

The Anthropogenic Earth: Integrating and Reifying Technology, Environmentalism, and Religion

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“SO LONG AS WE do not through thinking, experience what is, we can never belong to what will be. . . . The flight into tradition, out of a combination of humility and presumption, can bring about nothing in itself other than self deception and blindness in relation to the historical moment.” Martin Heidegger²

INTRODUCTION

A principle result of the Industrial Revolution and associated changes in human demographics, technology systems, cultures, and economic systems is a planet where the dynamics of major natural systems are increasingly shaped by human activity—the anthropogenic Earth. Continued stability of both human and natural systems will require development of the ability to ethically and rationally engineer and manage coupled human-natural systems in a highly integrated fashion. Clearly, this Earth systems engineering and management (ESEM) capability does not yet exist. It is, moreover, apparent that the current science and technology base, institutional and governance structures, and ethical, philosophical, and religious systems are not yet adequate to the challenge. But failing to develop an ESEM capability does not lessen human domination of the Earth; it just facilitates evasion of responsibility.

The institutional and knowledge gaps may be apparent to some. However, the profound philosophic and religious challenge posed by an Earth increas-

¹ This paper is a summary version of a longer paper that covers these areas in much greater detail. See B. R. Allenby, “Observations on the Philosophic Implications of Earth Systems Engineering and Management,” Batten Institute Working Paper (Batten Institute, Darden Graduate School of Business, University of Virginia, Charlottesville, VA., 2002). To the extent some of the discussion in this paper may strike some as incomplete or, worse, somewhat superficial, I apologize and refer the reader to the full text.

² M. Heidegger, *The Question Concerning Technology and Other Essays*, W. Lovitt, translation (New York: Harper Torchbooks, original essays 1952–1962, collected in 1977), pages 49, 136.

ingly shaped by one species, and the concomitant need for ESEM, is seldom recognized. For ESEM is not just the beginning of a fundamentally different relationship between a dominant species and a planet; it is also the culmination of 2,500 years of human history, which has in fits and starts resulted in the ascendancy of technological humanity. As Barrett notes, “A great chapter in human history—twenty-five hundred years long, from the beginnings of rational thought among the Greeks to the present—has come to an end. . . . [a situation which] calls us towards some other dimension of thinking of which we can catch now and then perhaps only glimmers.”³ That dimension of thinking is ESEM, and the purpose of this paper is to begin building the intellectual foundation of ESEM as a rational and ethical response to the anthropogenic Earth.

The fundamental importance and great complexity of the ESEM discourse should not be trivialized. Environmentalism as a discourse has been powerful and valuable but, applied outside the implicit boundaries it has observed for the past century, carries within it the same potential for destruction as any ideology. The technologist discourse, until it is leavened with a more sophisticated appreciation for the complexities of coupled human-natural systems, and a concomitant reduction of hubris, similarly carries within it seeds of high modernist disaster. The policy discourse, dominated by environmentalist ideology, the outmoded concept of the absolute sovereignty of the nation-state, and a postmodernist drift (lack?) of values, is hopelessly inadequate to the task it faces. And yet there are some reasons for optimism. If, as Heidegger suggests, we have the strength of will to perceive that we have arrived at the end of one phase of human history, and the beginning of a new one—the age of the human Earth—we can also recognize that it will be human choice as to what that Earth could, or should, be.

I will begin by briefly discussing the growing scientific consensus regarding the increasing human influence on fundamental natural systems, and then introduce the concept of earth systems engineering and management (ESEM). The major part of this paper will then attempt to embed ESEM in the philosophic and religious discourse of the past few centuries. At this early stage, such a discussion can be neither complete nor definitive. Rather, what I do hope to do is ground ESEM in the world as it now is—not as we wish it were—and with this more sophisticated understanding of where we stand now, offer some ideas about our options for the future, thus helping to enable rational and ethical choice.

³ W. Barrett, *The Illusion of Technique* (Garden City, New York: Anchor Books, 1979), 222.

Earth Systems Engineering and Management (ESEM)

The foundation of the ESEM discourse is the recognition that the critical dynamics of most fundamental natural systems are increasingly shaped by human activity.⁴ The physics and chemistry of every cubic meter of air and of surface water has been affected in one way or another by human activity. Critical dynamics of fundamental chemical cycles such as those of nitrogen, carbon, sulfur, phosphorus, and the heavy metals, as well as the dynamics at all scales of atmospheric, oceanic and hydrological systems, are increasingly dominated by the byproducts of the technological activities of our species.⁵ The biosphere itself, at levels from the genetic to the landscape, is increasingly a human product. At the genomic level, for example, the human genome has been mapped, as has that of selected bacteria, yeast, plants, and other mammals, which in turn enables the genetic engineering of species. At the ecosystem level, Gallagher and Carpenter remark in *Science* that the concept of a pristine ecosystem, untouched by human activity, "is collapsing in the wake of scientists' realization that there are *no places left on Earth that don't fall under humanity's shadow*."⁶

This domination has evolved over centuries of human cultural, technological, and economic development. Population growth over time, linked to the state of technology, has been steadily upwards, from perhaps four million, 10,000 years ago at the beginning of the agricultural revolution, to some 300 million, a thousand years ago, to 6 billion currently. Human population growth clearly accelerated strongly with the advent of the Industrial Revolution, as did economic activity, which followed similar growth patterns on both a global GDP and a per capita basis.⁷

⁴ It is important to note that in many cases the human component of natural systems may be quantitatively small, but if it impacts critical points in the system, it may well dominate important systems dynamics. Thus, for example, the atmosphere contains about 750 gigatons of carbon, next to which human emissions from energy and deforestation, approximately 9 gigatons of carbon per year, appears trivial. The anthropogenic releases, however, are sufficient to increase the carbon dioxide content of the atmosphere from roughly 260 to 350 parts per million, dramatically affecting the ability of the atmosphere to absorb energy that would otherwise be released into space, thus changing the energy density and behavior of the atmosphere in many ways. It is human impact on the *dynamics* of these natural systems that is important, not the relative size of the human component compared to other elements of the systems.

⁵ J. R. McNeill, *Something New Under the Sun* (New York: W. W. Norton & Co., 2000), is perhaps the best general discussion. A more detailed discussion is provided in Allenby, *Philosophic Implications*.

⁶ R. Gallagher and B. Carpenter, "Human-dominated Ecosystems: Introduction," *Science* 277:485 (1997), page 485, emphasis added.

⁷ McNeill, *Something New*; A. Grubler, *Technology and Global Change* (Cambridge: Cambridge University Press, 1998).

Against this background of the anthropogenic Earth, ESEM can be defined as the capability to rationally and ethically engineer and manage human technologies and systems, and related elements of natural systems, in such a way as to provide the requisite functionality while facilitating the active management of strongly coupled natural systems.⁸ Obviously, ESEM in many cases will deal with large and complex systems, with complicated biological, physical, governance, ethical, scientific, technological, cultural and religious dimensions and uncertainties. Under such conditions, the usual human assumption of "control" fails, and the appropriate approach requires humility, a strong appreciation of ignorance and uncertainty, and a continued dialog with integrated human/natural systems. Accordingly, ESEM is best thought of as a capability that must be developed over a period of decades, rather than something to be implemented in the short term. Note also that the question is not whether humans should *begin* to design and engineer the world, for that has already occurred. Rather, the question is whether we will in future do so *rationally and morally to the best of our ability*.

One example of ESEM is the recent effort to (re)design the Florida Everglades, a unique ecosystem that has been profoundly affected not just by human settlement patterns, agriculture, tourism, industry and transportation systems, but also by the various management regimes attempted over the past 100 years. In response to the imminent danger of collapse of the Everglades as a functioning ecosystem, a \$7.8 billion Everglades "restoration" project has begun. Its intent is to restore waterflow in non-human systems to functional levels, while continuing to support industrial, agricultural, settlement and other human activity. It is obvious, however, that the Everglades is now, and will continue to be for the foreseeable future, a product of human design and human choices. Human modification of the fundamental dynamics of the Everglades has already occurred: there is no "pristine" system to return to, and the Everglades will never be "natural" again. It will be an engineered system, and it will display those characteristics—including preservation of flora and fauna, if that is a design objective, and the system can be engineered to do so—that humans choose. The challenge is not to restore a hypothetical past state, but to exercise ethical and rational choice based on projections of systems evolution over time. This is the essence of ESEM.

Other ESEM examples that come readily to mind involve anthropogenic atmospheric perturbations such as climate change, large urban areas viewed

⁸ B. R. Allenby, "Earth Systems Engineering and Management," *Technology and Society* 19(4):10-24 (2000/2001).

as integrated systems, and the death of the Aral Sea.⁹ Study of these and similar cases leads to several foundational observations critical to ESEM and, more broadly, understanding the human Earth:

1. The world is more profoundly multicultural than most people understand or are willing to accept.
2. The world is far more complex than most people understand or are willing to accept. The "high modernist" hubris and technocratic blindness that, for example, Robert Moses and Le Corbusier exemplified as regards urban design are inappropriate and dysfunctional given this complexity.
3. Culture in general, and the religious impulse in particular, are far more important in constructing the world than most people understand or are willing to accept.
4. The anthropogenic Earth is a reification of human beliefs, especially those regarding technology, environmentalism, and religion. These three discourses in particular are tightly coupled and coevolved.

In order to establish a firm ground for a forward-looking discourse such as ESEM, it is first necessary to perceive the current state of affairs clearly and realistically. To do otherwise is to continue mythologies that, although comforting and perhaps even beautiful, can do grave damage as they become reified in a world where natural systems are increasingly part of the human experience. To begin with, note that institutionally, culturally, and economically, the world today is predominantly a product of the Western experience.¹⁰ This observation should not be read as cultural triumphalism, or as denigrating the scientific and technological developments of other cultures. But it was in Europe, especially the rationalistic and scientific Europe of the

⁹ These examples are explored in more depth in Allenby, *Philosophic Implications*.

¹⁰ As A. Giddens comments in *The Consequences of Modernity* (Stanford, CA: Stanford University Press, 1990), pp. 174, 136:

[Modernity] is institutionally based on the nation-state and systemic capitalist production... Both have their roots in specific characteristics of European history and have few parallels in prior periods or in other cultural settings. If, in close conjunction with each other, they have since swept across the world, this is above all because of the power they have generated. No other, more traditional, social forms have been able to contest this power in respect of maintaining complete autonomy outside the trends of global development. Is modernity distinctly a Western project in terms of the ways of life fostered by these two great transformative agencies? To this query, the blunt answer must be 'yes'... The modes of life brought into being by modernity have swept us away from *all* traditional types of social order, in quite unprecedented fashion.

Enlightenment, where the threads of institutional evolution, religious conviction, scientific and technological capability, cultural systems, and economic theory and market development, all came together. The result was not just the development of ad hoc technologies or scientific discoveries, but the generation of a cultural juggernaut—a set of uniquely powerful networked cognitive systems—which swept over the globe. The most powerful challenge to this structure in the past 150 years has been Marxism—and, of course, Marx himself was a quintessential Enlightenment figure.

The Enlightenment as global culture has succeeded, ironically, because of two somewhat paradoxical characteristics:

1. Only a structure which, like the European Enlightenment, contained its own critique and negation within itself could possibly become the basis for a globalized cultural framework in a multicultural world; and,
2. The Enlightenment framework succeeds only to the extent it negates itself as a unique source of "truth."

Understanding this context is critical to perceiving and understanding the anthropogenic Earth, for natural systems that, prior to the Industrial Revolution, were relatively unaffected by human systems are now systematically affected by them. As such predominantly natural systems thus become integrated with human systems through, for example, the commoditization of carbon in global climate change agreements or genomes, they increasingly reflect in their dynamics the behavior of human systems. They thus grow to reflect the myriads of human beliefs and activities with which most of us are familiar, from religion to economic systems to everyday behavior patterns. In other words, the philosophic division between mind and body which has characterized elements of philosophic dialog ever since Descartes is obsolete at the level of global systems: human religious, philosophical and cultural structures are, and will be, increasingly reified in the physical structure and dynamics of natural systems. Human mind will become reintegrated with the physical world not at the scale of the human body, but as the structuring spirit of virtually all natural systems—and this will happen not as some grand metaphysical apocalypse, but simply as a result of the number of human beings, and their cumulative economic, political and cultural behavior, and their intentionality, their will. It will be the emergent behavior of a radically new, human world.

This result arises from the profound shift in the relationship of humans to the planet that marks the last century in particular. The journey has been

from "being in nature" (e.g., hunter/gatherer society),¹¹ to opposing and controlling nature (the Enlightenment, Industrial Revolution, and settlement of the American West), to absorbing nature into the human experience. Perhaps it is best, if somewhat simplistically, summarized by saying that human experience was largely endogenous to nature; now nature is largely endogenous to human experience.

That the anthropogenic earth constitutes the reification of Mind in the physical world is apparent; what or whose cognitive processes are involved somewhat less so. Here, Vico's comments on human history, itself increasingly intertwined with the dynamics of natural systems and cycles, are prescient:

It is true that men have themselves made this world of nations, although not in full cognizance of the outcomes of their activities, for this world without doubt has issued from a mind often diverse, at times quite contrary, and always superior to the particular ends that men had proposed to themselves. . . . That which did all this was mind, for men did it with intelligence; it was not fate, for they did it by choice; not chance, for the results of their always so acting are perpetually the same.¹²

Complex systems evolve, in paths that will reflect the actions of myriads of cognitive systems acting at all scales—but it will not evolve as planned by any one of them. The knowledge and control necessary for that task are lacking; the contingency of human systems would at any rate preclude that. Given, however, the dynamic of reification of human belief structures in the anthropogenic earth, the importance of two important human discourses, the environmental and the technological, is apparent. These are complex discourses but an important strand through both of them is their relationship to the religious experience of the West, and, in particular, the Enlightenment. To that we now turn.

¹¹ There is a strong tendency among environmentalists (and some New Age theologies) to romanticize non-industrial "primitive" cultures as inherently more sustainable, more "natural," and more ethical in their treatment of non-human systems. This naïve fiction generally reflects an ignorance of history, and human behavior and culture. Broadly speaking, what has changed over time has been the technological capability to exploit environments, and make them more amenable to humans, not the underlying drive to do so. Indeed, it is undoubtedly that drive that has to some extent led to the unique success of the human species, and, within that species, to some societies and not others.

¹² Quoted in E. P. Thompson, *The Poverty of Theory* (London: Merlin, 1978), p. 291.

Environmentalism, Cultural Constructs, and Theology

Modern environmentalism is a complex cultural phenomenon. Those who consider themselves environmentalists cover a broad spectrum in most societies, from those who identify and attempt to mitigate specific problems to those for whom "Nature" has become synonymous with "God." This fundamental division in the environmentalist movement is frequently characterized as the "shallow" greens versus the "deep" greens. In the following discussion, I will generally deal with environmentalism as a belief system and ideology, with the understanding that my remarks are consequentially generic—and, of course, not intended to deny that humans are having significant impacts on earth systems.

An interesting aspect of environmentalism is that, unlike most discourses that, thanks to postmodernism, have been deconstructed in the public mind, it remains generally unchallenged. Indeed, it can be urged with some validity that environmentalism is the most totalizing discourse in the world today (albeit not the most powerful, for environmentalist policies are routinely trumped by economic, national security, energy, and other more traditional policy structures). Accordingly, precisely because a totalizing discourse inevitably shapes culture and context to a universal and unrecognized degree, the objective, the normative, and the mythic will be far more difficult to unravel in environmental debate than in other areas of human endeavor. This also implies that environmentalism will become a powerful prism through which other positions, disciplines, and discourses are perceived, and a belief system against which other human values—employment, individual freedom—are judged and criticized.

An elementary point for social scientists, but one that tends not to be understood by either environmentalists or technologists, is that concepts such as "nature," "environment" and "wilderness" do not reflect absolute reality. Rather, they are cultural constructs—ideas that are contingent to their particular time, place, and culture. A primary example is the concept of "sustainable development." Here the history of the cultural construct is quite clear; after all, it was popularized in a specific book, *Our Common Future*.¹³ Over the past fifteen years, however, "sustainable development" and the looser term of "sustainability" have become a principal goal of environmentalism, so what began as a cultural construct now defines for many the desired endpoint for all human activity—the teleology of sustainability. In the pro-

¹³ WECD (the World Commission on Environment and Development, also known as the Brundtland Commission), *Our Common Future* (Oxford: Oxford University Press, 1987).

cess, the contingency of the term, although quite explicit in its history, has vanished.

Another instructive example is the cultural construct of "wilderness." As Redman notes, "Wilderness is not an easy-to-observe ecological condition as much as it is the interplay between the constantly changing state of nature and the constantly changing state of the human mind."¹⁴ Thus, in the Bible, as in most pre-Romantic literature, "wilderness," as opposed to gardens or agricultural areas, was evil: it was where people went when they were bad. Indeed, for many early Enlightenment Romantics the source of "wilderness" and the wild—viewed at the time as a flaw in Creation—was the Biblical Fall.¹⁵ It is thus perfectly understandable why, when the European settlers first came to North America, they carried with them this image: the pioneer was heroic precisely because she or he tamed a wild, empty, evil wilderness, and made a fruitful agrarian environment of it. The common cultural view was expressed, for example, in John Quincy Adam's 1846 appeal to Americans to settle Oregon, "to make the wilderness blossom as the rose, to establish laws, to increase, multiply, and subdue the earth, which we are commanded to do by the first behest of the God Almighty."¹⁶

But this image changed, especially in the United States. As it was settled, the cultural construct of "wilderness" shifted almost completely, to mean first adventure, then, in the context of the almost entirely mythic American West, to become a defining element of what it meant (usually for the white male elite) to be an American. Wilderness became the place where paradise was recovered; indeed, it became the Other, the sacred within which God was to be found.¹⁷ The irony, of course, is that the usual discussion of religion and environment in the West tends to turn around Genesis 1:28¹⁸ and similar passages from the Bible and other foundational religious texts. But it is the opposite that is closer to the truth: environmentalism clearly embeds within it important elements of Christian eschatology.

¹⁴ C. L. Redman, *Human Impact on Ancient Environment* (Tucson, AZ: University of Arizona Press, 1999).

¹⁵ M. H. Abrams, *Natural Supernaturalism: Tradition and Revolution in Romantic Literature* (New York: W. W. Norton & Company, 1971).

¹⁶ C. Merchant, "Reinventing Eden: Western Culture as a Recovery Narrative," in W. Cronon, ed. *Uncommon Ground: Rethinking the Human Place in Nature* (New York: W. W. Norton and Company, 1995).

¹⁷ Cronon makes the point that "to gain such remarkable influence, the concept of wilderness had to become loaded with some of the deepest core values of the culture that created and idealized it: it had to become sacred." *Uncommon Ground: Rethinking the Human Place in Nature* (New York: W. W. Norton and Company, 1995), p. 73.

¹⁸ "And God blessed them [Adam and Eve], and God said to them, 'Be fruitful and multiply, and fill the earth and subdue it; and have dominion over the fish of the sea and over the birds of the air and over every living thing that moves upon the earth.'"

The roots of much of the deification of nature arise in large part from two elements of the Enlightenment. The first involved the scientific revolution, with its implicit conviction that discovering "natural laws" was, in effect, knowing God. It is not far from seeing the hand of God in natural laws, to seeing nature as evidence of God, to seeing nature, especially in a world where everything else seems to have been made secular, as God. The second, and in a way contrary, Enlightenment project, was the Romantic movement (particularly Rousseau), which, in an effort to reframe medieval Christianity in terms that were compatible with Enlightenment scientific advances, increasingly posited the sacred in "Nature."

This Enlightenment project to reconstruct the sacred, God, as Nature, succeeded. McKibben speaks for many environmentalists—and clearly illustrates the religious force behind environmentalism—when he takes the interesting Nietzschean viewpoint that the "end of nature" necessarily means that "God is dead." Indeed, the pantheistic and the Christian merge for him in "nature": "Wild nature, then, has been a way to recognize God and to talk about who he is. How could it be otherwise? What else is, or was, beyond human reach? In what other sphere could a deity operate freely?"¹⁹ Note here again the need to define Nature as Other in order to maintain its essential sacredness, necessarily rejecting the recognition of the anthropogenic state of the Earth.

The moral hazard of the theology of environmentalism is powerful in at least two ways. First, taken to the logical extreme it implies a world with the fewest numbers of human beings possible: "if nature dies because we enter it, then the only way to save nature is to kill ourselves. The absurdity of this proposition flows from the underlying dualism [between the human and nature as sacred] it expresses. . . . when they [deep greens] express, for instance, the popular notion that our environmental problems began with the invention of agriculture, they push the human fall from natural grace so far back into the past that all of civilized history becomes a tale of ecological declension."²⁰ This is, of course, an obvious restructuring of the story of the Fall and expulsion from Paradise—only Satan has been replaced by civiliza-

¹⁹ B. McKibben, *The End of Nature* (New York: Random House, 1989), p. 77.

²⁰ Cronon, *supra* n. xvii, page 83. While this profoundly anti-human posture would seem beyond the pale, Earth First! founder Dave Foreman, a hero of many environmentalists, has commented that (quoted *ibid*):

Before agriculture was midwived in the Middle East, humans were in the wilderness. We had no concept of "wilderness" because everything was wilderness and *we were a part of it*. But with irrigation ditches, crop surpluses, and permanent villages, we became *apart from* the natural world. . . . Between the wilderness that created us and the civilization created by us grew an ever-widening rift.

tion and human settlement, and God by wilderness "that created us." The outward forms have changed to the words of environmentalism, but the structure and story are that of Christianity. And to achieve salvation—wilderness—we must destroy Satan, who is essentially all human evolution since the hunter-gatherer stage. Quinn in his popular environmentalist novel *Ishmael* takes the same position: "The land of the Fall lay within the Fertile Crescent and was surrounded by nonagriculturalists. . . . The tillers of the soil were watering their fields with the blood of Semitic herders. . . . agriculture is the lot of the fallen." And, if the point weren't clear enough, Quinn makes it clear that it is civilization that will destroy the world: "We're definitely living in a way that's going to put an end to creation. If we go on, there will be no successor to man, no successor to chimpanzees, no successor to orangutans, no successor to gorillas—no successor to anything alive now. The whole thing is going to come to an end with us." And why? "We're destroying the world because we are, in a very literal and deliberate way, at war with it."²¹

This powerfully restates the Christian story: to be human—to have evolved at all—is to be fallen. And the environmentalist eschatology is also restated from Christian roots, for recovery of Eden can only be accomplished by an expiation worthy of the sin of civilization: the apocalypse necessary to turn an urbanized world of six billion people into a pre-agricultural society of perhaps scores of millions would be fully as devastating as anything in traditional religious eschatologies—and yet this vision is foundational for environmentalism. It is not just that the ethical implications of a population collapse of this magnitude should give pause to almost anyone. It is also that this position profoundly misunderstands what it is to be human in the first place, for the biological characteristics of our species—large brain size, modern anatomy—coevolved with cultural and linguistic capabilities, and technology. Thus, to urge the abandonment of technology—to argue that virtually any technology, beginning with agriculture, is illegitimate—is, in essence, to argue for the renunciation of the human as a species, and a return to prehuman animality. Only a powerful theology indeed could support such a suggestion—species suicide to atone for alleged cosmic evil.

Technology, Culture and Theology

If the environmentalist discourse is one side of the anthropogenic Earth, then surely technology is the other, for it is technological evolution that

²¹ D. Quinn, *Ishmael* (New York: Bantam Books, 1992), pp. 171, 173, 178, 238, 130.

underlies it. The role of technology as the intermediary through which humans impact the physical world and its systems, and in a non-trivial sense create their future, requires that we explore some of its more relevant implications.

To begin with, it is important to differentiate between two very different technological activities: designing and engineering artifacts, versus ESEM. Simply put, if an engineer is designing a toaster, she or he does so *within an existing cultural and ethical context*. The activity presupposes by its existence a market system within which a device to toast bread can be engineered, manufactured, sold, and used, and that society finds such a pattern of commerce acceptable and useful. To the extent there are ethical dimensions of the activity, they are explicitly established in legal and regulatory structures. But the same cannot be said of earth systems engineering, for in that case it is not an artifact within an existing context that is being designed; *it is the cultural and ethical context itself*. Thus, designing the Everglades is not just a question of building the proper dike here, or creating a channel there (artifactual engineering): it is selecting a desired outcome—continuation of human presence in Florida with a level of protection of wading birds in the Everglades, for example—that cannot be justified on solely objective grounds, but involves creation of the context itself. The ethical and, indeed, religious dimensions of the Everglades project are not exogenous to the activity, but are important design objectives and constraints.

For most people, technology and technological systems are self-evidently real and rational. But this appearance, true as it is in many ways, begs an important question: why have technology and the underlying scientific enterprises, although based on the achievements of many cultures, become dominant only in one, the Eurocentric civilization that now dominates much of the world? The reasons for this are not trivial, and do not appear to have anything to do with innate capabilities of individuals or the objective dimensions of technology. Rather, technology in the Western tradition has been uniquely coupled with religion. Thus, Noble notes that "the technological enterprise [is] an essentially religious endeavor . . . [that] has been and remains suffused with religious belief," and argues persuasively that, with the resurrection of Christian millenarianism in the late 1100's by the Cistercian abbot from Calabria, Joachim of Fiore, a linkage in Western culture between technological evolution and progress towards the Second Coming was created: "[the Joachimite Franciscans] formulated what would become an enormously influential and enduring eschatology of technology, a perception of the advancing useful arts as at once an approximate anticipation of, an

apocalyptic sign of, and practical preparation for the prophesied restoration of perfection."²²

This integration of Christianity and the technological enterprise is very apparent in the foundational writings of early European scientists. Consider, for example, one of the first utopian fables, Francis Bacon's *New Atlantis*. The centerpiece of the "fable," as Bacon calls it, is Solomon House, "dedicated to the study of the works and creatures of God. . . the finding out of the true nature of all things (whereby God might have the more glory in the workmanship of them, and men the more fruit in the use of them)." The inhabitants are devoted to science and research, which is clearly equivalent to serving God: "we maintain a trade, not for gold, silver, or jewels; not for silks, not for spices, nor any other commodity of matter; but only for God's first creature, which was Light. . . knowledge of the affairs and state of those countries to which they were designed, and especially of the sciences, arts, manufactures, and inventions of all the world; and withal to bring unto us books, instruments, and patterns in every kind."²³ The focus on applied knowledge (that is, on technology), its self-evident linkage with Christianity and the workings of the mind of God, and the religious mandate to advance the technical arts, is apparent. Bacon has in essence projected the New Jerusalem, and it is a scientific and technological utopia. In this light, it is striking that Solomon House in *New Atlantis* was the model for the scientific societies that followed Bacon, especially the Royal Society of London, whose members regarded him as the founder of the new scientific philosophy. And indeed the view of technology as a means of salvation was a powerful current underlying the evolution of institutional technology, through the Rosicrucians and, later, the Freemasons. The latter were instrumental in founding many of the institutions supporting Western technological development, including the Royal Society, the French *La Loge des Neuf Soeurs* (sometimes called "the UNESCO of the eighteenth century"), and the principle early engineering schools in France (the *Ecole des Ponts et Chaussées*, the *Ecole Polytechnique*). These in turn formed the model for later engineering institutions such as West Point.

Nor has this grounding in Christian millenarianism disappeared from modern technology. While usually implicit, it occasionally becomes quite explicit, especially in the two areas of biotechnology and artificial intelligence, where the power to create new "life," traditionally reserved to deities

²² D. F. Noble, *The Religion of Technology* (New York: Alfred A. Knopf, 1998), pp. 4-5.

²³ F. Bacon, *New Atlantis* (Montana, U.S.: Kessinger Publishing Co., 1627, republished 1999), pp. 308-09.

through creation myths, comes closest to realization.²⁴ This also is hardly new; Bacon's chief scientist in *New Atlantis* explains their bioengineering program thusly:

. . . we make (by art) in the same orchards and gardens, trees and flowers to come earlier or later than their seasons, and to come up and bear more speedily than by their natural course they do. We make them also, by art, greater much than their nature, and their fruit greater and sweeter, and of differing taste, smell, colour, and figure from their nature. And many of them we so order as they become of medicinal use. . . . By art, likewise, we make them [beasts and birds] greater or taller than their kind is, and contrariwise, dwarf them, and stay their growth; we make them more fruitful and bearing than their kind is, and, contrariwise, barren and not generative; also we make them different in colour, shape, activity—many ways. *We find means to make commixtures of divers kinds, which have produced many new kinds, and them not barren, as the general opinion is. . . neither do we this by chance, but we know beforehand of what matter and commixture, what kind of those creatures will arise.*²⁵

²⁴ Thus, for example, the artificial intelligence researcher Hans Moravec wrote in *Mind Children: The Future of Robot and Human Intelligence* (Cambridge: Harvard University Press, 1988), page 4: "It is easy to imagine human thought freed from bondage to a mortal body—belief in an afterlife is common. But it is not necessary to adopt a mystical or religious stance to accept the possibility. Computers provide a model for even the most ardent mechanist." Arguing (at 1) that we are currently "uncomfortable halfbreeds, part biology, part culture, with many of our biological traits out of step with the inventions of our minds," he then proceeds to outline the technological equivalent of death, salvation, eternal life, and even the Resurrection as human minds are downloaded into information systems (pages 1, 112, 114, 116-17, 122-23):

What awaits us is not oblivion, but rather a future which, from our present vantage point, is best described by the words 'postbiological' or even 'supernatural.' It is a world in which the human race has been swept away by the tide of cultural change, usurped by its own artificial progeny. . . with enough widely dispersed copies, your permanent death would be highly unlikely. . . . Concepts of life, death and identity will lose their present meaning. . . . Our speculation ends in a supercivilization, the synthesis of all solar system life, constantly improving and extending itself, spreading outward from the sun, converting nonlife into mind. . . . [we will reach the point] where long-dead people can be reconstructed in near-perfect detail at any stage of their life. . . . Wholesale resurrection may be possible through the use of immense simulators.

Let the obvious parallels with Christian eschatology not be obvious, he concludes (page 159), "we are the handiwork of a blind watchmaker. But we have now acquired partial sight and can, if we choose, use our vision to guide the watchmaker's hand."

²⁵ Bacon, *New Atlantis*, pp. 323-24, emphasis added.

Obviously, Bacon is not foreseeing genetic engineering technologies. But his passage is of interest because it indicates that from the beginning of the European technological project, manipulation of life was seen not as irresponsibly playing God, but, to the contrary, as a religious mission—indeed, almost a commandment.

And this same attitude, properly modernized, can easily be found today. Thus, Robert Sinsheimer, molecular geneticist and past President of the University of California at Santa Cruz, comments that:

Throughout history some have sought to live in contact with the eternal. In an earlier era, they sought such through religion and lived as monks and nuns in continual contemplation of a stagnant divinity. Today, they seek such a comfort through science, through . . . the long quest back through time and evolution for our own origins. . . . The lives of most people are filled with ephemera. . . . But a happy few of us have the privilege to live with and explore the eternal.²⁶

William Haseltine, head of Human Genome Sciences, is even more explicit: "The real goal is to keep people alive forever."²⁷ And Boisselier, who intends to clone the first human being, is equally explicit: "I believe that one day we will reach eternal life through this technique, so I am also fighting for the right of the future reborns, or should we say the resurrected."²⁸

In this light, the controversy over biotechnology can be understood as at least in part as theological. The powerful reaction against genetically modified organisms, particularly by an environmentalism with its roots in Rousseau's primitivistic counterculturalism, is against not just the rhetoric, but the reality of a shift in the control of life from an exogenous source (God recreated as "Nature," now made sacred) to human technique. Not surprisingly, the environmentalist ideology views this shift in fundamental responsibility for the design of life apocalyptically:

Why, then, does it [biotechnology] sound so awful? Because, of course, it represents the second end of nature. . . . It is the simple act of creating new forms of life that changes the world, that puts us forever in the

²⁶ Quoted in Nobel, *Religion of Technology*, n. xxii, p. 189, who provides a number of other examples before noting at pages 191–92 that the choice of Christian images and millenarian language "is a sure sign of the enduring influence of the mythology of medieval Christianity in the shaping of Western consciousness, to which these individuals too are heir, whether or not they are Christians themselves."

²⁷ "Futurology Corner," *Science* 290:2249, 22 December 2000.

²⁸ B. Boisselier, "Think of Parents' Wishes," (editorial), *USA Today* April 5, 2001, p. 10A.

deity business. We will never again be a created being; instead we will be creators.²⁹

Thus one arrives at a picture far different than the usual, commonly accepted, version of science and, especially, technology locked in a struggle with Christianity.³⁰ Not only is this conceptualization of the relationship between Christianity and technology wrong, it is downright misleading, for the two are tightly linked and have been for centuries: indeed, one can say that either, without the other, would have failed. As it is, the combination has proved potent indeed, and it is the Western Eurocentric culture that has formed the core of the globalized human enterprise.

The Anthropogenic World View

Consider for a moment where the discussion in this paper has taken us. First, it has become apparent that the Western Eurocentric culture embedded within it important elements of Christianity, and that culture now forms the basis for the globalized culture. The Christian elements are not necessarily explicit, but especially the eschatological elements, tightly braided with the cultural and technological systems they evolved with, are implicit. Technology is a Western project, and in fact the dominant Enlightenment culture has succeeded primarily because power (economic and military), science and a scientific culture (an intelligible universe with the Mind of God and human rationality aligned), and religious zeal (technology as salvation) are integrated within it. Moreover, modern environmentalism as a doctrine also embeds significant elements of Christian theology, although it is again generally implicit and not infrequently distorted, especially through the lens of Rousseau's "noble savage" myth. Meanwhile, the related cultural constructs of sustainable development and sustainability have evolved from the same background; although not explicitly Marxist, in their concern for egalitarianism and communitarianism, and their teleological focus, they clearly derive from the Marxist utopian tradition, which in turn derives from Christian utopianism as in More and Bacon, and before that from the prototypic utopia, Plato's *Republic*. This structure, with three great discourses—the technological (probably the strongest), the Christian as explicit religion, and environ-

²⁹ McKibben, *End of Nature*, p. 166.

³⁰ I emphasize Christianity because of the fundamental alignment of the modern technological enterprise with that faith. Obviously, this creates a difficult dynamic for religions, such as Islam, which lie outside that tradition, and must decide whether, and how, to work with a technological society that, to some extent, embeds important elements of the Christian tradition within itself.

mentalism as theology, along with the minor discourse of sustainability—combine to create a meta-Christian unity.³¹ The discourses form a spectrum of teleologies, from the Edenic to the New Jerusalem of technology, with utopian sustainability—to some degree a blending of the environmentalist and the technological, an attempt to blunt their radicalism while still creating a utopia on earth—somewhere in the middle. Although it is superficially ironic that technological society and its most powerful critic, environmentalism, arose from the same cultural and theological traditions, this is not at all surprising: only an antithesis which carried the power of a dominant culture could hope to be heard at all against the powerful thesis of technological advance.

We have also seen that the world in the past few centuries has been, and is increasingly being, physically structured to reflect cultural, religious, and ethical intangibles as human activity increasingly manipulates earth systems. This makes it important to understand the principle theological elements that will be thus reified, and what their implications may be. Obviously, this is particularly true where major theological underpinnings are both eschatological and teleological, and thus offer the possibility of becoming to some extent self-fulfilling prophecies, at least in the long term. That religious beliefs are highly sensitive is obvious, but a failure to reasonably and tolerantly explore these questions, which increases the probability that powerful theological forces will continue to affect the evolution of the anthropogenic world in ways which are both hidden and not understood, raises obvious dangers.

Finally, it is important to understand the forces supporting teleological approaches to ESEM, so that the possibility of future paths and, even, suggested end states can be evaluated as objectively as possible. For example, the deep green Edenic vision of a world with a few small urban islands surrounded by a completely non-human wilderness requires a dramatic reduction in population. Achieving such steep population declines in a morally acceptable manner would, at best, be difficult; moreover, history indicates that population fluctuations almost inevitably impact the poor and underdeveloped disproportionately. The high technology visions of the New Jerusalem, frequently presented with little grounding in human psychology, are equally problematic from both a physical systems and a human equity

³¹ These discourses obviously include secular and non-Christian elements; like all human institutions they are highly syncretic (as is the discourse of Christianity itself). They are, however, embedded in, and achieve much of their power from, their implicit Christian dimensions, so much so that they are properly understood as fundamentally Christian discourses.

perspective. It is not that either, or for that manner any, teleological vision is liable to be realized: the complexity of these systems, their internal dynamics and inherent unpredictability, inevitable contingency as a result of human intentionality, and the constraints created by system structure preclude that. But teleological impulses, carried as general cultural traits, can be very powerful, especially as they tend to remain unconscious, and as such they can unquestionably impact the paths that realistically lie in the option space of the anthropogenic world. They often express themselves not as teleologies *per se*, but as little understood constraints on the "option space" open to an anthropogenic culture and world.

All institutions, discourses, cultures, disciplines, and individuals face the world with limited perception and a package of simplifying constructs (including languages). Without some such filters, any cognitive system short of deity would be overwhelmed by experience. And emotionally, and politically, and ideologically, oversimplification is almost always far more comfortable than reality. The problematic of the anthropogenic world, however, is that its dynamics are transboundary and omnipresent, showing little respect for the categories and boundaries that have served humanity so well for the past thousands of years. We can, therefore, no longer hide behind them. The anthropogenic world demands far more of us, for it is a human creation just as any other institution we have built. We are called by what we have already wrought to a responsibility, a maturity, an authenticity, and a rationality that we not only lack, but are even unable to define. Sartre was right: "Man is condemned to be free." And in the context of the human Earth, this is a challenging freedom indeed, for it is not just an authentic self, not just an authentic community, but an authentic world for which we are morally responsible. With no illusions as to how far we still have to go, we also have no choice but to begin; to do otherwise is to abdicate our humanity, and to lapse into a profound and ethically bankrupt inauthenticity.