast with artifice. This structuring of the living world as "environment" is, I would argue, a scientific approach, whereas calling it "nature" recalls a tradition of essential relatedness to living things that pre-dates science. Environment is an object of scientific study; Nature is a subject, something with being that resists being made an object.

The environment, in Commoner's writing, is an ecosphere lawlike in its behavior; its laws, like all laws of science, are immutable, and though the system described is complex, the laws are simple. We must change our scientific approach to the environment; science in the lab cannot take the place of science in the field.

In this book, which follows Science and Survival, Commoner makes a more extensive analysis of the economy than he has before. The emphasis shifts from science to the ecosystem. Concerning the ecosystem, science is incomplete,

but the economy is incompatible. Saving the environment is a battle against economic and political interests; it is ecology against economy. The environmental crisis is a sign of our inability to use our wealth and power for the good of all. The environmental crisis and social justice are linked; the environmental crisis and the fate of civilization are linked. The environmental crisis is a social problem; while it needs scientific solutions, these must be socially initiated.

The postwar change in productive technology is the immediate cause of damage to the environment. The fault of this technology -- its damaging effect -- lies in its scientific basis, in the linearity of scientific assumptions and the atomism of scientific methods. And yet Commoner has more to say about changing this technology than changing the science that, in his analysis, lies at its base. Perhaps this is because he evaluates the need for new social choices as the more pressing one, since scientific principles in any case cannot guide moral choices. Science is in this sense amoral; however, scientists need not and should not be. They have a responsibility to the public to speak out -- Commoner himself is consciously acting on this responsibility.

Economic and social systems have not recognized any limits to growth; ecosystems are known to have such limits.

Ecology, Commoner says, must now subsume economy and politics. By ignoring the wholeness of systems, with their limits to total growth and the circularity of cause and effect within the whole, we have broken out of the circle of life. To survive, we must return to and close the circle which, when unbroken, continually renews our existence.

NOTES TO CHAPTER TWELVE

1. See the Bibliography for references to these works.
2. Barry Commoner, The Closing Circle: Nature, Man and Technology (New York: Knopf, 1971). It was a selection of the Book of the Month Club, Saturday Review Book Club, Ecological Book Club, and was reprinted as a mass-market paperback (New York: Bantam, 1972).
(All page references that follow are to this book, except as noted.)
3. Barry Commoner, Making Peace With the Planet (New York: Pantheon, 1990).
4. p.11, pp.12-13, p.13.
5. p.26.
6. pp. 32-45.
7. pp.40-41.
8. p.43.
9. p.46.
10. p.48.
11. p.49.
12. p.52.
13. p.56.
14. p.78, p.79.
15. p.90.
16. p.94.
17. p.108.
18. The damage to Lake Erie has not been irreversible.

19. The idea that we belong to two worlds -- nature and society -- dates at least to the time when society became an object of investigation, around the 18th century. Another environmental book of the early 70s, Only One Earth, by Barbara Ward and René Dubos, repeats the same idea.

20. p.113.

21. pp.122-23.

22. p.128, p.129.

23. p.133.

24. p.133.

25. p.146.

26. p.175. Twenty years later we are not blind to them, but are still not dealing with them on the scale that is required to slow degradation of the environment. See Commoner's 1990 book, Making Peace With the Planet.

27. pp.182-83.

28. p.189.

29. p.190, p.191, p.192.

30. p.193.

31. pp.197-98, p.198.

32. p.211.

33. p.246.

34. p.251.

35. p.257, quote of American economist K.W. Kapp, orig. in The Social Costs of Business Enterprise (1963), p.271.

36. p.292.

37. p.294, p.295, p.296.

38. p.299, pp.299-300.

CHAPTER THIRTEEN

GLOBAL PERSPECTIVES

The previous chapter discussed a book that connected economy and ecology, and gave specific examples of how choices on productive technology have environmental effect. This chapter reviews a book that makes the economy-ecology connection more generally, and on an international scale.

Summarizing Issues

Only One Earth: The Care and Maintenance of a Small Planet, by Barbara Ward and René Dubos, was published in 1972.¹ It is an unofficial report, originally intended as a kind of working document, commissioned by the United Nations Conference on the Human Environment, which was held in Stockholm later that year. The book was to provide a conceptual framework for conference participants and the general public. The two authors, one an economist (Ward), the other a biologist (Dubos), prepared their summary of issues with the assistance of 152 corresponding consultants

in 58 countries: scientists, engineers, industry executives, academics, institute directors, clergy, bankers, lawyers, writers, journalists and diplomats. The book was published simultaneously in Arabic, Danish, Dutch, English, French, Italian, Japanese, Spanish, and Swedish. The conference, and its associated book, gave official notice to the emerging global perspective on environmental problems. It was the first major international conference, and it set the tone for many such meetings, on a smaller scale, for years to follow.

Two concepts that are now familiar are noted as word coinings in this book: one is the earth as a spaceship - an idea presented by Adlai Stevenson in 1965 to the Economic and Social Council of the U.N. in Geneva²; the other is the biosphere - a term invented by Vladimir Ivanovitch Vernadsky, for the emergence on a lifeless planet of the covering of living things.³ "Spaceship Earth" conveyed the fragility and vulnerability of life on a planet suspended in space, whose inhabitants have no recourse to anything other than what they are already supplied with. The "biosphere" came to stand generally for the recognition that life on the planet is one interrelated whole, and as much a matter of concern as the atmosphere. While pollution of the atmosphere was evident in the early 70s, a potential crisis of the biosphere was not.⁴ Ward and Dubos explain that the

experts consulted for criticisms of and suggestions for the preliminary draft of the book differed greatly on what should be stressed and how material should be presented. (Some seventy comments were received.) Some felt the proposed text was pessimistic, a "'fear story'." "One of them, indeed, sees in the style all the defects he violently objects to in Silent Spring -- 'emotional and non-factual'." Others wanted a more forceful warning, and one urges against just a "mere recital of facts because salvation will ultimately depend on an emotional awakening."⁵

In commenting on the process of summarizing and weighing many different arguments, Ward and Dubos take the conventional scientific position on the separation of fact and value, using as an example nuclear energy:

"Experts rarely disagree on the validity of facts themselves; they differ only with regard to the interpretation and use of these facts... But while all scientists agree on [certain] facts [about mutations resulting from radiation], individually they differ as to the levels of radiation [from nuclear power plants] they consider tolerable, because this involves social considerations based on value judgments. For example, the biological hazards... must be balanced against the advantages... from... economic development."⁶

When a scientific fact enters the social arena, it mutates into something else, something that is now arguable because it is subject to values. Ward and Dubos will try to recognize values but provide only facts, not recommendations. The authors were in fact required not to

suggest any policy actions, as these could "prejudge the work of governments of the United Nations."⁷

Social and Natural Worlds

The scheme of the book is to present a picture of a world of social unities and of a world of natural unities, and then to show how technological and economic developments affect them both. There is a unity of social, economic and political interconnections; and a "unity of science" -- characterized both as a unity of matter and energy, and a unity of the physical world and its laws. The social, economic, and political unity the authors refer to is the unity of a system with interdependent parts -- it is not the unity of agreement. This is a holistic sense of unity.

Man, the authors say, (sharing Commoner's observation), inhabits two worlds - natural and social. Ward and Dubos take a scientific view of the social world -- it is the "extraordinary" development of man's brain that separates him from his animal ancestors and that "is at the root of his creativity and his destructiveness."⁸ The authors' argument is that we live in both worlds, but on only one earth, and we need to recognize that the two worlds join whether we intend them to or not.

"Something fundamental and possibly irrevocable is happening to man's relations with both his worlds... Men seem, on a planetary scale, to be substituting the controlled for the uncontrolled, the fabricated for the unworked, the planned for the random."⁹

This technoprogressive theme is notably at odds with the out-of-control critiques of Carson, Commoner, and Ehrlich. Ward and Dubos make their case mostly by concentrating on the substitution of "the fabricated for the unworked." They sketch in a few pages the rise of man by means of the use of nonhuman energy and technology. More or less chronologically, major achievements are the use of fire, of animal power, of metals; the development of river valley civilizations and bureaucracies; money, commerce, mathematics, astronomy, and alphabets. The tempo of development increases in the 17th century, and "in the twentieth century... every index takes off for the stratosphere. Energy use, the consumption of foodstuffs and raw materials, urbanization, above all, population...."¹⁰

The authors now give the warning that they have been leading up to. Though there are different evaluations of the possible benefits and disadvantages of this great change,

"What is certain is that our sudden, vast accelerations -- in numbers, in the use of energy and new materials, in urbanization, in consumptive ideals, in consequent pollution -- have set technological man on a course which could alter dangerously and perhaps irreversibly, the natural systems of his planet upon which his biological

survival depends."¹¹

As an example of consumption pressures, the authors ask, "Suppose seven billion [the projected population for the year 2010] try to live like Europeans or Japanese?"

"The two worlds of man -- the biosphere of his inheritance, the technosphere of his creation -- are out of balance, indeed potentially in deep conflict. And man is in the middle."¹²

Science, Technology, and the Market

After the 16th century, say Ward and Dubos, there was a change in western Europe to an emphasis on useful knowledge (they cite Bacon), thus on repeatable controlled experiment, and on analysis (as specified by Descartes -- reducing fields of study to discrete objects or ultimate elements), on observation, and measurement and mathematics. Knowledge, economics, and political power "became more interrelated, powerful, and self-reinforcing with each advance in technology and organization."¹³

"The vast range of scientific achievements that has flowed from the precise measurements of energy and the study of closely delineated 'discrete objects' makes up one of the most remarkable odysseys of the human mind."

"[These achievements have] reduced the crushing burdens of physical work... freed men for other pursuits, and extended to millions a wealth and opportunity formerly enjoyed by the smallest elite."¹⁴

The authors do not mention the new burdens of these achievements, the crushing work in mines that this technology first demanded, or the work in its factories near dangerous mechanical equipment. Their understanding of the individual's gain or loss from science and technology (as compared to society's or the planet's) is almost entirely positive.

Ward and Dubos also present their triad of knowledge, economics and political power as science, the market, and the nation. It is this triad that rest of the book analyzes. Knowledge is thus equated with science, economics with the (free) market, and political power with the nation, as if these were their natural identities.

Science, the authors say, has emphasized division and specialization; only recently has it attempted to explain wider relationships; it still risks making too little of connections and relationships.

"On the one hand, it [science] is dedicated to the highest standards of objectivity and enslaved to the sternest mistress -- the spirit of truth. But once the results are known -- the horsepower measured, the atom bombarded, the nucleus split -- vastly increased powers of use and misuse fall into men's hands. Energy and matter have, as it were, been torn out of the restraints imposed upon them by the natural system."¹⁵

It now seems old fashioned, at best, to say that science is enslaved to the truth; the authors hold an idealistic view of science, which allows as criticism only the possibility

that it has overstepped its boundaries.

Scientific advance requires us to have more wisdom, to be able to provide checks and balances on this released energy and power, but "It has not been restraint or reflection that has chiefly presided over the emergence of the new scientific, technological order." "The new technological order," the authors assert, "is solidly rooted in man's desire for goods and his willingness to work and plan and invest to get them."¹⁶ Ward and Dubos are saying that though technology is an achievement of science, it is sustained by desire. This bases the technological order on individual acquisitiveness (although the authors include nationalism as an influence) as if this acquisitiveness were universal, equally practiced and equally available as an option, even though the authors' later comments on rich and poor nations show that they know this is not so. As a theoretical stance it is inadequate, because it lacks recognition of structural supports for technology and of power relations that impose technologies.

Ward and Dubos briefly review mercantilist commerce, and the shift of investment from financing long journeys to building factories and workforces once steam engines and other tools became available. They quickly outline the raising of capital, and the large scale production and distribution of goods, and conclude that "As a decentralized

way of satisfying a million different tastes and needs, the market system could hardly be matched."¹⁷ Demand (need) balances supply and prices. Again, individual acquisitiveness is considered to be the basis of the system; nothing is said about how the needs of the buyers (e.g., urban housing) are themselves produced by the constraints of a system over which the individuals have no power.

The authors acknowledge that the market system has also had "unintended, fragmented, and destabilizing side effects," particularly "the gap between rich and poor." Another effect has been damage to the environment. Ward and Dubos observe that economic theory, growing out of the early conditions of the growth of capital, inclines toward accepting this damage. Since the early entrepreneurs took high risks, they did not want any unavoidable costs laid to their account, and "The definition of costs... took on a minimum content which it has to some extent retained. Costs were what the entrepreneur could not avoid paying." Slag heaps (one of which, in Wales, slid downhill and buried a schoolhouse with its children a century later -- a contemporary incident for Ward and Dubos), air pollution, water pollution, dangerous machinery -- the remediation of any of this was a cost the entrepreneur would not accept. "Natural systems were treated as 'free goods'...." and the poisoning of the water that affected someone else downstream

was considered an "external diseconomy."¹⁸

The Nation

In the "trinity of forces -- science, the market, the nation," the market has been decisive as "a stimulus to the development of our disturbed, fragmented, and powerful modern order," but the nation state has been still more potent as an agent of change. The

"modern nation-state has developed the authority, the organization, the will and the energy to do three critical things": create an internal market; create, with other nation states, a world market; "[bring] science and state together in the pursuit of war."¹⁹

Though all this has impacts on the human environment, statehood has not been reconciled with a shared planet. No nation's infrastructure is designed to deal with the environmental effects of production and consumption.

"If all man can offer to the decades ahead is the same combination of scientific drive, economic cupidity, and national arrogance, then we cannot rate very highly the chances of reaching the year 2000 with our planet still functioning safely and our humanity securely preserved."²⁰

It is time, Ward and Dubos say, to rethink the triad. We have to rethink science (make it more integrative), the nation (it must fit into a morally and socially responsible world order as well as a world that is physically one), and

the economy (revise management of incomes, environments, cities).

Scientific Knowledge

Like Commoner in The Closing Circle, the authors feel that it is necessary for the reader to take in some basic science. They have already evaluated the contribution of science as a whole, and reiterate its influence for unity. Science, in its "dissection of the seamless web of existence" and its increasing precision and specialization, has paradoxically given a vision of the unity of the entire cosmos.²¹

Ward and Dubos begin their account of life with physics and the knowledge gained within the last century that energy and matter are interchangeable. Like many others at the time, they grapple with the subject of atomic power and its dangers, which they try to convey with a scientific comparison. The thermonuclear fusion process at the heart of the sun is what releases the energy which comes to the Earth -- but Earth receives just one two-billionth part of it.

"We can, it is clear, stand only so much of the sun's vast radiance. Yet we have already repeated on earth the process which flings it forth... The hydrogen bomb... first exploded in 1952...

releas[es] the kind of energy which is generated by the sun. All other environmental risks, it is clear, fade into insignificance compared with the possibility that this terrible weapon might ever come to be used in all-out war."²²

Having described the basic constituents of matter, the authors turn to the appearance of life, occurring in stages over great periods of time. As the Earth developed, mechanisms took shape to "protect it from the destructiveness of solar radiation, yet enable it to use its life-giving energy." First there is a lifeless planet on which solar radiation pours down "through unimpeded space"; then the covering of living things -- the biosphere -- emerges over billions of years. First a molten globe, then one surrounded by clouds, then a cooling of the crust, whereupon the clouds turned to water and

"The rains began to fall. They fell for years, for centuries, for millennia in a continuous, global downpour, filling the crevices and the gulfs. They covered the lower lands. They climbed up the mountains. They all but filled the Southern Hemisphere. The oceans were born and became the cradle of life."²³

With this description, Ward and Dubos convey the immensity of time that passed in preparation for life, and give a sense of how impossible it would be to retrieve the conditions for life if we damaged it severely on a planetary scale.

The rains ended about three billion years ago; chemicals combined under the influence of the sun's

radiation and electrical discharges in atmosphere; carbon compounds appeared; then primitive bacteria; then living cells capable of photosynthesis (sea plants at first) -- transforming light energy into carbohydrates, pulling in carbon dioxide and letting off oxygen.

The reader's scientific education continues through the "random process" of evolution. DNA is mentioned. Plants creep up onto rocks, fish creep up onto the land, in a "flood" of land life about 350 million years ago; everything begins to adapt. The energy chains of food-giving and food-getting develop, ecosystems form. About 100,000 years ago begins "the unexplained and unparalleled enlargement of the human brain, which resulted in Homo sapiens, thus bringing into play on earth a type of force different from other natural forces...."²⁴

This long-in-the-making balance of life is a delicate one. Though ecosystems are self-repairing, they can be overloaded and damaged to the point of no return. But how, ask Ward and Dubos, can we achieve the necessary caution toward the environment in an age of extreme nationalism and extreme material expectations? (Or put another way, how can we integrate state and economy with scientific knowledge?)

The authors find hope in science. Knowledge of the atom and of evolution are

"master intellectual achievements of modern times [and] have provided a solid basis for a completely

new appreciation of the unity, interdependence, and precariousness of the human condition. And since this reality comes to us with all the weight of scientific proof and cogency, we can hope that it will be more convincing than was the earlier, less scientifically substantiated knowledge."²⁵

"There is... something clarifying and irresistible in plain scientific fact," they conclude.

So there is a paradox. Scientific knowledge gives us both the power to annihilate ourselves and the perspective to avoid this suicide. All traditions have warnings against "arrogant and unheeding power" but they are particularly urgent in Western tradition, Ward and Dubos note, perhaps because the West is "responsible for opening up the furnaces of nuclear power and for penetrating to the most intimate mechanisms of life." Thus the legends of Prometheus, punished for stealing fire, and of Faust -- "the man of science who sells his soul to secure all knowledge and power." This does not mean we should retreat from science. In fact, we need to know more about the interconnections of the environment. "But the warning remains... If man continues to let his behavior be dominated by separation, antagonism, and greed, he will destroy the delicate balances of his planetary environment. And if they were once destroyed, there would be no more life for him."²⁶ Here Ward and Dubos establish a moral basis for the environmental problem, yet they use the remoteness of the subjunctive to express it -- perhaps as a way of appearing scientifically

dispassionate. For them, it is scientific dispassion that promises to overcome the passions they see as the problem.

The Balance of Resources

In this world of accelerating change, the availability of resources is a major uncertainty. There are many problems of calculation: in projecting population, resources, and consumption when trying to figure out if there's enough to go around; they are all interdependent. Projections of population growth are based on current rates of increase. A small rate of population increase can result in rapid total population growth. A 1% increase will double a population in 70 years (other things being equal); 2%, 35 years; 3%, 23 years. While population is growing fastest in the underdeveloped countries, resource use grows fastest in the developed ones. Thus the sufficiency of resources cannot be estimated from total world population alone. The American child in his lifetime will "run through the biosphere's available supplies at least five hundred times faster than an Indian baby." "Developed lands [do not] escape the dilemma. Something has to give -- family size, standards of living, or the biosphere's survival."²⁷

"But," the authors observe, ".... all modernized

societies conduct their economies on the basis of rising material standards for all citizens."²⁸

"Where along the escalator is the exit to a level floor? Is there a kind of biological limit to man's desire for food, shelter, leisure, entertainment, talking by telephone, moving about in a motor car, flying in airplanes, visiting distant lands?... We do not know. But clearly we have not reached it yet."²⁹

Once again, the authors see individual acquisitiveness driving the economic system.

The availability of resources is not simple to predict, because nothing stays the same -- for example, the possibility of use of low grade ores changes with technology; there are new uses for existing materials; new materials are synthesized. All such transformations, however, require energy, and so we can try to estimate energy availability. The world relies greatly on fossil fuels -- coal, oil, and natural gas -- and Ward and Dubos review questions about reserves, political problems, pollution, and as-yet unharnessed alternative energies. Nuclear energy ("Promethean Fire," as the authors call it) is the most immediate alternative. But

"To generate this power on earth is, almost literally, the Promethean act of stealing fire from the gods. And we should remember with an uneasiness born of a sense of sacrilege that the first use of this fire was to wipe out two cities, without care for individual guilt or innocence, man or woman, youth or age."³⁰

Citizen and Science

Is this energy worth its hazards, including cancer? It is here, well into the book, that the citizen (not much noticeable before) is introduced as a risk assessor.

"In all this debate, one thing is certain. The ordinary citizen cannot judge the scientific facts. What he can and must do is bring his reason and common sense to bear on his country's whole approach to the problem."³¹

The citizen gets very busy using common sense to protest nuclear stations near big population centers, to insist on monitoring systems set to the lowest contamination rate possible, to make sure that reprocessing fuels and transporting and disposing of them are closely inspected. Then, "Should the citizen go further and simply say that he prefers to do without the Promethean fire? That nuclear energy is simply too risky and too expensive?"³² The question is left unanswered.

We can't go on with economic growth, population growth, and inadequate controls on pollution and untrammelled energy use without ending in ecological disaster. But "Growth and environment are not in necessary opposition."

"If population becomes stabilized, basic injustices are redressed, effluent charges imposed, new technologies of nonpolluting technologies evolved, the pressure of arms relaxed, and citizens persuaded, by education and example, to widen the range of their nonconsumptive joys, societies can still 'grow', yet still preserve and enhance their

environments."³³

The Underdeveloped World

A section on developing regions ties the global economy to the impending environmental crisis and social problems. The authors offer a profile of the developing nation: annual per capita income is low; investment comes largely from abroad; exports are primary materials, imports are machines and skills; population is heavily rural; school enrollment and literacy rates low; population growth rate is high. "Population and work force explode ahead of industrialization"³⁴ instead of behind, as in the 19th-century West. The exit from poverty requires greater productivity, which means impact on the environment (agriculture by new methods, industrialization, urbanization).

Population:

Developing nations have about 25% of the resources of the global economy, and 75% of its population. The 20th century's control of major epidemics -- yellow fever, smallpox, plague, malaria -- has brought death rates down sharply. "The general rate of population increase -- of over 2.5 per cent a year -- is... unprecedented in human

history." Two billion peoples in the developing world at writing must reach 5.5 billion by the year 2000. (These projections remain approximately the same twenty years later).

Productivity can't increase if consumption claims on resources (population growth) outstrip it. There are two important factors in slowing down birth rates: 'population transition' (the shift to lower birth rates) due to attainment of modern industrial productivity and lifestyle, and government policy.

Policies for Growth:

Agriculture is the basis of everything else in developing countries. Calorie intake is usually less than 2000 calories a day, and protein intake is low, sometimes deficient. In Africa, Asia, and Latin America, population growth means more people to feed per acre; less land lies fallow as acreage is increased, but this means that this traditional method of restoring soil fertility is bypassed; abandoned land erodes, deserts form. Overgrazing has a similar effect.

Green revolution rice and wheat strains (since 1967) grow fast and successfully with fertilizers, increasing crops in some places at a rate faster than the increase in population. But there are special environmental problems in

much of the third world: soils are thin, dependent on rain forests for humus. When forests are cleared to increase the cultivation area, rain leaches out soil nutrients; when the rain ends, the wind blows away topsoil or the sun bakes it to brick. Tropical climate has extremes of rain and heat; regular water supply is a problem; irrigation is necessary, but must be kept in balance with the water table and evaporation rates.

Also, the green revolution requires heavy fertilizer and pesticide use, and is a monoculture method not related to local conditions; it is thus susceptible to environmental challenges. The green revolution is capital intensive rather than labor intensive, as agriculture traditionally is in Asia; people will get turned off the land, migrate to cities, increase urban problems.

"it is not only the balance of nature that will be endangered. It is the balance of the villages, the balance of the cities, the balance of the whole social order."³⁵

Djakarta has a population of five million but is basically "a vast agglomeration of rural villages" without sewage systems, reliable drinking water, transport links. The shantytowns surrounding Rio grow by 5000 migrants a week. So the green revolution needs a framework of land reform, extension services, cooperatives, and traditional (ecological) local wisdom. Unfortunately, the authors note, the necessary trained people are not available.

The development of industry also has such "social diseconomies." Debt is owed to foreigners; reinvestment benefits elites, not the national economy; exports are primary materials which do not bring in enough foreign exchange (except oil); technology is imported and not suited to local conditions, especially the abundant labor condition, so unemployment goes up.

On the other hand, developing countries have energy options that the industrializing West did not; they can decentralize industry, and could learn from mistakes of the West concerning urbanization and its social and environmental problems. Yet the environmentally acceptable technologies and strategies demand high capital inputs, and scientific skills. The special problems of the third world will be very hard to overcome. All strategies for improvement face the question of population growth. To mobilize for this growth requires something like a nation-state. For developing countries the nation-state is also a symbol of escape from servitude, but it is inadequate where the nation is "too small for effective sovereignty"³⁶ or lacks the necessary resources for change and growth -- a common condition of developing countries. Also, separate sovereignties but interdependent technosphere and biosphere present problems for unity.

The Shared Biosphere:

Interdependence of nations and of technosphere and biosphere is especially evident in the atmosphere. The authors discuss the possibility of a greenhouse effect from carbon dioxide gases -- on the rise in recent decades because of the burning of fossil fuels and of deforestation (fewer leaves are available to remove carbon dioxide). This combines with what may be a natural warming period at the end of an ice age (the Pleistocene). We need global decision-making; local decisions are inadequate.

Oceans are another area of interdependence. They provide the water vapor which becomes rain; their phytoplankton provide oxygen; they cool warm regions and warm cold ones; they provide protein (fish); they dissolve mineral and biological debris. But they are not endless. All refuse dumped into the sea accumulates there in one way or another; the sea has no outlet. Biological life is concentrated near the surface of the ocean, and concentrated near land, where it is most vulnerable to human activities: runoff pollution; oil spills; toxic dumping; sewage dumping.

Coexistence in the Technosphere:

We also have an interdependent technosphere, "the constructed world order of technological innovation, investment flows, and commercial exchanges."³⁷ To keep

pace with population growth, national economies need to grow at 6% per year in developing countries. Aid or trade concessions from developed countries are needed; half the amount spent on arms would be sufficient. Some nations are still testing nuclear weapons in the air at the time of Ward and Dubos' writing. Environmental problems are not unsolvable, but "fear and doom are truly appropriate" when it comes to warfare.

Strategies for Survival

Once again the authors rely on the power of science as truth:

"If men have not hitherto realized the extent of their planetary interdependence, it was in part at least because, in clear, precise physical and scientific fact, it did not yet exist."³⁸

There are three fields in which to act: science, markets, nations -- matching the "thrusts" which have brought us to our present predicament.

1) Knowledge (science): "Nations [should] accept a collective responsibility for discovering more" about human/nature interactions. This would involve monitoring, research, study, exchange of information.

2) Sovereignty and decision-making: Intergovernmental institutions are necessary. (International organizations, conventions, and forums have already multiplied rapidly, the authors note.) Air and ocean pollution, climate are obvious areas to start environmental cooperation.

"A strategy for planet Earth must, then, explicitly take account of the fact that the natural resource most threatened with pollution, most exposed to degradation, most liable to irreversible damage is not this or that species, not this or that plant or biome or habitat, not even the free airs or the great oceans. It is man himself."³⁹

"The first global environmental agreement [was] the Test-Ban Treaty [of] 1963."

"We have lacked a wider rationale of unity. Our prophets have sought it. Our poets have dreamed of it. But it is only in our own day that astronomers, physicists, geologists, chemists, biologists, anthropologists, ethnologists, and archaeologists have all combined in a single witness of advanced science to tell us that, in every alphabet of our being, we do indeed belong to a single system, powered by a single energy, manifesting a fundamental unity under all its variations, depending for its survival on the balance and health of the total system.

If this vision of unity -- which is not a vision only but a hard and inescapable scientific fact -- can become part of the common insight of all the inhabitants of planet Earth, then we may find that, beyond all our inevitable pluralisms, we can achieve just enough unity of purpose to build a human world."⁴⁰

* * *

Ward and Dubos want their readers to care about the scientific account of the biosphere and the technosphere; the ecology of production, consumption and waste; a global perspective on economy and politics; the positive possibilities of science and technology, and the cautions against their misuse; science-based unity.

Their main argument is that the world is an interconnected whole -- physically, economically, and politically -- and that we cannot ignore the facts of the physical world that science shows us (ecological danger), nor ignore global imbalances in economic and political power. They both praise and criticize science but never fail to equate it with truth, even in its overspecialization and its overreaching technology.

More than any major book that has gone before, this one gives a global definition of the ecological crisis. In preparation for a United Nations conference the authors extend environmental concerns planet wide, and connect political policy, economic action, and scientific and technological developments to one another. The conference was on the human environment, and Ward and Dubos keep this emphasis, hardly mentioning wildlife or problems of species extinction.

This emphasis is common to Commoner, Ehrlich, and Hardin as well. It was the threat to human life that galvanized their science-based environmental arguments. Bookchin shares this human-oriented concern. Commoner and Ehrlich are aware of, and indicate threats to, fish, plant life, and some mammals, but give them limited space in their arguments. Carson alone among the much-read authors giving environmental warnings in the 60s and 70s starts from the loss of nature. Yet a deep felt concern for nature may drive much of the public's voiced support of environmentalism. The connections of environmental crisis to choices of production technology and international politics and economics, by which the fate of nature is played out, requires an analysis that contrasts with the empathy of relating with nature. The analysis and the empathy combine in the movement of environmentalism, but successful environmental arguments were increasingly framed by rational calculation, whatever individual motives might have been.

NOTES TO CHAPTER THIRTEEN

1. Barbara Ward and René Dubos, Only One Earth (New York: W.W. Norton, 1972).
(All page references that follow are to this book, except as noted.)
2. pp.xvii-xviii.
3. p.36.
4. Atmosphere and biosphere are no longer always considered as separate spheres; the Gaia hypothesis of Lovelock makes them one interactive system.
5. pp.xv-xvi.
6. p.xvi.
7. p.viii.
8. p.2. The idea that social life is to be explained by something that can be quantitatively measured -- brain size and structure -- is an idea modeled on the physical sciences.
9. pp.2-3.
10. p.6.
11. p.11.
12. pp.11-12. Inside this scientifically-styled report there is a narrative of the rise of man (equated with the development of technology) made possible by the growth of his brain, and leading to dangerous power over nature.
13. p.13.
14. p.16.
15. p.17. This is now called the use/abuse model of scientific enterprise in science studies; some scholars find its stance of neutrality ideologically suspect.

16. p.17.
17. p.19.
18. p.19, p.20, p.21.
19. pp.25-27.
20. p.28.
21. p.30.
22. p.34.
23. p.36.
24. p.38, p.41.
25. p.44.
26. pp.44-45.
27. p.118-19, p.120.
28. p.120.
29. p.122.
30. p.129.
31. p.135.
32. p.136.
33. p.142, p.143.
34. p.147.
35. p.169.
36. p.189.
37. p.208.
38. p.213.
39. p.217.
40. p.219.

CHAPTER FOURTEEN

A FINITE WORLD

The global interconnections of economy and environment were detailed in the book reviewed in the previous chapter; this chapter reviews the book that put numbers on the global limits of natural resources and a time limit on the capacity of the environment to support the world's growing population.

Modeling the World System

The Limits to Growth, published in 1972, was based on a report made for the Club of Rome's Project on the Predicament of Mankind.¹ The Club, founded in 1968 by Aurelio Peccei, an Italian industrialist and economic consultant, had as its purpose to understand interdependent world problems, bring them to the attention of policy makers, and encourage action. Its members were businessmen, scientists, educators, and national and international government professionals. What the Club termed the "world

problematique" included poverty, environmental degradation, urban sprawl, insecurity of employment, inflation, alienated youth, and the rejection of traditional values. The Limits to Growth dealt only with the economic and environmental aspects of the problematic. The team who worked on the report began at MIT in 1970, where Jay Forrester had used systems theory to develop a global model of economic and population trends.

Dennis Meadows, a former graduate student of Forrester's, led the project. Donella Meadows, one of its members, along with Jørgen Randers and William Behrens, prepared the book on the findings for a general readership. The authors don't explain that the mathematics of their model are run on a computer, perhaps because this technique was not familiar to a general readership in 1972.² But it is the power of the computer that gives systems theory, and Forrester's system dynamics, the capacity to make such models workable. The model is itself an outcome of the age of technology which generates the problems that the model studies.

The MIT project team constructed a mathematical model in which economic, population, resource use, and other trends intersect and interact. It sets assumptions, manipulates data, lets development run, and then reads out the results. The results, as interpreted and reported by

the MIT group, showed that allowing capital and population to grow to their 'natural' limits would produce a pattern of overshoot of environmental carrying capacity and collapse of further growth, within the next century. They conclude that human-determined limits must be set in order to preserve a functioning world system. Five basic factors were identified as those that "determine, and therefore, ultimately limit, growth on this planet"³: population, agricultural production, industrial production, natural resources, and pollution.

The Limits to Growth was first published in 1972; a second edition came out in 1974, and millions of copies were sold in many languages.⁴ The Introduction quotes U Thant, head of the United Nations:

"I do not wish to seem overdramatic, but I can only conclude from the information available to me as Secretary-General, that the Members of the United Nations have perhaps ten years left in which to subordinate their ancient quarrels and launch a global partnership to curb the arms race, to improve the human environment, to defuse the population explosion, and to supply the required momentum to development efforts. If such a global partnership is not forged within the next decade, then I very much fear that the problems I have mentioned will have reached such staggering proportions that they will be beyond our capacity to control."⁵

The authors comment little on this strong warning, stating only that U Thant refers to long term problems that concern us all. They stress the necessity to extend our perspective beyond the next few months or years, to decades

and centuries, and introduce the idea of using a model (an "ordered set of assumptions about a complex system") as a means for sorting through information as it increases in quantity and complexity of interactions.⁶ The model, the authors say, is unavoidably "imperfect, oversimplified, and unfinished," but it is the only formal model they know of

"that has a time horizon longer than thirty years, and that includes important variables such as population, food production, and pollution, not as independent entities, but as dynamically interacting elements, as they are in the real world."⁷

Their assumptions about the five factors of growth are that they show these trends: rapid population increase, widespread malnutrition (agriculture), accelerating industrialization, depletion of nonrenewable resources, and a deteriorating environment (pollution). All the data on growth trends in population, food, capital, nonrenewable resources, and pollution are combined in a "world model." The effect of numerical changes in the basic assumptions is tested on the world model to see what behaviors or interactions result.

There was strong reaction to the publication of this report, both accepting the conclusions and rejecting them. There is still argument about the practical impact of limits, and resistance to any economic program of scaled-down growth. But it is no longer unusual to have an economic projection time-span of over thirty years, or to

compute multiple interactions instead of discrete paths of projected change. The Limits to Growth startled people in the same way that Silent Spring did, and like Silent Spring became an exemplar for subsequent accounts.

The conclusions of the study, as summarized in the introduction are: 1) If present trends continue, the limits to growth on the planet will be reached in the next one hundred years, with a consequent sudden decline in population and industrial capacity; 2) The trends can be altered toward a state of global equilibrium which satisfies each person's basic needs and offers each person equal opportunity; 3) The sooner the world's people start toward such a goal, the greater are the chances of success. The authors foresee "a period of great transition -- the transition from growth to global equilibrium."⁸ Many critics associated Limits with the goal of "zero growth"; this term is not used in the book, but the equilibrium it recommends comes to that. The Club of Rome, for whom the report was made, never recommended zero growth, but was linked with the idea anyway.⁹

Exponential Growth

Exponential growth is a key idea of the Limits report.

All five elements of the model -- population, food production, industrialization, consumption of nonrenewable resources, and pollution -- are growing exponentially. Instead of a linear increase by the same amount each year -- as in adding one hundred dollars at regular intervals to one's savings -- there is an increase by a constant percentage, as in adding to savings or investment earnings by the same percentage each year.¹⁰ The authors give two examples of the surprising results of exponential growth. One comes from the story of the game of chess, newly invented and presented to a Persian king. In return for devising the game, the inventor asked only that he be given one grain of rice for the first square of the board, two grains for the second, four grains for the third, and so on through the 64 squares. This doubling reached more than 500 grains at the tenth square, more than a million at the twenty-first square, a million million at the fortieth square. The rice storehouses of the king were exhausted before the last square was reached. (This example is more instructive, in the 20th century, with pennies. If pennies are substituted at the rate of one-fiftieth of a penny for a grain of rice -- approximating the retail price -- the inventor has 200 million dollars by the time the fortieth square is completed.)¹¹

The other example is a riddle: You have a pond on which

a lily is growing, doubling in size each day. If the lily is allowed to grow unchecked it will cover the pond, choking all other life, in thirty days. For a long time the lily seems to remain small, so you decide not to cut it back until it covers half the pond. On what day will that be? (The twenty-ninth -- you will have just one day to save the pond.)¹²

Exponential growth is not difficult to understand, but when many different elements grow concurrently, at different rates, and in interaction, analysis becomes complex. The dynamic behavior of a system is marked by positive and negative feedback loops; with positive feedback there is an increase in quantity; with negative feedback a decrease. In population, which grows exponentially, the positive feedback is births; the negative feedback is deaths. If fertility (the percentage of the population that gives birth each year) remains constant at a level above replacement, and mortality remains constant, then the larger the population, the more babies are born, making a still larger population from which still more babies are born. If there are no births, and mortality remains constant, population diminishes, but slowly, since each year there is a smaller base quantity on which the percentage of deaths operates. The decrease is not linear, but instead of the change in quantity being faster for not being linear, as in the case

of growth, it is slower. Other things being equal, reducing the positive feedback of births to zero acts like taking your foot off the gas pedal, not like putting on the brakes.

With population, there is a delay in each feedback loop, since the age of giving birth is many years away from the time of being born, as is the age of death on average. For this reason, the authors of this 1972 report noted that population could not level off before the year 2000, when it would reach about 7 billion, since the majority of that year's prospective parents had already been born. (As of the 1992 United Nations Population Fund report, the most likely level-off year has been moved to 2150, when 1992's estimated 5.5 billion people will have more than doubled to a projected 11.6 billion. This rate of growth is slower than the 35-year doubling period mentioned in Limits -- and in Ehrlich's Population Bomb -- but growth will still be steep for another 50 years after 1992, and will take more than a century to level off.)¹³

Growing even more rapidly than population, industrial output increased at 7% a year from 1963 to 1968, or 5% per year per capita.¹⁴ [p.45] (When the growth rate is 1% per year, doubling time is 70 years; when it is 2%, it is 35 years; 7% gives a doubling time of ten years.) Positive feedback loops operate on industrial capital and output in very much the same way as they do on population, the authors

argue. Some fraction of output is investment; more investment makes for more capital stock, which makes for more output.¹⁵ Depreciation acts as negative feedback. Although industrial output is growing faster than population at the time of the report, distribution of wealth is unequal, and problems of poverty are not solved. Industrial growth is greatest where population growth is lowest; there, GNP per capita can increase. In developing countries, where population growth outstrips industrial growth, GNP per capita cannot rise. The gap between the rich and poor nations is widening. The rich get richer and the poor get poorer, and the authors ask whether this pattern of growth rates for industrial capital and population around the world can be sustained.

Resources

Much of the future will depend on physical resources, many of which are not renewable. (At the time of the report, non-renewable resources were thought of as extractives -- coal, oil, gas, minerals; it has now become evident that ancient forests are nonrenewable, as are other complex biosystems whose evolutionary synthesis can never be recreated.) There are renewable resources, such as food,

but the arable land on which food depends is limited. Other resources are social -- social stability, education, employment, technology; Limits to Growth does not try to model these. Instead, it sets the assumption that either current or better social conditions prevail. For instance, if the best social conditions prevail, and all arable land is under cultivation; if 0.4 hectares is required to feed each person (the world average; eating at U.S. standards requires twice as much land); if population growth continues at the existing rate, then "desperate" arable land shortages occur before the year 2000. If agricultural productivity is doubled, the shortage occurs about 25 years later. The situation, the authors observe, is like that of the lily pond; for a long time, everything seems in balance, but in a very short period of time the whole system can fail.

The example of food production is illustrated with a graph that projects trends into the future. Beginning at the bottom left of the chart, one curve -- arable land needed at the present agricultural productivity level -- begins to rise steeply after having been first nearly level and then only gradually climbing; similar curves, further displaced into the future, show land needed at higher productivity levels. A flat line above the climbing land curve shows total arable land; part of it drops off into a descending curve as land is taken for urban-industrial

purposes. Where the available-land and needed-land curves intersect, need has outstripped supply -- there is no longer enough land to produce the food that the world needs. All the factors of growth analyzed in the book have such charts, and all are of this type -- rising and falling curves intersect, although not always with such simplicity -- and even if all supporting conditions are made optimistic beyond current conditions and anyone's expectations, the crash when growth meets its limits is only delayed about 25 years.

Depending on the factor under consideration, failure comes as early as 2000, or as late as 2070, but within a century of the date of the report. Exponentially growing industrial production depletes natural resources and increases pollution until the lack of land and materials, along with health damages from pollution, cause deaths which bring the population rapidly downward. Approximately 75 graphs and other graphic devices in Limits show how this is so (given the assumptions of the model). The mathematical evidence of the limits to growth is before the reader's eyes every few pages.

The text is mostly an explanation of what is displayed on the charts; the language is simple and the argument is made easy to follow. A very brief summary appears in long legends below each graph. Explaining nonrenewable resources, the authors take chromium as a test case, because

it has one of the longest static reserve indices of 19 in-the-earth resources listed in the report. The legend below the chart reads:

"The lifetime of known chromium reserves depends on the future usage rate of chromium. If usage remains constant, reserves will be depleted linearly (dashed line) and will last 420 years. If usage increases exponentially at its present growth rate of 2.6 percent per year, reserves will be depleted in just 95 years. If actual reserves are five times present proven reserves, chromium ore will be available for 154 years (dotted line), assuming exponential growth in usage. Even if all chromium is perfectly recycled, starting in 1970, exponentially growing demand will exceed the supply after 235 years (horizontal line)."¹⁶

The effect of the simplicity and irresistible factuality of these presentations repeated throughout the book gives the report an immediate impact. A blurb for the second edition sums up this effect: "If this book doesn't blow everybody's mind who can read without moving his lips, then the earth is kaput."¹⁷

Limits is one long warning that says "watch out, slow down, change course," not with those words, but with one encapsulated trend report after another. Data and graphs on "Energy consumption and GNP per capita" complete the section on nonrenewable resources. Pollution is described with such examples as "Carbon dioxide concentration in the atmosphere; Waste heat generation in the Los Angeles basin; Nuclear wastes; Oxygen content of the Baltic sea; Lead in the Greenland ice cap; DDT flows in the environment; DDT in body fat." We have many such reports now, but there was nothing

else like The Limits to Growth when it came out -- all the major elements of productivity and pollution brought together, projected into the future, explained in condensed form, and stating incontrovertibly that we cannot continue going on as we have been.

The authors caution that the output graphs that show values for population, capital, etc., from 1900 to 2100 "are not exact predictions of the values of the variables at any particular year in the future. They are indications of the system's behavioral tendencies only."¹⁸ They explain that knowledge of the causal relationships between the factors they consider varies in degrees of completeness. Per capita resource use, for example, is fairly well understood; fertility is not so well understood; and the effect of pollution on life expectancy is not well understood at all. The authors' basic stance on these difficulties is that we have to work with what we've got; "there is no perfect model available for use in evaluating today's important policy issues."¹⁹ They believe their model is useful despite its deficiencies. It will, they hope, generate discussion and research and it can "generate valid basic behavior modes for the world system."²⁰

All the computer runs of the behavior of the world system under varying conditions of productivity, resource availability, and population show some form of overshoot of

carrying capacity and subsequent collapse. If the trends of 1900-1970 don't change, collapse of growth comes before 2100.

"Food, industrial output, and population grow exponentially until the rapidly diminishing resource base forces a slowdown in industrial growth. Because of natural delays in the system, both population and pollution continue to increase for some time after the peak of industrialization. Population growth is finally halted by a rise in the death rate due to decreased food and medical services."²¹

The authors comment:

"The exact timing of these events is not meaningful given the great aggregation and many uncertainties of the model... We can say with some confidence that, under the assumption of no major change in the present system, population and industrial growth will certainly stop within the next century, at the latest."²²

A major change, such as doubling the resources allows industrialization to reach a higher level, but pollution rises so steeply that it increases the death rate; industrial production still has to fall as resources do, and capital-intensive agriculture can thus no longer be sustained; population falls as food production does; collapse occurs as before, and not much later than with the no-major-change scenario. Even with "'Unlimited' Resources (unlimited nuclear power doubles the resource reserves that can be exploited, but there is still some actual limit to the resources that can be mined from the earth), Pollution Controls, Increased Agricultural Productivity, and 'Perfect'

Birth Control," "industrial growth is halted, and the death rate rises as resources are depleted, pollution accumulates, and food production declines."²³ There is no avoiding the limits that the planet places on our productive activity -- the productive system that we now have cannot go on growing endlessly into the future.

Setting Limits

"The unspoken assumption behind all of the model runs we have presented," say the authors, "...is that population and capital growth should be allowed to continue until they reach some 'natural' limit."²⁴ The alternative is "man-determined limits," but if we wait too long, "the choice of limits will be gone."²⁵ The authors recommend a change toward a world system that is "1. sustainable without sudden and uncontrollable collapse; and 2. capable of satisfying the basic material requirements of all its people."²⁶ To reach this goal, both population and capital must be stabilized. In the model that follows such policies, the economy is shifted away from goods and toward services, food production and soil enrichment is given priority, pollution is reduced and recycling carried out. With all this, the demand on nonrenewable resources is reduced. If such

policies are instituted in 1975, stabilization is reached by 2100; if we wait until 2000 to institute the same policies, the equilibrium state cannot be maintained, and food and resource shortages occur before 2100. Of the three alternatives, the authors conclude -- "unrestricted growth, a self-imposed limitation to growth, or a nature-imposed limitation to growth -- only the last two are actually possible."²⁷

In the the equilibrium state, "Population and capital are essentially stable, with the forces tending to increase them in a carefully controlled balance."²⁸ The behaviors of population and capital that are necessary to maintain equilibrium depend on how long the equilibrium is to be maintained. With a time horizon of 70 years, the levels of population and capital of the 1970s could be maintained, but the rates would have to change -- birth rate and rate of capital investment and depreciation would have to drop.

For a long time-horizon, minimum requirements are: birth rate equals death rate, and the capital investment rate equals the depreciation rate; all rates are kept to a minimum; capital and population levels and their ratio "are set in accordance with the values of the society," and can be revised as "technology creates new options." "Population and capital are the only quantities that need be constant in the equilibrium state." "Education, art, music, religion,

basic scientific research, athletics, and social interactions could flourish."²⁹ There are two barriers to equality, the authors state; population is one. While the equilibrium state will keep population growth down, it will not assure equality of distribution of goods, but at the very least everyone could be maintained at subsistence level, which is not the case once overshoot and collapse happen. "The other effective barrier to equality -- the promise of growth -- could no longer be maintained."³⁰

On the transition from growth to global equilibrium, the authors have little to say. "Neither the world model nor our own thoughts have been developed in sufficient detail to understand all the implications" of that change. But there is a "great need for more facts -- for numbers that are scientifically measurable but which have not yet been measured."³¹ "Every day of exponential growth," the authors conclude, "bring the world system closer to the ultimate limits of that growth. A decision to do nothing is a decision to increase the risk of collapse."³²

Criticism

Within about a year, the publication of The Limits to Growth was followed by the publication of Models of Doom: A

Critique of The Limits to Growth.³³ The authors, who, like the authors of Limits, constitute themselves as a "project team," were members of the Science Policy Research Unit at the University of Sussex. Much is made of the computer model used by the MIT group; all the critics stress that you get out of a computer what you put into it. "The critique of a computer model is not just a question of looking at the structure, or conducting mathematical tests. Far more important is the examination of the underlying assumptions."³⁴ A common objection is that the model doesn't model the real world because it deals only with physical limits and does not consider social limits and possibilities. Malthus is recalled, and his failure to anticipate technological progress is pointedly remembered. A frequent criticism is that the authors of Limits are too "pessimistic."³⁵ The authors are compared to idealist reformers:

"Much of the moral idealism which in earlier times found expression in various movements of social reform appears now, particularly in the USA, to seek an outlet in the environmental movement. It is this environmentalist critique of industrialism, rather than the socialist critique of cupidity, which finds explicit representation in the MIT model."³⁶

Further on, this author remarks:

"One is tempted to be persuaded by [their] predictions that Adam Smith's benevolent 'hidden hand' has been replaced by a malevolent 'hidden boot'. Today's dismal science is no longer economics but ecology. It is not surprising that

the leading ecological Cassandras and the MIT system dynamics group quote each other with approval."³⁷

Another author says, "Surely one might have expected people to be sceptical about such an apocalyptic thesis....," and concludes that a "new pessimism" is at work. Also,

"Having abjured any particular political or ideological viewpoint, carefully dissociating themselves from politicians... it is quite clear how anxious [the authors] are to appear to be above politics... It is precisely because the world dynamics model says nothing about the means necessary to achieve the stable system ... that it appeals to the 'intellectual technologists' of the Club of Rome as well as to ordinary citizens."³⁸

As do other authors in the book, this one compare the MIT team to Marxists:

"In common with other chiliasts, the new scientific chiliasts are utopians at heart. Like the great phrophet of world salvation through world breakdown, Karl Marx, their apocalyptic visions of the immediate future are tempered by the glittering image of utopia barely discernible through the fire and brimstone that rages in the historical foreground."³⁹

Several authors complain that it doesn't take a computer to reach the conclusion that limited resources will eventually be used up.

In a response appended to Models of Doom, the Limits authors assert that their theory of growth has been made explicit, but that the Sussex authors' has not. "The training and professional expertise of the Sussex group is predominantly in economics and the physical sciences," they state.

"Both of these fields have evolved modeling philosophy that is directed primarily toward precise, short-term prediction and is based on a reductionist view of the world... System dynamics models are general and holistic...[and are] designed for the exploration of the long-term dynamic properties of complex systems."⁴⁰

"The Sussex criticisms apply micro reasoning to macro problems," choosing selected evidence on local resources and pollution, "while ignoring both the evidence for and the causes of negative global trends."⁴¹ Furthermore, say the MIT group, the Sussex authors don't really seem to understand the basic dynamic properties of the world system, which, as reviewed by the Limits authors are:

1. Exponential growth is an inherent property of the population and capital systems.
2. There are physical limits to population and capital growth.
3. There are long delays in the feedback processes that control the physical growth of the world system.
4. There are two possible social responses to the limits to growth: weaken growth forces or remove the symptoms of impending limits (build more highways, import more copper, build nuclear power plants, buy fertilizer).
5. The equilibrium state may be a desirable option, wherever the limits to growth may be.

Finally, the Limits authors say that they and the Sussex

group have contrasting "concepts of man." While some would call theirs "pessimistic," about mankind's technological capacities, they simply call it "humble."⁴²

In Beyond the Limits to Growth, Eduard Pestel, a founding member of the Club of Rome, looks back on the original book, criticizes some aspects of the model, considers the problems of nationalism, North-South differences, and the environment, and has both optimistic and pessimistic things to say about the present. Pestel says he has "been asked repeatedly when the Club of Rome would again startle the world with a report like [Limits]"; the Club would have liked to do so, he says. But

"there is a time for everything, and The Limits to Growth came at the right time, when the first doubts were gnawing at the expectations for unceasing progress and prosperity, sooner or later, everywhere on earth. Once this time has passed, there will be no repeat performance for such an equally shocking message of monumental simplicity, be it by The Club of Rome or anyone else."⁴³

Pestel is probably right. Donella Meadows, Dennis Meadows, and Jørgen Randers have written a sequel, titled Beyond the Limits, published in 1992. It has not been much noticed, although it is mentioned in a Business Week cover story on "Growth vs. Environment" which appeared about a month before the June 1992 meeting of the United Nations Conference on Economics and Development -- the "Rio conference." "In 1972," the article begins,

"Donella and Dennis Meadows set off a furor with their book Limits to Growth. They argued that the earth's resources and its ability to absorb pollution and regenerate are finite. Using computer models, they also predicted that population and growth would bump up against these constraints within a century... The book sold 9 million copies. But the subject was quickly eclipsed by more pressing concerns and derision of their Malthusian alarms. Now the Meadowses are back... [and] they argue that human activity already has overshot earth's ecological limits, and that unless corrective steps are taken soon, their original scenario is more certain.""

In Beyond the Limits, however, the authors temper the flatness of their findings somewhat, and are careful to emphasize that disaster is not foreordained. Some options have closed since the 1972 report, but others have opened. A sustainable society can still be built, they say, if the changes begin now, in the 1990s.

* * *

The Limits to Growth is the culmination of the scientific presentation of environmental arguments that began, in a much different form, with Silent Spring, ten years earlier. It follows the scientific model of hypothesis and test, with evidence in the form of mathematical expressions. It is almost devoid of social comment or sociological observation; it conveys no emotion, and offers no political criticism.

Its authors would fit well on a profile of "new class" techno-bureaucratic professionals derived from Gouldner's description of those who share the "culture of critical discourse," in which arguments are putatively self-grounded and do not rely on the status of the speaker for authority. Gouldner contends that although such self-grounding makes the discourse 'scientific' (letting the facts speak for themselves), critical discourse is also ideological, because it does what ideologies do: presents a map of 'what is' in society; a 'report' of how it is working or failing; and a report on how it could be changed that functions as a 'command' or call to action.⁴⁵

Donella Meadows, now a professor in Environmental Studies at Dartmouth, has a Ph.D. in biophysics, and is described as a systems analyst in the publicity for her recent book. Dennis Meadows has a Ph.D. in management, is a professor of Systems Management at the University of New Hampshire, and is the Director of the Institute for Policy and Social Science Research. Jørgen Randers has a graduate degree in solid state physics and a Ph.D. in management. He is chairman of the Norwegian Bank for Industry.⁴⁶

Gouldner's new class is not exactly like Mannheim's socially unattached intelligentsia, but it shares the capacity to use its wordsmithing skills for either side of an argument; there is nothing in its social position, for

instance, that inclines this 'class' of professionals toward one side or another of the environmental debate. (For comparison, consider industry executives or workers in extractive industries.) The Models of Doom group, who opposed the Limits argument, is similar in training and social position to the Limits group (despite the distinctions between them drawn by the Limits authors).

Limits has no particular argument about science; it is simply itself scientific in its presentation. Its analysis is not directed to the question of science and society; it is about limits, especially limits to capital and population growth in a finite world. The book's presentation is oriented toward systems and wholes; it is the first use of a computer model reaching a large public; it is global in outlook (appearing the same year as Only One Earth); it gives a warning. The authors caution against technological fixes, but do not critique, only point out that technology just delays collapse, and sometimes complicates environmental issues.

Limits does not engage directly in the science-in-society argument, but it is a major book for the development of the environmental argument. It insists that resources are limited and damageable, and that we must think about them in a different way or suffer severe consequences. It links economy and environment in mathematical expressions

and fact-laden but simple prose. It is as successful with its lack of emotion as Silent Spring is with its impassioned account of the destruction of balance in the natural world. Economic growth, not out-of-control science, is the problem, yet science/technology is not, as with many other analyses of growth problems, the taken for granted solution. Since so much of our scientific research is directed toward growth in productivity, however, the warning that we must change our productivity goals means that we must rethink the uses of science.

NOTES TO CHAPTER FOURTEEN

1. Donella H. Meadows, Dennis L. Meadows, Jørgen Randers, William W. Behrens III, The Limits to Growth (New York: New American Library, 1972 [orig. pub. New York/London: Universe Books, Pan Books, 1972]).

{All page references that follow are to this book, except as noted.}

2. A more technical report for the public followed in 1974 -- Dynamics of Growth in a Finite World, by Dennis L. Meadows et al (Cambridge, MA: Wright-Allen).

3. Limits, p.xi.

4. Reported sales vary from 4 million ("The 'Global 2000' Juggernaut," Heritage Foundation Reports, May 13, 1983) to 10 million (Marie Jennings, "Blueprints for Our Planet's Future," Universal News Services, September 12, 1991). Jennings reports 37 languages of publication; another source reports 20 (Ronald Bailey, "Dr. Doom," Forbes, October 16, 1989). As with most of the books analyzed in this study, sales figures could not be obtained from publishers because the data was too old to be retrievable.

5. p.21.

6. p.26.

7. p.27.

8. p.29.

9. See Beyond the Limits to Growth: A Report to the Club of Rome by Eduard Pestel (New York: Universe Books, 1989), pp.30-32.

10. An excellent explanation of exponential growth is given in Derek de Solla Price, Little Science, Big Science... and Beyond (New York: Columbia Press, 1986).

11. In their new book, Beyond the Limits: Confronting Global Collapse, Envisioning a Sustainable Future (Post Mills, VT: Chelsea Green, 1992) the authors (Donella H. Meadows, Dennis L. Meadows, Jørgen Randers) suggest that

readers substitute a peanut for each grain of rice, and see how many squares of peanuts they are able to eat at the doubling rate.

12. Lester R. Brown, who founded the Worldwatch Institute, which monitors resource use, population, and economic trends, used The Twenty Ninth Day as the title of his 1978 book on the environmental crisis (New York: W.W. Norton). "The global lily pond in which four billion of us live," he said, "may already be at least half full." (p.1)

13. "Curb on Population Growth Needed Urgently, U.N. Says," by Paul Lewis, The New York Times, 4/30/92.

14. p.45.

15. The assumption that industrial output will be partly apportioned to investment has become less easy to take for granted since the takeovers of the 1980s, in which newly purchased companies, often taken over against their will, were deprived of reinvestment, and used only as a platform from which to finance further purchases and sales of stocks and bonds.

16. p.70.

17. Robert C. Townsend, author of Up the Organization, (New York: Knopf, 1970) another best-selling and iconoclastic book of the 1970s.

18. p.100.

19. p.129.

20. p.127.

21. p.129.

22. p.132.

23. p.147.

24. p.149.

25. p.159.

26. p.164.

27. p.175.

28. p.177.
29. pp.178-79, p.180, p.180.
30. pp.183-84.
31. p.185.
32. p.188.
33. H.S.D. Cole et al, eds., Models of Doom: A Critique of The Limits to Growth (New York: Universe Books, 1973).
34. Ibid., p.9, Christopher Freeman.
35. Ibid., see Cole and Curnow's summary, p.125, and Harvey Simmons, p.203.
36. Ibid., p.175, T.C. Sincliar.
37. Ibid., p.181.
38. Ibid., p.203, p.206, Simmons.
39. Ibid., p.207.
40. Ibid., p.220.
41. Ibid., p.225.
42. Ibid., pp.239-40.
43. Pestel, p.160.
44. "Growth vs. Environment," Business Week, May 11, 1992, p.67.
45. Alvin W. Gouldner, The Future of Intellectuals and the Rise of the New Class (New York: Oxford University Press, 1982; orig. pub. 1979). See especially Thesis Six.
46. Biographical data was not available on the other author, William Behrens.

CHAPTER FIFTEEN

CRITICIZING SCIENCE, SAVING THE ENVIRONMENT

This chapter presents general conclusions about the environmental argument made in the writings of the 60s and 70s which have been reviewed in previous chapters. The following chapter presents conclusions about the applications of Mannheim's method to the analysis of environmental thought.

Nature and Environment

It was scientists who made nature into the environment. Nature, the presence that had its own being, became the environment, the problem-place of human activity. The environmental style of thought gives nature another meaning, defines it differently from those who argue for the preservation and protection of nature from an empathetical standpoint.¹ From 1962, when *Silent Spring* was published, to 1972 when *The Limits to Growth* was published, there was a tremendous increase in the range of what was covered by

discussion of environmental problems. When Carson's book came out, only experts in agricultural chemistry and some professional naturalists were discussing the problems of environmental degradation and threat to wildlife (and human life) stemming from the use of pesticides. The warning that Carson gave was startling -- because it was put in language that ordinary, non-expert readers could understand, and because for non-experts the information was new and the warning was sudden. Ten years later, the problems of pesticides and fertilizers were a commonplace topic in newspapers, magazines and books, along with myriad other topics relating plants, animals, insects, whales, people, air, soil, water, the atmosphere, forests, endangered species, industrial growth, agricultural practices, economic policy, energy production and use, all to one another. When Carson insisted that a whole network of effects followed on the spraying of pesticides, she was criticized for exaggeration. Ten years later, the range and intricacy of environmental problems in public view had expanded worlds beyond what Carson spoke of.

"Nature" has an ontological status; "the environment" does not. Nature is a subject, with its own quality of being; the environment is an object of study. With nature there is an empathetical relationship; with the environment there is an analytical relationship. One stands outside the

environment to study it as a scientific object, though recognizing -- analytically -- human inclusion. But we are part of nature -- we are inside of it and it is inside of us. It has long been recognized that human beings have a dual nature -- we stand both inside of nature and outside of it. We need, for our survival, both to be able to attune with nature, and to go beyond being entirely subject to it. We need both an analytical and an empathetical relationship.

The nature/environment distinction appears in the environmental movement as two different types of writing, two different types of argument, one oriented toward nature as spiritual sustenance, the other oriented toward the environment as a multiplicitous object requiring scientific understanding. Nature is spiritually sustaining because it is humanity's ancient home, even though a dangerous one, and to lose an empathetical relationship to it is to lose something that is part of our being. It is this concern, this sense of existing loss and greater impending loss, that motivates the nature-oriented part of the environmental movement. The science-oriented part of the movement, the writings that seldom mention nature, but examine the environment in detail, presents itself as more information-driven, more alerted to danger by the facts than by empathetical unease. What the motivations of individual writers are can hardly be determined, and must certainly be

a mix of fact and feeling, but in the arguments that are to be found in the environmental movement, there are two distinct types -- nature-oriented and science-oriented. For scientists, nature is an object of scientific study -- it is the environment; for nature-oriented environmentalists, nature is a subject or a totality that has aspects of being if not absolute beingness.

In the United States, in the 1960s and 70s, an argument about the environment developed that reconceptualized the relationship between man and nature as the relationship between scientific society and the environment. It was scientists who brought what had been "Nature" to the attention of the public as the problem of "the environment." It was not that nature-oriented writers weren't writing, or that nature-oriented organizations weren't active. But it was scientific argument that captured public attention. It was when scientists sounded the warning that people listened. Science has become the signal of importance, the flag that alerts us to pay heed.

The Environmental Style of Thought

Environmentalism is a diverse movement in which there are many different arguments about environmental crisis and

ecological balance. I have chosen to call one of these arguments the "environmental style of thought" because it is the one that dominates the current environmental debate. This argument is as much about science as it is about the environment, and it is part of a developing science-in-society debate.

The environmental style of thought has particular characteristics. It is:

- holistic
- science skeptical but science dependent
- quantitative/statistical
- science based
- evidence supported
- future oriented or aware.

The argument began taking shape in the 1960s and developed quickly in the 70s. Since then, even the nature-oriented groups have had to adopt the "science says so" stance of this argument. The nature arguers, though, place less emphasis on the critique of science, leaving this to scientists and Greens. Greens have tried to combine both a concept of nature and a critique of science, but their political efforts to further this vision, so prominent in Europe, have had limited effect in the United States, where third parties have no established place in the political structure. In the 60s, when the civil rights movement,

countercultural revolt, and the Vietnam war disrupted politics as usual, environmental arguments were tied in to nuclear protest, which had a political intensity that environmentalism, for all its popularity, has not arrived at in this country. The dominance of the scientific form of environmental argument, with its claim to objective neutrality, may keep such intensity at bay until a Bhopal-scale accident afflicts the United States.²

In the 1990's the environmental argument remains highly science dependent; its critique of science sometimes seems blurred. Perhaps, then, the environmental style of thought is simply science-dependent, not science-critical. That is a simpler case to make; in fact, it hardly requires making a case at all. Warnings about the environment depend on scientific information -- the very construction of nature as "the environment" already shows the presence of science. But the environmental argument, at the same time that it exemplifies the necessity of providing scientific evidence for a recommended course of action, is also the major example known to the public of the criticism of science.

Science Skepticism

The issue of environmental crisis polarizes attitudes

of trust in and skepticism toward science. There are groups and individuals who reject all scientific intervention and who adopt a back-to-nature philosophy and lifestyle; there are scientists, businessmen and women, and technical professionals who are occupationally committed to trust in science.

Both trust and skepticism are expressed along three lines --

- the uses of science
- the direction of science as practiced and institutionalized
- the theoretical orientation of science.

While environmentalists display skepticism along any or all of these lines, it is a mistake to make a simple equation between environmentalists and science skeptics. In any specific person or intellectual position there will be a mix of trust and skepticism. Scientists themselves may be skeptical or trusting and are usually both. The dichotomy of science-truster and science-skeptic cannot be understood simply as antagonistic actors located in specific occupational and social positions. Rather, the polarity stands for a division in thought. It is experienced by ordinary citizens wondering if their food is safe from pesticide residue, or indeed if anyone knows what is safe, while at the same time trusting that the body of chemical

and biological knowledge which invents pesticides can also provide medical remedies for physical ills. The same people who distrust the scientists who proclaim the safety of nuclear energy may be convinced that if science is only turned in the right direction, better solutions for providing energy can be found.

The science trust/science skepticism polarity is not yet fully developed in public debate, but it underlies argument that has been going on for some time. The first doubt about science -- science that can be trusted to bring progress -- came with the atomic bomb, and further doubts about science as the source of truth have come with the environmental crisis.

Compounding our vacillation between trust in science and skepticism about it is the existence of two separate and non-congruent frameworks of thought for understanding what authority to use to legitimate social action. The conceptual framework for science does not include a place for politics, since fact and value must be kept separate; the one for politics does not include a place for science, since its philosophical foundations predate the institutional rise of science and the permeation of technology into every aspect of life. The inadequacy of either conceptual framework used alone, and the concern over how far to trust science, can be followed through the

environmental arguments of the 1960s and 70s.

The Written Arguments

1962 Silent Spring :
the argument from science

Silent Spring was the book that catalyzed the environmental debate by making a scientific argument that went beyond the plea for nature. It gave scientific documentation of environmental damage. It was a banner argument that environmentalists could display as the emblem of their cause. Like all the major subsequent works, it sounded a strong warning. The book was a media and political event that had enormous impact on public consciousness. Its science-based, technical content gave new legitimacy to the cause of protecting nature and safeguarding human health from new, synthetic products developed in scientific laboratories.

Carson criticizes science for its irresponsibility in failing to study the effects of its inventions, for its complicity with the profit-driven chemical industry, for its arrogance in asserting that we can control nature. In its application in the use of pesticides, goals are unexamined, the pace is heedless, the use is indiscriminate and without forethought. At the same time that Carson critiques

science, she is committed to science as a way of reaching the truth. She is skeptical of the way science is being carried out, but trusting of the value of scientific inquiry.

Carson's recommendations for citizen participation in deciding goals for the use of chemical pesticides fits into the political framework in which citizen and state are linked by rights and responsibilities. Yet such goals must include the natural world as a determining force in human behavior; the natural world becomes as important a reference point as human nature is in political thought. We are left with the problem that rights and obligations between science and its users are not determined by the natural world in the way that rights and obligations between citizen and state are presumed to be determined by human nature. There is a gap between science and its uses that is not bridged philosophically or practically. The dimensions of that gap only begin to be visible in Silent Spring.

1966 Science and Survival:
science questioned

Science and Survival criticizes science for being out of control. Commoner argues that we have created technologies whose possible modes of behavior exceed our capability to predict that behavior, and that there is a biological aftermath of this failure. Part of the responsibility for

damage to life can be traced to a crisis in biology, a theoretical conflict between molecular and classical, cell biology that has hampered research into and vision of the system-wide results of piecemeal interventions into the natural world. We have come to fear scientists who seem to be sorcerer's apprentices.

Besides this problem at the theoretical level, there is one at the level of institution and practice. The process of scientific discovery and free discussion is hindered by nationalism and by military demands. Patterns of research support limit scientists' choice of problems, and technological application outstrips scientific knowledge of outcomes.

Despite this extreme skepticism of science, Commoner trusts science as a method of inquiry, as truth-seeking at its base, and wishes to defend its integrity. He maintains the traditional separation of fact and value which keeps science per se outside of the political framework even while individual scientists fulfill their responsibility as citizens to provide information to the public. Scientists should not decide specific social goals, and should not use politics to reach scientific goals. When scientists engage in politics, Commoner says, citizens begin to doubt the connection of science with truth. Commoner tries to make a triad of citizen, science, and government, but must

acknowledge that scientists are divided over their role in relation to government. Again, there is a conflict between two conceptual frameworks, one for politics and interests, one for science and objectivity.

1968 The Population Bomb:
the logic of numbers

The Population Bomb offers the vision of a frightening future brought on by biological imbalance between population and environment. Ehrlich brought population into the environmental debate; he added to its "science says" content. Unlike Commoner, Ehrlich does not hesitate to mix science with social policy, to recommend specific social actions on the basis of his scientific judgment. The book does not critique science or analyze how science is carried out in society. On the whole, Ehrlich is a science-truster, trusting not only in science as objective inquiry, but in the application of science to social problems. His preference for direct government action fits into the political framework. He perceives no contradiction between scientific objectivity and political action because there is no dispute to resolve -- Ehrlich is convinced that the source of the environmental problem has been located and that the solution, population control, is clear. The difference between the conceptual frameworks becomes important only when one recognizes differences in scientific

evaluations of the problem, and a need to resolve those differences in the political sphere.

1968 "The Tragedy of the Commons":
Hobbesian argument

"The Tragedy of the Commons" is too brief an essay to be used to characterize Hardin's position as science trust or science skepticism, although his reliance on quantification of social interaction and the use of mathematical calculation to explain social dynamics is scientific in tone. He states that there is no technological solution to the problem of overpopulation, but this is not because he doubts the value of technologies, but because technique is up against finite limits. This essay presents a concept of human nature as a scientific evaluation rather than as a philosophical judgment. Hardin calls for political solutions -- curtailing the freedom to breed -- and like Ehrlich presents his scientific judgment as if there were no contending scientific explanations and no conflict to resolve in a political sphere that has no established method for resolving scientific disputes. In not criticizing science or expressing doubts about it, Hardin is in a minority among environmentally concerned voices.

1971 Post-Scarcity Anarchism:
anarchist argument

Bookchin, in Post-Scarcity Anarchism, doesn't accept the conventional political framework. Arguing that politics and economics structured around scarcity are outdated, he sees the ecological crisis as an example, one of "apocalyptic proportions," of the tension between the actual present and the potential future. In his judgment, there is no solution to the crisis within the bourgeois-capitalist framework -- the framework that gives formal authority to government and pragmatic power to an exploitative economic system. The dichotomy science truster/science skeptic applies to those choosing between the conventional political framework and the conventional view of science; Bookchin's thought falls outside of these conventions. However, his thought is congenial to those who distrust science as a servant of industry or as hostage to politics.

1967 "The Historical Roots of Our Ecologic Crisis":
historical/ worldview argument

White's "Historical Roots of Our Ecologic Crisis" finds these roots in the Christian view that nature was made to serve man. Both science and technology, says White, begin their development in the Middle Ages, in a context of the Judaeo-Christian faith in perpetual progress. Particularly in Western Christian thought, man is both part of nature and

transcends nature; he can exploit nature. To avert worse ecological disaster than we have already brought upon ourselves, White concludes, we must change our values. White is referring to a view of human nature in his argument, a view that is not entirely absent from the Enlightenment conception of human nature that influences our traditional political framework. In White's analysis, science is put to use according to our worldview. It is not so much that science is to be doubted as it is to be seen as a historical creature. It may discover timeless laws but it is not free of the influence of its time. This analysis denies the total separation of science from values which is part of the conventional scientific view, and contributes to a revised evaluation of science.

1971 The Closing Circle:
technology questioned

In The Closing Circle, Commoner argues that the cause of our environmental problems is the type of productive technology that we have. In synthesizing new products, we have converted natural cycles into man-made linear events. Reductionism, the "dominant viewpoint of modern science as a whole," is unequipped to deal with natural complexity. The environmental crisis is both ecological and social, and science is poorly prepared for finding causes of the crisis in either sphere. The crisis is extreme, and Commoner

states that his judgment as a biologist is that if we continue on our current course, civilized human society will not be possible. Ecology, he says, must now subsume economy and politics.

In this conclusion, Commoner takes the science framework as the chief guide to deciding on social action. This does not mean that he would put science in the role of making social decisions, for he maintains the necessity of the separation between fact and value, and asserts that science is not a guide to moral judgments. But science is our check on reality, our point of reference for what will or will not occur given certain conditions. He remains critical of the uses, direction and theoretical orientation of science as it is now, while continuing to posit science (as ecology) as the source of solutions to our problems. Commoner aims for a less reductionist science and for joint scientist/citizen participation in deciding on the uses of science. He tries to connect the two conceptual frameworks, one for science, one for politics.

1972 Only One Earth:
global perspective

More than any other book before it, Only One Earth brings the third world into the environmental equation, reviewing how its population, economy, and agriculture are linked to the industrialized nations. Barbara Ward and René Dubos have

a technoprogressive theme rather than an out-of-control critique of science and technology like Carson and Commoner, or a behavioral emphasis like Ehrlich and Hardin. They recognize that the acceleration of technological progress now threatens life on the planet, but they explain this acceleration as the result of consumption pressure. The technological order, in their analysis, is rooted in the individualistic desire for goods.

They give little attention to structural connections between government and institutionalized science, even though they construct a triad of science/market/nation to explain the global nature of the environmental crisis. They find that the triad has to be rethought, but suggest individual solutions for each element of it, not rearrangement of their connections. Science should become more integrative, the market should factor environmental costs into its cost-benefit analyses, nations should recognize the imperative of a socially and morally responsive world order.

Ward and Dubos criticize science but hold it as the route to truth. Like Commoner, they maintain the separation between fact and value, but unlike him they don't try to connect the frameworks for science and politics. Citizens, they say, cannot judge scientific facts (although it is implied that they can evaluate risks revealed by those

facts). They recognize the political complexities of global environmental crisis, but rely on the truth-giving power of science to indicate essential goals. They use both frameworks for their thought, but keep them separate.

They are very much science trusters, who envision that moral sense combined with scientific dispassion will overcome the materialist desires that are at the root of environmental excesses. Yet at the same time they harbor a deep doubt about the scientific enterprise, a fear of hubris that is discussed below.

1972 The Limits to Growth:
finite world argument

The Limits to Growth presents economy and environment according to a mathematical model of growth trends in natural resource use, population, agricultural production, industrial production, and pollution. The authors make long-range predictions facilitated by computer calculations. This method, and the use of systems theory, made it possible to include complex interrelationships that had previously eluded systematic summary. Limits was as startling as Silent Spring and, like that book, became an exemplar for subsequent reports. Meadows et al concluded that if current growth trends continued, the natural limits to growth would be reached within 100 years. They explained exponential growth and introduced the notion of overshoot and collapse,

with the resultant extreme difficulty or even impossibility of recovery under greatly reduced circumstances: smaller population, less production, less material well being. Thus, they said, man-determined limits must replace natural ones in order to divert disaster.

Limits itself follows the scientific model of hypothesis and test with evidence in the form of mathematical expression; it is almost devoid of social comment. In its scientificity it is the culmination of the science-documented environmental arguments that began with Silent Spring ten years earlier. It is so neutral in tone that it offers no basis for classification as either science-skeptical or science-trusting. That style of neutrality is itself scientific, but it is not evidence of a position on science. For Meadows et al, as for all the authors, science is the route to truth about the natural world. Its argument is almost entirely within the scientific framework.

All the major environmental books of the 60s and 70s are warnings. Most are skeptical of some aspect of science in society -- its uses, its direction, or its theoretical orientation, but all accept the epistemological authority of science.

As the decade from 1962 to 1972 progresses, the

argument about the environment expands from the relatively narrow issue of pesticide use to warnings about diverse technologies, multiple pollutions and health threats, environmental overload through population pressure, and finally to the planet-wide dangers of interventions into the environment.

With each warning about our current course and future danger, the complexities of matching an ideal scientific disinterest with the interests inherent in political and economic action become increasingly apparent. The environmental argument tacks back and forth between reliance on science and criticism of how it is carried out in society, between trust in its power to get at the truth, and skepticism about the goals it actually serves. Inside the cool logic of science is perceived the heated impatience of the sorcerer's apprentice.³

The power that science gives us can now change nature itself; the first unequivocal recognition of this came with the splitting of the atom. Ward and Dubos compare this power to split the atom to Promethean fire. Prometheus (a Titan, son of Ge, the Earth and Uranus, the Sky) stole fire from Zeus (king of the gods) and gave it to men. The angry Zeus chained Prometheus to a rock where he endured what was meant to be endless torment until he was rescued by the hero Heracles. Zeus further retaliated with manipulations that

caused Pandora to open the box that released all the ills that plague mankind; only hope remained in the box.

Promethean fire stands as a symbol of all the bold interventions into nature made possible by science ambitious for mankind. At a level deeper than reasoned argument, there exists a profound unease about the power and outcomes of science, along with a sense of the impossibility of ever again living without it.

At a more mundane level, the natural world that for a time seemed only a backdrop to our political activities is now felt as an uncertain terrain on which all our activities are played out. Its land may become desert, its waters poisoned, its atmosphere fail to protect us, but we can no longer blame capricious gods or unknown forces. The natural world has become the constant reminder that we must live up to our scientific knowledge.

NOTES TO CHAPTER FIFTEEN

1. On the change in meanings given to nature that has accompanied the scientific and industrial revolutions, see Carolyn Merchant, The Death of Nature: Women, Ecology and the Scientific Revolution (San Francisco: Harper & Row, 1980). Merchant chronicles the shift from an empathetical relation with nature to an instrumental relationship.
2. Bhopal, a city in central India, is the site of an industrial accident in 1984 which killed approximately 4,000 people. Poison gas (methyl isocyanate, more toxic than cyanide) was released in an explosion at a Union-Carbide chemicals plant that produced pesticides; the escaping gas covered the slums and residential areas of the city. Besides those who died as a result of exposure to the gas (about 1,500 within three days, the rest in the years up to 1992), another 20,000-40,000 suffered injuries. (Sources: "Indian Court Seizes Union Carbide Dividend," (Reuters), The New York Times, 5/23/92, p.37; Sanjoy Hazarika, "Court in India to Seize Union Carbide Assets," The New York Times, 5/1/92, p.D7.; Barnaby J. Feder, "Carbide to Sell India Assets to Build Hospital for Bhopal," The New York Times, p.D1.; "Extradition Bid on Bhopal," The New York Times, 3/28/92, p.40.; Edward A. Gargan, "Settlement on Bhopal is Accepted," The New York Times, 10/4/91, p.D4.)
3. The complexities of the relationship between the environmental movement and the scientific ecology which is emerging at the same time are explored by Wolfgang Sachs in "Environment and Development: The Story of a Dangerous Liaison," The Ecologist, 21 (6), November/December 1991. pp.252-57. Sachs notes that for those committed to development, "attributing absolute value to nature for its own sake... would have barred the way... to the exploitation of nature." (p.252) Both environmentalists and the "development elite" draw on scientific ecology, the environmentalists using it to make a case for holistic approaches, the development supporters using it to make claims for techno-control of the environment. Of environmentalism, he observes:
 "As a movement highly suspicious of science and technical rationality, it plays anew the counter-melody which has accompanied the history of modernity ever since romanticism. But as a science-based movement, it

is capable of questioning the foundations of modernity and contesting its logic in the very name of science." (p.254)

Sachs sees the environmental movement as basing its challenge on ecosystems theory, which gives it scientific credibility, but also "opens the way for the technocratic recuperation of the protest." (p.255) "Ecosystem technology," he concludes, "turns finally against ecology as a worldview." (p.256)

I thank Narahya Jolly for bringing this article to my attention.

CHAPTER SIXTEEN

SCIENCE AND POLITICS:

ENVIRONMENTAL THOUGHT AND CONSERVATIVE THOUGHT COMPARED

This chapter evaluates the use of Mannheim's style of thought analysis as applied in this study.

Mannheim's Method

Using Mannheim's terms, I have defined an environmental style of thought focused on science. I took Mannheim's "Conservative Thought" as a model to follow in analyzing environmental thought because that essay led me to see that the environmental debate does not fit easily into our conventional political framework. In following Mannheim, I found both similarities and differences between his case -- conservative thought -- and mine -- environmental thought.

To review, Mannheim's method relies, he says, on the analysis of meanings; it does not judge the veracity, validity or accuracy of arguments. Whether or not Carson was accurate in her argument does not determine its

influence on a developing style of thought or its success in capturing the experience of some group of people. The same holds true for Commoner, Ehrlich, and all the others. Furthermore, changed meanings are given to familiar terms; "science", "technology", and "scientific advances" are reconsidered in the environmental argument, and viewed from a skeptical angle which diminishes the positive value that postwar society has given these terms. Nature is reconceptualized as environment.

Mannheim identifies elements of the conservative style of thought by referring to the events, people, or ideas that contributed to the development of conservatism. I have abstracted out these elements, and take them to be general to any style of thought (as previously discussed in Chapter Six). These are in brief form below, with Mannheim's conclusions for conservative thought, and mine for environmental thought, compared. The key theoretical or epistemological problem, and the characteristics of "basic intention" are the major elements of Mannheim's analysis.¹

A polarizing event gives impetus to the style of thought: the French Revolution for conservatism, the atomic bomb for environmental thought.

An organizing center can be identified -- the center of contention around which groups develop their already

existing differences: politics for conservatism, the uses of science for environmentalism.

A polarity characterizes opposing styles of thought: conservative/liberal, science truster/science skeptic.

An effective group mounts an oppositional response to a prevailing mode of legitimating social action: the nobility for conservatism, relatively independent scientists for environmentalism.

A "basic intention" is articulated by the style of thought, a previously unarticulated purpose which comes out of the group's experience: harking back to an earlier way of life for conservatives, preserving and protecting the natural world and human health and life for environmentalists.

A "key problem," an epistemological issue, unifies the thought and shows how the group thinks things differently: opposition to natural-law thought for conservatives, opposition to reductionist thought for environmentalists.

"Basic intention" and "key problem" are Mannheim's central categories in his analysis of style of thought; each category contained characteristics specific to the thought style. The characteristics, or "authentic manifestations" of the basic intention of conservative thought were its preference for details rather than for overall structure, for concrete situations rather than abstract ones, for a

qualitative (qualified) concept of liberty rather than a universalistic one. For environmental thought these characteristics are an emphasis on system complexity and interrelatedness, the frequent use of facts and quantification, the giving of a warning or stressing the use of prediction as necessary responsible action, and a moral imperative to speak out. "Authentic manifestations" are related to life experience -- in the case of the scientist environmental writers, to what we call occupational experience.²

The characteristics related to the key problem of conservative thought -- the opposition to Enlightenment thought -- were the substitution of History for Reason as the crucial force in human affairs, of the individual for the universal, of the irrational for the rational, of the dynamic for the static. For environmental thought, the key problem is the opposition to reductionism, and its theoretical characteristics are that wholes replace parts as elements of analysis, interrelatedness counters isolated elements, multiple or cyclical causes replace single or linear causes, time awareness replaces atemporality.

On Basic Intention and Authentic Manifestations

Basic intention (Grundintention) and its "authentic manifestations" in the style of thought are related to a group's life experience in Mannheim's theory. I think of basic intention as the desire for a particular kind of world which underlies the argument or style of thought. For Kettler, Meja and Stehr it is the basic design of the argument. The difference between these two interpretations seems to me to be a matter of emphasis on either the motivation for or the intellectualization of the group's purpose. Mannheim can be read to include both meanings. Either way, the point is that social situation and style of thought are connected. The connection is not a strictly deterministic one; ideas reflect their place of origin, but class origin does not determine a predictable content independent of other circumstances.

As noted at the end of Chapter Five, while Mannheim makes a convincing connection between the life experience of the nobility and the conservative argument, he does not "prove" that the connection must occur or could not be otherwise. This is an inevitable outcome of an interpretive method.³ Like Weber, he finds that historical conditions make certain ideas relevant or not. Furthermore, the same ideas can be taken up by different groups, as when Marxist

thinkers applied the concept of dynamic reason previously formulated by conservatives. A documentary analysis reveals the basic intention in the argument; a historical survey shows the conditions that make this intention of some moment. Documentary analysis was introduced by Mannheim as a method of describing worldview.⁴ We document (give evidence of) our understanding of a worldview with example "objects"; we illuminate the meaning of each object by seeing it as a "document" of the wider frame of reference of the worldview.⁵

Mannheim's analysis of the concepts of conservative thought is altogether deeper and more complex than mine of environmental thought. He had exceptional insight into the intellectual currents of social and political life, and in addition, he considers authors who were consciously ideological, who opposed specific conservative concepts to specific Enlightenment concepts. Of the authors I consider, only Bookchin is attuned to concepts in this way in his writing; the others are writing at a much more direct, empirical level. I am attempting to apply Mannheim's method beyond the consciously ideological type of argument that was his example.

Mannheim did not consider all aspects of the experience of the nobility in explaining the basic intention of conservative thought. He left out the militarism of

Prussian life, and its crudity. Similarly, I have not considered all the aspects of the experience of being a scientist -- I have left out, for instance, what it is like to work in large, hierarchical, bureaucratic organizations. Mannheim offers no explicit criteria for selecting some experience over others. He may have done as I have, selected what fits by working back from the argument to the experience, and left out both some experience that fit and some experience that didn't.⁶ While some critics find this direction of analysis theoretically objectionable, it is in keeping with Mannheim's theory, in which the linking of ideas to experience is not a deterministic one. The link is historically specific -- without the French Revolution and Enlightenment thought, Prussian nobles would have had different arguments to make, different elements of their experience to emphasize. Content of a style of thought, as Mannheim points out, cannot be decided a priori from social circumstances. Again the example is that both the wealthy and later the working class made dynamic reason a conceptual element of their styles of thought.

The basic intention of the environmental argument is to achieve a world where there is a balance between humans and nature. Specifically, as argued by scientists, it is to preserve and protect both nature and humans through the knowledge of science -- a science that must be carefully

watched so that its results are not misapplied.

Environmentalists, like Mannheim's conservatives, want a world in which they feel at home. For the nature-oriented environmentalists, this is not just having nature preserves and better pesticide laws -- those would only be patchwork solutions. In the desired world there will be a whole different attitude toward nature. In the desired world of the scientist environmentalists, there will be a different attitude toward the uses of science and the philosophy that directs it.

The characteristics, or manifestations of the basic intention of environmental thought, to balance humans and nature, I have given as emphases on:

- system interrelatedness
- complexity
- quantification
- factuality
- prediction/warning
- moral responsibility to provide information.

All of the scientist-authored works analyzed display these characteristics. Those of Bookchin, a social thinker, and White, a historian, do not emphasize system interrelatedness, quantification, or prediction. The systems-analyst authors of The Limits to Growth share in the scientific model of argument, but convey less sense of moral

alarm than the scientist-authors.

I have indicated that the scientific training and practice of the scientific authors is reflected in their environmental arguments, and I have thus related this experience to the "basic intention" of the argument. But Mannheim does not relate basic intention to the people who make the argument; he relates it to the class they argue for. Mannheim found a basic intention in the Prussian nobility, who had a predisposition to traditionalist views. Möser and Müller and others formulated the nobility's arguments but did not share their experience (although they may have wished to). Scientists, by comparison, act like a "new class" -- technical intellectuals who begin to formulate their own aims and speak for themselves.

To say that the characteristics of an argument for an ecological world, when that argument is made by scientists, share elements with arguments that scientists are trained to make is not surprising, but neither is it a given. Scientists may argue in a humanistic mode, not a science-based one, as René Dubos did in his many books, or as C.P. Snow did in his essays. A scientific argument needs a scientific opportunity. The environmental crisis was the opportunity for this type of argument to reach a wide public.

Why did these scientific arguments of the 60s and 70s

become best-selling books? It does not seem likely that it is their literary style that made them popular; all are well written but none is a "good read." And only the most environmentally committed of readers will attend to all their content. What made them sell? The simple explanation is that they had news, it was bad news, and bad news sells. Furthermore, they had unarguable bad news -- because it was scientific. (That, at any rate, is how the reports are presented; arguments of course followed.) While government and industry were pushing scientific good news, environmental authors told a different story. But there is more to the reception of the environmental argument than an interest in disaster. The response includes the very element that the scientists do not articulate -- a feeling for nature and a desire to keep nature whole. Though scientific arguments for the environment do not usually display this empathetical impulse, the holistic worldview that they express makes them resonant with the concern for the wholeness of nature.

The Effective Group

Mannheim does not go into detail about what I call the "effective group," the group that stands behind the style of

thought. In Mannheim's example, the effectiveness of the group exists potentially, because of its social position; the group does not necessarily achieve its program. The effectiveness of scientists, I think, exists potentially because of their position in the social structure of knowledge; they have a voice of authority, not on a political or class basis, but on epistemological grounds. They too, do not necessarily achieve their goals. The danger of pesticides is acknowledged after Carson's book, but the use of many pesticides increases; the ecological crisis is recognized but production technology does not change and exploitation of nature continues; 19th-century German conservatives do not keep reforms from going ahead. It is not yet clear who the effective group is (or will be) in the environmental movement overall, but the effective group for making the environmental argument has been scientists -- life scientists holding relatively independent research positions.

Mannheim's conservatives were not only effective in getting their argument into public discussion, they were those primarily affected by what they opposed. The same is not exactly true of the scientists who oppose environmental destruction. In fact, part of the environmental argument is that we are all equally affected, in the end, by what happens in the environment. The social reality is that some

are more affected than others -- those too poor to be able to change how their environment is treated and too uneducated to recognize dangers to themselves. Yet, if scientists can be said to be making an argument for a larger class affected by the environmental crisis, then like Möser and Müller they are an educated class (an intellectual elite though not a social one) articulating the case for those who cannot fashion the argument themselves.

In what way can scientists be considered greatly affected by the environmental crisis? One possible answer is that their specialized knowledge of its extent and effects puts them in the front line of awareness, if not necessarily of vulnerability, to its dangers. Another way to answer the question is to see if the environmental crisis was an opportunity to respond to something else that was greatly affecting them. In the case of biologists, this could have been the change in biology that shifted research from the cell as a unit of analysis to the molecular structure of its chemical components. This change has been seen by those involved, and others, as a contest between holism and reductionism as methodological imperatives.⁷ Just as the Prussian nobility was in danger of losing the rights and status of hereditary lordship, the non-molecular biologists were in danger of losing the tradition in which they had been trained and a future direction for research

which would recognize their holistic goals. In the holistic tradition, behavior constitutes structure; in the reductionist approach, structure determines behavior. These are two very different ways of looking at the world.

Class

In Mannheim's theory, groups with opposing styles of thought should have opposing social positions. But this does not seem to be true for (holist) environmental scientists and (reductionist) non-environmental scientists, for they are similarly situated in a professional class. The groups are opposed on theoretical grounds within the world of science, but not socially opposed within the wider society. (A social opposition may be true of environmentalists and non-environmentalists generally, as studies by Dunlap, Van Liere, Cotgrove, and Milbrath indicate.)⁸ It is also now the case that conservatives and liberals may be of the same class, although that was not the case at the time of the formation of the opposed arguments. Styles of thought express already-existing differences among social groups, said Mannheim, and he construed these differences as class differences, but this dynamic may be particular to an era of class formation.

One of the most noticeable differences between Mannheim's example of conservative thought and mine of environmental thought is that the 20th-century United States does not have a class structure remotely comparable to 19th-century Prussia. The United States did not ever have the equivalent of the 19th-century European class system with its clearly marked divisions and clearly divided interests. Our classes are more amorphous, more numerous, more overlapping, more mobile, less identified with, less antagonistic to one another. Class differences would always be significant differences in the European society which Mannheim knew, and major differences on what society should be like would always be class differences. In our very diverse society, differences can have many more locations than are offered by a simple model of class structure. There were already-existing differences between holistic and reductionist scientists when the environmental argument began, but they were not class differences. They were not even differences among class fractions. They were differences of theoretical and methodological approach within a skilled class.

One of Mannheim's propositions about distinctions between classes, however, suggests distinctions that are possible within them. Mannheim found that in class society there would be one class oriented toward the past, one

toward the present, and one toward the future.

Conservatives favored the past, the bourgeoisie the present (especially what was new in it), and the proletariat the future. These orientations were responses to actual or projected social change: conservatives wanted to hold on to their established position; the bourgeoisie, newly arrived, wanted to keep the new order going; the proletariat, with little in the present or past in their favor, wanted real change leading to a different future.⁹ Within the professional class of scientists now, there seem to be different orientations toward time, not as responses to social change, but as responses congruent with theoretical orientation. Ecology recognizes the future as part of the cyclical process of life; molecular biology concerns itself with the timeless factuality of molecular structure. This orientation to time is not a close parallel to the type Mannheim described, but the use of a time axis as a way of seeing distinctions in the thought of different groups is still revealing.

Difference and Parallels

Mannheim's sociology of knowledge was directed toward showing the social origins of social and political

arguments, toward unmasking interests. This type of unmasking was done by Marx in his analysis of capital and capitalists. Mannheim was routinizing it and neutralizing the approach about three-quarters of a century later. Today, about three-quarters of a century since Mannheim's early work, there is nothing remarkable about showing a connection between interests and arguments. People expect and recognize ideological bias, at least when it is not their own. But while finding interests in ideas is not remarkable in itself, actually making the connection in detail can point to unnoticed or untheorized implications of familiar arguments -- in the case of environmental thought, to the problems of integrating scientific and political frameworks of understanding. Another 20th-century difference is that ideas don't stay attached to their social origins as long as they did in 19th-century Europe. They move around more quickly, are widely communicated to different groups, are quickly modified and adopted for other purposes. Concepts can rapidly depart from their origins, and become attached to other interests.¹⁰

Mannheim gives a dialectical account of the development of thought style: Bourgeois rationalism suppresses traditionalism until that older view becomes relevant (under conditions of class differentiation of political interests) and takes the new form of conservatism. The parallel for

environmental thought would be that scientific reductionism suppresses holism until the environmental crisis makes holism relevant, when holism takes the new form of environmental thought. This is a plausible reading of the course of events in postwar biology, but to establish this influence requires more investigation than is possible here.

Like Mannheim's conservatives, environmentalists want not just to think different things, but to think things differently. As conservatives gave a different meaning to liberty, environmentalists give a different meaning to scientific progress. But even more significant, they give a different meaning to cause and effect by positioning that action in a cyclical rather than a linear context. Philosophically, this is another parallel to a return to older modes of thought -- to ancient Greek thought, in this case.

Just as Romantics and conservatives had to rationalize the Romantic view by making it self-conscious, though they were reacting against a highly rationalized view of the world, the nature-oriented environmental thinkers must make use of science, though they oppose its mechanistic approach to life. Mannheim observed that "It is the fate of irrationalism, as of everything else, to be comprehensible only upon the plane on which the age rests."¹¹ Even irrationalism, then, had to be rationalized -- to be

counterposed to reason using reason's terms. Our age rests on the plane of science (a particular form of rationalism), and even objections to science must be made comprehensible in scientific terms.

Mannheim found that the conservative "tendency" generated historical thinking (the emphasis on specifics of time and place, and on the metaphysics of history rather than of reason). What does an environmental tendency generate? Not holism (the emphasis on wholes rather than parts, and on emergent properties which cannot be reduced to constituent elements), which is already developed. Rather, I think the important thing is time awareness opposing atemporality -- another version of a resistance to timeless universals. This is another possible parallel to Mannheim. His concern about "historical and political ways of thinking" is part of a larger question about "how long we have had (or, at least, have seen as problematic) a disjunction between 'nature' and 'history'." That is, a philosophical and methodological distinction between the natural sciences and the historical cultural sciences. Mannheim wanted more than a history of ideas explaining this distinction; he wanted to know what social forces accounted for the split between nature and history. He recast the development as

"a contradiction between two worldviews and ways of thinking, borne by social forces: the

disjunction between liberal and conservative thinking which arose at the turn of the nineteenth century in direct connection with the concrete political and philosophically self-reflective debate about the French Revolution."¹²

This distinction between "natural-scientific and historical thinking... prevails today in the sphere of methodology," Mannheim affirms.¹³ One element of the natural-law thinking of the Enlightenment is timeless universality; scientific law follows in the same vein. Environmentalism dependent on scientific ecology cannot fully resist the timeless abstractions of science, but it can draw on that area of scientific thinking most responsive to the time element that defines living organisms. In environmentalism time awareness becomes an acute consciousness of the amount of time we have left to solve our ecological crisis and assure our survival.

In defining politics as the organizing center of conservative thought, Mannheim asserted that "the political factor must be autonomous and must become the primary nucleus around which new groupings crystallize." This is another way of describing the formation of class agendas in the developing nation state. The environmental parallel would be that science is autonomous (from political or other influence, as politics was from religious influence), and that groups define themselves around issues that have science as their center. Mannheim's autonomy is an abstract

autonomy, on the level of construction of theory, not of day-to-day affairs. Science has this kind of theory-level autonomy, but there are not yet major groups crystallizing around it, around disputes over what science should be, as there were around disputes over what the state should be. I believe that the possibility of such disputes is growing, and that the science-skeptic argument will continue to define itself.

One Style of Thought or Two?

Since the environmental argument has two major strains:

- science oriented, information driven
 - nature oriented, empathetically driven,
- applying Mannheim's method of analysis to this distinction raises the question, Do they combine in one style of thought -- "environmental" -- or are they two separate styles of thought?

Style of thought differences, Mannheim says, are most noticeable at the level of definition of the problem. Different styles of thought bring forth different ontological levels.¹⁴ Enlightenment thought hypostatized Natural Law; conservative thought hypostatized History. So if nature-oriented environmentalists hypostatize Nature, and

scientific ones hypostatize Science, are they two different styles of thought? Is the tendency of nature thinkers to respond empathetically and the tendency of scientific ones to respond analytically parallel to the abstract tendencies of liberal thought and the concrete tendencies of conservative thought -- again suggesting two separate styles of thought? On the side that answers "yes" is the recognition that the yearning for reunion with nature is an already established type of thought; the scientific environmental argument is a new type. There is a parallel here to feudal (already existing) and Romantic (new) thought opposing Enlightenment thought. On the "no" side is that this distinction is, by itself, not enough to establish a style of thought; there would also have to be different key problems and basic intentions, along with the other elements of a style of thought.

Science Criticism

There are many forms of science criticism:

- Frankfurt School criticism of instrumental reason
- critiques of technology
- holistic life sciences critiques of reductionist science
- feminist criticism of masculinist bias and

overobjectification of the world

- social construction of knowledge critiques of scientific objectivity
- environmental critiques.

Environmental criticism and the criticism of science intersect. I realize that because environmental voices are so diverse, that to name the scientific type of environmental criticism the "environmental style of thought" may seem unfair or inaccurate. But because the science-based argument is what made the environment a public issue, and is a departure from the nature-oriented arguments that preceded it and must now to some extent include it, I have decided that calling the science-based argument the environmental style of thought is correctly descriptive. This argument scientifically legitimates the vision of all human life as part of nature (the inclusive environmental view), and thus will be an indispensable argument for that vision so long as science remains central to our lives.

Mannheim notes that a new word is often the sign of a new social phenomenon, and that though traditionalism and conservatism overlap, the appearance of the term "conservatism" indicated its social and political appearance.¹⁵ Similarly, environmentalism and traditional concern for nature overlap, but the appearance of the term "environmentalism" indicates a new, scientific version of

nature appearing in social and political life.

Content and Context

The plan of the the study was to take the environmental movement as an area where a clear case could be made that science legitimates social action, and to determine, using Mannheim's sociology of knowledge, if there was a coherent argument focused on the uses of science and thus meeting a preliminary condition for the development of a style of thought -- having a center of contention around which there are opposed arguments. The opposed arguments, which appear on the surface to be environmentalist and anti-environmentalist, would then hypothetically have been about the nature and uses of science. This opposition was observed to exist between environmental and anti-environmental arguments and within environmental arguments. Environmental arguments alone were then analyzed to see if indeed their science skepticism was extensive enough to support the existence of a polarity around science in which environmentalists actively oppose a status quo of science in society. This presence was found and was located among environmentalists who were also scientists.

There was a two-fold purpose in the study -- to give

examples of scientific legitimation (implied by arguments); to describe arguments for social action according to a method which makes distinctions in content that can be related to the differing traditions and conditions of opposing groups. As with Mannheim's "Conservative Thought," much is left undone in relating content to social context. This bias is built into the method, I now realize, which concentrates on key epistemological problem first, and basic intention second, both of which are arrived at by a documentary analysis of texts. The historical research which is necessary to establish social context is not provided for in the method. What the method does do is show where that historical research must take place -- what group to look at, what conditions to investigate, what events to measure the impact of. This means that at the end of this study, there is a whole other work to be done -- an investigation of post-World War II scientific endeavor in the life sciences and in the developing field of ecology, in combination with an account of the environmental crises of the time and the responses to them by scientifically trained persons.

Frameworks

The use of "Conservative Thought" as a model for this study was an experiment. Could an early 20th-century analysis of early 19th-century thought be applied to late 20th-century thought in the late 20th century? One difficulty would be having little historical distance from which to make the analysis. The change in the center of contention (from politics to science) added complexity to the analysis, and required the identification of new characteristics contained by the categories basic intention and key epistemological problem. Besides this difficulty of internal analysis, there was a problem in applying Mannheim's analysis of social context.

For environmental thought, as compared with conservative thought, not only was there not a simple class structure to work with as context (as in 19th-century Germany), there was not a good fit of arguments to the political framework that gave meaning to conservative thought, and that addresses problems of class interests and social location. Science and technology doesn't threaten political position and class interests as directly as it threatens the body -- its health, possibilities for longevity, and genetic constitution. Science is now seen to be a double-edged sword that can harm as well as help (and

in its asocial relevance it is like religion -- religion offers heaven or hell regardless of class position). Environmental interests do not neatly fit into the political framework.

In discussing this shift from politics as reference point to science as reference point I have concentrated on environmental arguments, linking environmental thought to the critique of science. But of course not all critique of science is environmental, and not all environmentalism is critique of science. The observation that environmental issues don't fit the political framework, and do fit a science one, may be (exactly) the outcome of scientists framing the issue. Against the conclusion that it is only because scientists made the environmental argument that it doesn't match political concepts, is the fact that politicians didn't frame environmental issues well, not only because of anti-environmental interests, but because they didn't have the language that captured the problem. The arguments of scientists provide the same sort of paradigmatic delineation of issues for today's society that political theorists did for the 19th-century society studied by Mannheim.

It is my contention:

- that there is an un-named style of thought emerging which I have called environmental thought

-- that its center of contention is science
 -- that this signals that there is a conceptual shift
 occurring collectively in our society, from understanding and
 legitimating from within a political framework (state and
 citizen with rights and obligations determined by a
 philosophy of human nature) to doing this within a
 scientific framework (science and its users/recipients
 without clearly established rights and obligations; facts of
 nature replace philosophy of human nature; politics remains,
 but with a changed identity).

The following step (using Mannheim's method) should be:

-- that there is a new, or newly conscious, social group
 that bears the environmental style of thought (for example,
 some studies characterize environmentalists as a knowledge
 class not tied to the production sector of capitalist
 society). Such a group would be Mannheim's effective social
 group. But this group is not so easily found.

The Problem of the Effective Social Group

There are so many strands to environmentalism that its
 proponents cannot be squeezed into one class. In
 restricting my analysis to arguers/writers, I am in part
 saying that an elite group is skilled in certain kinds of

discourse -- an observation that is nothing new. More specifically, the group is scientists who are relatively independent of funding and politics (academic or governmental). They are relatively free to make the critical argument, and this distinguishes them from other, equally competent and knowledgeable scientists.

Environmentalism is tremendously inclusive as an attitude; that's part of its strength. Practicing environmentalists are a much smaller group than attitudinal environmentalists, but they still are spread around the middle class. And some practicing environmentalists are from poor communities resisting the use of their backyards for dumps or incinerators. Environmental allegiance expands, so the professing group grows larger. The effective group is another matter, but wherever the questions are scientific, there will be a knowledge elite involved.

Mannheim puts much more effort into analyzing the content of his conservative style of thought than he does into analyzing its effective group. And he emphasizes historical currents leading to conservatism more than he does a specific group project to get it going. However, if there's a style of thought, then there's a coherent argument which comes from a specific location in society no matter how diffuse the many contributing strands. That, at least,

is how I understand Mannheim's premise for conservatism, although it's possible that this is a dynamic peculiar to politics and modern class society. The more general premise that there are social origins for knowledge does not disallow multiple origins so long as some group(s) are specifically excluded from origination. That is, the argument can't come from just anywhere. In the case of environmentalism, industrialists, growth-oriented businesses, resource-exploiting occupations, are excluded.¹⁶ I have found the origin of the science-based environmental argument among holistically-inclined life scientists but I have not investigated in detail how the conditions these scientists perceived could incline them to make their argument.

In Mannheim, class society and political thought go together. It is the differences in life experience in relation to the elements of the political framework, structured by class division, which result in different intents/tendencies and then in different political arguments (styles of thought). Today, differences in experience in relation to elements of the science framework result in different tendencies and arguments about the direction of science in society and environment. If Mannheim's analysis applies (arguments come from specific social locations), it seems to me that for critique to arise, there must also be

some events in social structure -- openings or closings -- following on the polarizing events that are an impetus to a new style of thought.

What was the social-structural opening (and/or closing) for the (oppositional) response to the scientific/ technological aspect of the environmental crisis? The event-opportunistic opening was the environmental awareness following on Silent Spring and various disasters, but this is not the same as a social-structural opening/closing. Both scientists and nature-oriented groups responded to these events, but they were not events that affected social structure (as did the French Revolution).

For the argument to come forth, something had to have happened -- to be perceived to have happened -- to the world of those who put forth the argument. The nature group saw wild nature disappearing. Scientists in certain life-science disciplines, it is possible, saw the natural world - the subject of their studies -- being disrupted; they saw a balanced and functioning environment endangered.

Was the opening/closing for scientists specifically within the organization of scientific activity? I believe it may have been the increasing dominance of the reductionist molecular biology approach that appeared to be, to traditional biologists, the closing of opportunities and the ending of a tradition, while at the same time the

environmental crisis offered an opening for anti-reductionist theorizing.¹⁷

The growing critique of science follows on science's greatest "successes," just as the critique of the Enlightenment followed on the "success" of the French Revolution. It has taken shape among scientists themselves, and among feminists, environmentalists, and constructivist theorists of knowledge. Scientists and non-scientists combined in the 1960s and 70s in the United States to bring the environmental movement to the point where it became politically visible. Both were concerned with the being of science, with the implications of its traditional separation from the sphere of values. Could science remain autonomous in this way? Should it be allowed to if it could? These questions underlay the more immediate problem of what to do about the environment.

Science as a Center of Contention for Styles of Thought

Since we are in the midst of a conceptual shift from politics to science, both types of arguments and legitimations are used. With science as a center of contention, arguments can be developed around actions oriented toward the practical world -- science and

technology -- or around epistemological issues -- science and objectivity: is science our most objective knowledge, is our most objective knowledge our most valuable knowledge, is there any objective knowledge outside our definitions of it?

With science and politics both being centers of contention, two changes in the centrality of politics are possible over time:

A) Science replaces politics as ideologically central: If science replaces politics as a center, commitment to science replaces political commitment for characterization of thought. "Progressive" and "conservative" become analogies rather than accurate descriptors for these commitments, and there is a spectrum of opinion on what science is/should be that ranges from traditionalist to radically revolutionary. Scientists and philosophers of science, and also the layperson, will contribute to the defining of this spectrum. There will be Popperians (classicists) and Feyerabenders (radicals) in the scientific community, flat-Earthers and amateur scientists among the public.

A growing debate on scientific programs for the future could resemble religious arguments more than political ones -- ecology and environment vie for importance of place with the state, and both camps make allegiances to non-

political entities (to objective science or to the global environment) while trying to construct a morality that can encompass genetic engineering and backpack nuclear weapons.

B) Science takes equal place with politics as ideologically central: Since science and politics are now inextricably linked, and since the (ideal) objectivity of science and the partiality of politics are in basic contradiction, the continuing difficulty of discussion over issues like ozone layer damage, drug-induced abortion, pre-conception biological engineering, prolonged machine-supported life in hospitals, AIDS, the scientific possibility but political impossibility of ending the starvation of millions, the allocation of resources to the exploration and militarization of space, the reliance of political decisions on scientific expertise -- all these may contribute to new types of thought-styles, centered not just on politics, but on science as well.

If the legitimacy of social action must be scientifically as well as politically validated, this worldview will separate the industrialized and technologized nations still further from the poorest part of the third world, where nationalistic movements and political allegiances continue to dominate. In the West, science has been so successful in establishing a position as superior

knowledge that politics must often cover itself with the mantle of science. This raises the question whether science can 'free' itself from politics (as it earlier 'freed' itself from religion), as its ideals require, or whether it will just become another form of politics. An equally important question is whether a science free of politics would be a more even-handed guide to common good because less partisan than politics, or a totalitarian rule because of its total claim to the best method of decision making.

Science and Values

As new styles of thought develop around these questions, the difficulties that they raise bring the discussants inevitably to the question of values. If the objectivity of science is to be tested, we must see if science favors some values over others. If we can't establish objectivity free of values, then what values does science have? If science has values, how is it better as an ideological guide than politics, which has long given us a way of dealing with our values? (Politics is a limited and imperfect way of dealing with values, but an important one.) If the values of politics are only competing interests, none of which can establish ethical superiority, do the values of

science offer a way out, or are they only another interest?

What values will guide our use of technology if science does no more than proclaim itself a self-evident value (like truth), and if politics confines itself to competing self-interests?

And, for the sociology of knowledge, if what that discipline does is show both scientific and political values to be only self-interests, is it performing a needed critical role or, rather, a nihilistic one?

This study, of course, does not answer all of these questions. It attempts to clarify the science/politics tension and indicate the shift occurring from one set of explanations and legitimations to another. The final outcome of that shift is not yet determined. Legitimation could conceivably be redistributed fairly equally between the two frameworks of explanation, or science may win, as I think it will, superior authority.

Postscript

The Earth Summit conference in Rio (the United Nations Conference on the Environment and Development) took place in June 1992 as I was writing the final chapters of this work. It is one of many signs that the central political issue for

Western societies has changed. For centuries of nation-state building, that issue was how to govern, or what makes government legitimate. Now it is how to use science, and not misuse it, to keep from destroying life on the planet. Global environmental threat is an issue for all societies, but it has a special status in the West, whose nations cannot claim they need to play catch-up in economic development before they act to protect the environment. The old political problems have not gone away for Western nations; they remain. But politics is taking on a new identity, structured around science and technology instead of around theories of government and of the rights and obligations of citizen and state.

In the past twenty years environmental arguments have been extended to social and economic problems, and are changing our understanding of what it is that makes actions to solve these problems acceptable or not. The old political framework of argument ranked opinions on how to solve society's problems along a conservative/liberal spectrum. It is being replaced by a scientific framework that ranks them on a spectrum of stances toward how science operates in society. On the one hand are those who trust that the practice and outcomes of science will work to the general good; on the other are those who are skeptical, who find the direction of scientific research and technological

development is too often a threat to the ecological balance of people and nature. A new polarity is forming, one of science-trusters and science-skeptics, and it is likely to replace the old conservative/liberal polarity as we enter the next century.

It is not the validity of science that science-skeptics doubt, but its direction and uses. Nuclear radiation, pesticides, toxic effluents, are seen to endanger life from the genetic level on up. The environmental type of argument equates scientific knowledge with both creative and destructive power that must be kept in hand. It has become another way of looking at political, economic, and lifestyle choices, one that does not first call on democratic political concepts.

The new kind of argument about social and economic problems is fact-based and scientifically oriented; the old kind is based on theories of government and human nature. The new kind of argument weighs, calculates and predicts; the old kind invokes principles and ideals, traditions and utopias. The new kind of argument, in its environmental form, was developed by scientists -- especially those in the life sciences -- who gave a warning about the environment which was also a warning about science.

At a time when repressive governments are being replaced by new democratic ones, and racial and economic

may seem absurd to say that the old politics is no longer the issue. But it is not that pressing political issues don't count or that politics is being eclipsed -- it is the philosophical and theoretical basis of politics as we have understood it that is coming to an end. We have as much trouble integrating our current hold on values with politics as we do integrating our understanding of science with it. And science, values and politics intersect when, for example, sexual orientation or teenage sexual activity are judged to be matters more biologically than socially influenced. Increasingly, it will be scientific opinion about the environmental outcome of productive technologies and market choices that will be used to justify political action taken to effect the environment both directly and indirectly, not concepts of citizen and state, based on political theory. Even those who are skeptical of the benefits of science must rely on science to provide information and to give confirming or disconfirming evidence. Science dominates our institutions as a form of knowledge, and as a source of legitimation for their actions.

If the Rio conference, and other efforts in the same direction, do not advance us toward a solution of the environmental crisis, questions about political forms and theories will be moot. Equally, if political mechanisms

theories will be moot. Equally, if political mechanisms cannot be found for working toward ecological balance, arguments about the right uses of science will be hollow. Politics and science are inextricably linked, and politics can no longer be the same; nor can science retain its traditional aloofness from political process as we undergo the shift from one framework of argument and justification to another.

NOTES TO CHAPTER SIXTEEN

1. Mannheim does not summarize individual works, as I do, but analyzes their conceptual content. I give a detailed account of environmental arguments because they are not established as a category of thought in the way that conservative arguments are.
2. For Prussian nobles, life and occupation, i.e., hereditary lordship, were the same.
3. Mannheim does discuss the problem of "imputation" of political and social tendencies to concepts in Conservatism, pp. 37-43.
4. In "On the Interpretation of Weltanschauung" in From Karl Mannheim.
5. The documentary method was adopted and modified by Harold Garfinkel, Studies in Ethnomethodology (Englewood Cliffs, NJ: Prentice Hall, 1967) as a basic technique and tenet of ethnomethodology: We all treat actions and statements in our everyday world as documents of other meanings beyond the immediate one, and these other meanings help explain the immediate event to us. Garfinkel applied this method to social interaction; here I again apply it, as Mannheim did, to written arguments within their social and historical context.
6. The beginning of a style of thought is a "mode of relating to the world." The method is to work back from the thought to its intention (which derives from a mode of relating) to the group who has the tradition.
7. Commoner refers to the divergent purposes of molecular and organism-centered biology in Science and Survival. For an account of reductionist and antireductionist arguments in the philosophy of biology, see Alexander Rosen, The Structure of Biological Science (Cambridge: Cambridge University Press, 1985), a basically reductionist treatise written for biologists about the issue of biology's autonomy from or provincial relation to the physical sciences. Biological reductionism is critiqued from a Marxist point of view in Steven Rose, Molecules and Minds: Essays on Biology and the Social Order (Milton Keynes, England: Open

University Press, 1987). Biochemist Erwin Chargaff, a prominent defender of the old, pre-molecular school, is quoted in Horace Freeland Judson, The Eighth Day of Creation: Makers of the Revolution in Biology (New York: Simon & Schuster, 1980) as saying: "My main objection to molecular biology is that by its claim to be able to explain everything it actually hinders the free flow of scientific ideas. But there is not a scientist I have met who would share my opinion." (p.222).

8. These studies indicate that environmentalists are more likely to be employed in the service sector than the production sector. Being young, female, and white also increases the tendency toward environmentalism. so do left politics, but Milbrath finds that political orientation does not explain environmentalism. See:

Riley E. Dunlap and K. Van Liere, "The New Environmental Paradigm," The Journal of Environmental Education, 1978 (4); K. Van Liere and Riley E. Dunlap, "The Social Bases of Environmental Concern: A Review of Hypotheses, Explanations and Empirical Evidence," Public Opinion Quarterly, 1980, 44 (2); Stephen Cotgrove, Catastrophe or Cornucopia: The Environment, Politics and the Future (Chichester/New York: Wiley, 1982); Lester W. Milbrath, Environmentalists: Vanguard for a New Society (Albany: State University of New York Press, 1984).

9. From Karl Mannheim, pp.169-71.

10. Such movement of ideas is recognized in Weber's "elective affinities."

11. Conservatism, p.65.

12. Karl Mannheim, in Conservatism, pp. 33-35. The editors discuss this formulation of the question in their introduction to the book.

13. Ibid., p.36.

14. Conservatism, pp.56-58.

15. Conservatism, pp.76-77.

16. See note #8 above.

17. In The Eighth Day, Judson says of the change in biology:

"As understanding of the cell was invaded by new kinds of molecules, biology was invaded by new kinds of

scientists, most famously the physicists.... For biochemists, molecular biology also represented a painful loss of control of the century-old continuity of their tradition -- a break which became irreparable as the number of students entering research doubled and doubled again in the fifties."(p.215)

The biologist E.O. Wilson has commented that "Someone said not long ago, 'Pollution will do for the study of ecology what cancer did for molecular biology'." Quoted in Anne Chisholm, Philosophers of the Earth: Conversations with Ecologists (New York: E.P. Dutton & Co., 1972).

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