

TECHNOLOGY VERSUS NATURE: WHAT IS NATURAL?

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The question of technology versus nature must be set within the larger question of culture versus nature, as it is an intensified form of that more general issue. Technology involves artifacts, both in its etymology, from the Greek *tekhne*, "art" or "skill," and in its central idea, the body of knowledge available to a culture for fashioning and using implements. Generally in anthropology only humans have a technology. More specifically, this dimension of culture has dramatically escalated in modern times, with the coupling of science and industry. That also presses the question whether such technology is natural, a question made more urgent, and puzzling, in cultures with high technology.

The parallel question is whether nature ends with technology, whether technology can and ought to bring nature to an end, and that question too has its urgency. Technology versus nature? That suggests a contest, and that technology might win, and nature be defeated. The question what is natural thus leads to conservation questions, asking whether and how far, in a technological society, the natural ought to remain. Willy-nilly, the technocrat is making decisions in environmental ethics. Those decisions are likely to be confused without a philosophical analysis of the technological and the natural.

1. *Nature and everything*

In one sense, "nature" is quite a grand word, referring more or less to everything generated or produced. *Natura* or *physis* is the source from which all springs forth. So comprehensive a term becomes troublesome at once. One can get clear about the phrase "nature and culture", which seems to indicate two domains, but if one is a metaphysical naturalist, then nature is all that there is. John Stuart Mill writes: "Nature, then, in this its simplest acceptation, is a collective name for all facts, actual and possible, ... a collective name for everything which is".¹

Used in this universal or cosmological sense, claiming that "everything is natural" is about as informative as insisting that "everything that is, exists". Metaphysical naturalists may need the word in this sense for their purposes, both to argue that the non-natural is an empty set, also to characterize the natural, so far as they can. Humans and all their activities will be included; humans are generated within nature and they break no natural laws. Everything technological will, on this meaning, be completely natural.

Such scope is also problematic, however, because it prevents discriminating analysis of the differences between spontaneous nature and deliberated culture. A predicate, "natural," that includes all actual and possible properties, excludes nothing; denoting everything is like denoting nothing, at least nothing in particular. The most forceful objection to this sense of nature, in our context, is that such definition allows no useful contrast with culture, but we need that contrast carefully analyzed if humans are going to relate their cultures, including their technologies, to nature, asking about sustainable development or about nature conservation as goals.

2. *Culture distinguished from nature*

A straightforward contrast class to nature is culture, John Stuart Mill continues, noting that the previous sense "corresponds to only one of the senses of that ambiguous term"; in another sense "Nature is opposed to Art, and natural to artificial": Nature "means, not everything which happens, but only what takes place without the agency, or without the voluntary and intentional agency, of man. ... Nature... is a term for everything which is of itself, without voluntary human intervention. ... All praise of Civilization, or Art, or Contrivance, is so much dispraise of Nature".²

If I am hiking across wildlands, when I pass the rocks and trees, the birds and even their nests, these are natural, but if I come upon an abandoned boot, or a candy wrapper, these are

artifacts, unnatural. Expanding such examples into a metaphor, the whole of civilization is producing artifacts in contrast to the products of wild spontaneous nature. Artifacts are the products of culture; they are nature cultured, and culture is something else from wild nature.

Wild animals do not form cultures, not at least cumulative transmissible cultures. Unlike coyotes or bats, humans are not just what they are by nature; humans come into the world by nature quite unfinished and become what they become by culture. Information in nature travels intergenerationally on genes; information in culture travels neurally as persons are educated into transmissible cultures. The determinants of animal and plant behavior are never anthropological, political, economic, technological, scientific, philosophical, ethical, or religious.

One sometimes encounters the term "culture" used of animals. Opening an anthology on Chimpanzee Culture, the authors doubt, interestingly, whether there is any such thing: "Cultural transmission among chimpanzees is, at best, inefficient, and possibly absent".³ There is scant and in some cases negative evidence for active imitation or teaching of the likeliest features to be transmitted, such as tool-using techniques. Chimpanzees clearly influence each other's behavior, and seem to intend to do that; they copy the behavior of others, including their tool-using. But there is no clear evidence that they attribute mental states to others, that they, for instance, attempt to change the mind (as opposed to the behavior) of another chimpanzee. They seem "restricted to private conceptual worlds".⁴ Without some concept of teaching, of ideas moving from mind to mind, from parent to child, from teacher to pupil, a cumulative transmissible culture is impossible. That means also that a developing technology is impossible.

The view that high technology is more emergent from nature than were indigenous technologies ought not to overlook the fact that classical technologies were quite sufficient to separate humans from nature. The separation begins as soon as any culture begins to rebuild nature and becomes self-consciously reflective about this. The critical factor is the deliberated or intentional modification, coupled with espousing and critiquing world views, that separates humans in their cultures from wild nature. Plato and Socrates were as self-conscious about this as any high-tech computer expert.

Any transmissible culture, and especially modern high technology culture, does need to be discriminated from nature. The Boeing 777 jet plane is being built, seven a month, in the largest building in the world, assembling three million parts per plane. At the Everett, Washington, site, Boeing used in its design 2,200 workstations linked to eight of IBM's largest mainframes, linked with other computers and databases spread across 17 time zones around the world, bringing the total to 7,000 workstations. The information processed on this system was stored on 3.5 terabytes, which (to translate into terms meaningful to most of us) were it stored on ordinary 3.5 inch disks holding 1.44 megabytes, would require a stack of two and a half million disks nearly five miles high. Up to 248 teams, with up to 40 members, worked on the project.⁵

In addition to the technological side, there is the economic. Boeing kept an eye on competing with the A-330 Airbus, subsidized by British, French, German, and Spanish companies, with Boeing more on its own raising capital and encouraged by United's initial \$ 22 billion order. That brings in politics alongside economics. The 777 is being built in a cumulative transmissible culture, using learning (such as how to make aluminum or use radar) and social processes (such as capitalism and political policies) that have a historical legacy accumulated over many centuries.

Boeings fly, like wild geese, fly using the laws of aerodynamics. The flight of wild geese is impressive; scientists can hardly yet be said to understand these "bird brains" and how they migrate. Perhaps, in its own way, the evolution of wild geese in spontaneous nature is as mysterious as is the human capacity to develop Boeing jets. The information storage system in the goose genetics could, in its own way, be the equal of the Boeing system. But it is only philosophical confusion to remark that both processes are equally natural, and let it go at that. No interesting philosophical analysis is being done until there is insightful distinction into the differences between the ways humans fly in their engineered, financed jets and the ways geese fly with their genetically constructed, metabolically powered wings.

The Boeings are built within a hundred miles of old-growth forest that American environmentalists are concerned about saving; this controversy has been raging during the years of design and construction. One could even argue that saving the forests is more important than building the new Boeings; the money would be better spent saving nature than on new jets, since more of the current planes would serve us nearly as well. But one is unlikely to be guided in the rationale for conserving the forest until one recognizes that the processes that govern the forest are radically different from the processes by which the Boeing 777 is produced.

Well, beavers build dams. The naturalists may protest that beavers, if they could, would refer to their dams as artifacts and everything else as nature, including all the human artifacts, such as dams, that they might encounter. But this supposes powers of artifacting of which beavers are not capable; if beavers could blueprint their dams and make power projections of megawatts to be generated by the head of water so created (anticipating, for instance, the power demands of the enlarged factory that Boeing needs to make 777's), if they could research better darns made with synthetic materials, such as steel and fiberglass, if beaver officials would decline to give the needed building permits until the plan also included an adequate fish ladder to let the salmon go up, they would not be beavers any more.

Perhaps the beavers intend what they do when they build their dams. Animals do make some choices; not all animal behavior is stereotyped. Still, their intentionality does not greatly exceed their genetic instinct; humans have a higher order intentionality that rebuilds nature with steady intent, resulting in cumulative transmissive cultures. The Boeing plant in Everett Washington has enormously modified the nature that was displaced for its building.

Many are concerned these days, given our environmental crisis and the need for sustainable relationships with nature, to insist that culture too is natural, that humans are a part of and not apart from nature. Freya Mathews puts it this way: 'It is no longer controversial to state that a human individual is essentially a cultural being, and that culture is an emanation of Nature'⁶. The Boeing 777 is not some sort of emanation from the old-growth forest. I argue that we need a stronger term; culture is an "emergent" from nature. Nature evolved into culture; culture evolved out of nature, but it did evolve out of it. Emanation is too weak a word. Over the millennia in their cultures, humans make an increasing exodus from nature.

3. Nature environing culture

Still, we must be cautious. Nature is the milieu of culture. Using a metaphor, nature is the womb of culture, but a womb that humans never entirely leave. Nature can do much without culture—the several billion years of evolutionary history are proof of that. Culture, appearing late in natural history, can do nothing without nature as its ground. In this sense, nature is the given. No culture can ever be independent of nature, not unless some future society learns to produce matter *ex nihilo*. Culture will always have to be constructed out of, superposed on, nature.

No matter what kind of exodus humans make from nature, they are going to remain male or female, with hearts and livers, and blood in their veins, walking on two feet, and eating energies that were originally captured in photosynthesis by chlorophyll. Culture remains tethered to the biosystem and the options within built environments, however expanded, provide no release from nature, which remains as a life-support system. Humans depend on air flow, water cycles, sunshine, nitrogen-fixation, decomposition bacteria, fungi, the ozone layer, food chains, insect pollination, soils, earthworms, climates, oceans, and genetic materials. An ecology always lies in the background of culture, natural givens that underlie everything else. Some sort of inclusive environmental fitness is required of even the most advanced, high-tech culture.

Always, there is foundational nature. Landscapes are never completely cultural artifacts; they result from culture interacting with nature. But no sooner do humans begin to stir about in their cultures than do they modify their environing nature. Of course, animals and plants regularly reshape their environment. They dig dens, or build nests, which changes their immediately

surrounding environment. They post territories and drive out competitors. Beavers build dams and alter riparian ecologies. Zebra and wildebeest graze the Serengeti plains and change the composition of the grasses that grow there; the grasses coevolve with the grazing ungulates. Insects kill trees; the dead forest is more readily ignited by lightning, and succession is reset. Trees send down roots that break up the rocks and help make soil. Leaves rot and make humus, which holds water that otherwise would run off. Photosynthesis changes the oxygen content of the atmosphere. The environment has been remade for present and latercoming trees.

But in all these cases there is no cumulative transmissible culture by which the rebuilding is done. Despite the changes they introduce, plants and animals are largely adapted to the environment in which they find themselves. These adaptations are genetic, behavioral, morphological, physiological—fur or horns or teeth, or thorns or deciduous leaves or camouflage. Culture makes possible the deliberate and cumulative, and therefore the extensive, rebuilding of nature. Humans reshape their environments, including new ones into which they expand, rather than being themselves morphologically and genetically reshaped to fit their changing environments.

Nature now widely bears the marks of human influence. There is, many claim, no unmodified nature. Culture both does and ought to modify nature. Indeed, culture is neither logically nor empirically possible without the alteration of nature. Any and all culturally-intended activity modifies spontaneous nature. But that does not gainsay the fact that there is always environing nature. No creature, humans included, can live without an environing nature. Even if we managed to end terrestrial nature, as we begin to fear in a discussion to follow, there would be the surrounding astronomical nature.

4. *Natural and unnatural, artificial and artifactual*

An analysis of closely interrelated terms can help, especially where these are partly descriptive and also partly normative. We have used the word "artifact", descriptively to refer to any product of culture, and especially to its technological products, contrasted with spontaneous natural processes and their products. Made into an adjective, however, "artificial" contains a judgmental factor, meaning not simply "made by human craft (art)", descriptively; but also "inferior because less good than natural", the idea being that the human manufacture fails of the quality of the natural original. When artifacts are intended to substitute for the natural, this can be so. An artificial leg is inferior to a natural leg, which has been lost in an accident, however much the artificial one is desired in those tragic circumstances. In certain contexts, we seldom want something artificial.

In other contexts, we may be quite happy with the artificial. Indeed we may praise the technological. Synthetic rubber is better for tires than real rubber. Even silk carnations may be preferred as decorations where the natural flowers, though they would be preferred in some respects, are ephemeral and trouble to keep. Although we "naturally" incline to think that in earth-based contexts we will always prefer the natural (breathing air, eating potatoes, walking on two feet), the truth is we often make the natural more or less artificial (artifactual) to suit our pleasure (air-conditioning the air we breathe, using pesticide on the potatoes and cooking them, putting shoes on our feet and getting into an automobile).

"Artifact" becomes a non-normative adjective in "artifactual", which, while an uncommon term, is useful as a merely descriptive one. This recalls the original meaning of "manufactured", made by hand, although that term has now taken on an industrial sense, "coming out of factories". "Synthetic" has an interesting history; once it too usually meant "of less quality" but in recent decades that normative color has tended to vanish. There is nothing pejorative about "synthetic oil"; like synthetic rubber, it is better than the original oil. Gore-tex, made of Teflon, has nine billion pores per square inch and passes water vapor but not liquid water, and makes fine rainwear, better than that made of rubber.

Similarly to the pejorative overtones of "artificial", the word "unnatural" typically carries negative connotations. On the cosmological meaning of "natural," if one is a metaphysical naturalist, as we have noticed, the non-natural is an empty set. Nothing is unnatural. But in axiological contexts, "unnatural" carries the force of "against nature", like "un-American" means "against America". In that sense, one seldom wants to be "unnatural," since this often suggests violating natural goods. Those who dislike hair dyed purple will complain that the color is unnatural, although of course most blondes are equally unnatural, with the difference being that blonde is a color of human hair that is found in spontaneous nature on other heads, while purple is not. The complaint that homosexuality is unnatural carries considerable force, recognizing that males and females form the only biologically possible reproductive pairs. The human race would go extinct, if homosexuality were the norm and universally observed. At the same time a marriage ceremony, with the wedding party in gowns and tuxedos, bride and groom making an exchange of rings before a clergyman, is unnatural in the sense that no such service is found in spontaneous nature. Strictly speaking, the unnatural is not just the river that is undesirably polluted with chemicals from leaky factories. The unnatural includes all the good things, as well as the bad ones, brought to humans in culture by technology and craftsmanship. But the overtones of the word "unnatural" are such that we will prefer to call these "cultural" goods in contrast to "natural" goods.

The rapid development of contemporary technology opens up the possibility that, in the next millennium, nature will be less and less constitutional, as it is more and more modified, in the increasingly technologically sophisticated world of the future. Nature will become not so much redundant as increasingly plastic. The technicians can get houses out of trees, also clothing out of crude oil, a turkey with more white meat by gene-splicing, and this molecule out of that molecule, even this atom out of that one, whatever x out of whatever y. Human life will depend less and less on working with natural kinds (feldspar, turkeys, cellulose, or carbon) and more and more on artifacted kinds (vinyl, transgenic turkeys, fiberglass, or Teflon).

How far might this go? Engineers are hard at work on artificial photosynthesis.⁷ Might we prefer this, if it gives us a better food supply? Biochemists have already made artificial blood, where the hydrogen atoms are replaced by fluorine atoms.⁸ Such blood is being tested in medical treatments because it is resistant to leukemia and to certain toxins. People might come to prefer it. What would be wrong with people with artificial blood eating artificial food? One way to answer is to set this question in a larger framework, to look at what might be the end of which this is the beginning. What would be wrong with people rebuilding the planet? This forces the question whether and how far we really do wish for nature to be replaced by technology.

5. The planetary managers

Editing a *Scientific American* issue on 'Managing Planet Earth', William Clark writes that humans are moving toward consciously managing the Earth. Here "two central questions must be asked. What kind of planet do we want? What kind of planet can we get?"⁹ Earth is now in a post-evolutionary phase. Culture is the principal determinant of Earth's future, more now than nature; we are passing into a century when this will be increasingly obvious. Indeed, some say, that will be the principal novelty of the new millennium; Earth will be a managed planet.

At the one extreme in range is microtechnology, already realized in computing and genetics, with nanotechnology in prospect.¹⁰ We can design our children, or make transuranic elements. At the other extreme is planetary engineering, for example in weather manipulation. The U.S. Federal Weather Modification Advisory Board, established under the National Weather Modification Act of 1976, has reported that, with proper funding, the U.S. could, within twenty years, control rainfall in the Midwest, the amount of snow in the Rockies, the velocity of hurricanes on the Plains, and make the science and practice of weather modification a reality all over the nation.¹¹

Henri Bergson, writing early in this century, was prophetic. With the coming of the industrial age, when science joined with technology, we crossed the threshold of a new epoch.

In thousands of years, when, seen from the distance, only the broad outlines of the present age will still be visible, our wars and our revolutions will count for little, even supposing they are remembered at all; but the steam-engine, and the procession of inventions of every kind that accompanied it, will perhaps be spoken of as we speak of the bronze or of the chipped stone of prehistoric time: it will serve to define an age.¹²

The transition from muscle and blood, whether of humans or of horses, to engines and gears shifts by many orders of magnitude the capacity of humans to transform their world. Even more recently, the capacity to produce has been augmented by the capacity for information transfer. Consider the transition from handwriting to printing, from communication by written mail to electronic communication, from information processing in books to information processing by computers. All this has occurred in a few hundred years, much of it in decades we ourselves recall.

In the course of human history, there have been epochal changes of state, such as the transition from hunter/gatherer cultures to agriculture, from oral to written cultures, the discovery of fire, the discovery of iron. In our epoch, we have seen the coupling of science and technology. The next century will indeed launch a new millennium. The industrial age. The technological age. The postmodern world? The postnatural world?

Nature will be increasingly humanized. Activities on the planet will center on humans. "Dominate" remains a somewhat disliked word, since it has echoes of the abuse of power. But "manage" is still quite a positive term. Humans have, now and increasingly, the power to impose their will on nature, re-making it to their preferences. With so much human power already on hand, with planetary managers already at work, one does need to ask whether nature is already at an end.

6. Nature at an end?

All culturally-intended activity modifies spontaneous wild nature. The essence of culture is the deliberate rebuilding of nature. "Man is by nature a political animal," said Aristotle.¹³ The human genus may be animal, but the human differentia or essence is to build a *polis*, a town. The human habitat is village, town, city, which is another way of saying that human life is political, social, or, as we have been saying, cultural and technological. In agriculture, the plowed field is symbolic—an artifact remade from nature, using a technology, the plow. Ancient cultures, not less than modern ones, re-made the landscapes they used for their villages, fields, and flocks.

The question whether technology has ended nature is one of degree. Certainly, nature now bears the marks of human influence more widely than ever before. In one survey, using three categories, researchers find the proportions of Earth's terrestrial surface altered as follows: 1. Little disturbed by humans, 51.9%. 2. Partially disturbed, 24.2%. 3. Human dominated, 23.9%. Factoring out the ice, rock, and barren land, which supports little human or other life, the percentages become: 1. Little disturbed, 27.0%. 2. Partially disturbed 36.7%, 3. Human dominated 36.3%.¹⁴ Most terrestrial nature is dominated or partially disturbed (73.0%). Still, nature that is little or only partially disturbed remains 63.7% of the habitable Earth. Also, of course, there is the sea, less affected than the land; and the oceans cover most of the Earth.

In another study, researchers found that humans now control 40% of the planet's land-based primary net productivity, that is, the basic plant growth which captures the energy on which everything else depends.¹⁵ That is worrisome, but it does leave 60% still in the spontaneously wild. Possibly, with ever-increasing transformation of nature, whatever residual nature remains may cease to be of interest or significance for what it is in itself, with value attached more and more to the artifacted characteristics now superimposed on what was once

wild nature. There will typically be degrees of modification, of artifact, intermixed with degrees of the natural: the relatively natural, the relatively cultured—or agri-cultured, or manufactured.

Nature is mixed with human "labor" or "industry". A revealing word here* is "resource". Where there is a natural "source" that has been or can be "re-directed" by deliberate technology into channels of human interest and preference, nature is redone, "re-sourced," made over into an artifact that we can use. To use a more philosophical word, nature is "transformed", its form is transmuted into a more desirable humanized form. To use a scientific-engineering word, human values are "synthetic". Of course, some second-order technological effects on nature are not intended. No one intended for DDT to thin the eggshells of the peregrine falcons. But the first order effects are intended. If nature means absolutely pristine nature, totally unaffected by human activities, past or present, there is relatively little remaining on Earth—if our detection instruments are keen enough. There is DDT in penguins in Antarctica.

Still, nature on Earth can be relatively pristine, as it is in Antarctica, despite the DDT in the penguins. Sometimes one encounters the objection that the slightest human intervention has a sort of totalizing effect, and brings straightway the end of nature. This is like saying that the whole moon is pristine no more because the astronauts took a few steps on it, or that the sky is not natural because some jet planes have flown through it. It is true that certain human technological actions do have unintended consequences that spread everywhere; there are contagious effects that seep into the nooks and crannies of all nature. This might be true of global warming, or perhaps of toxic chemicals that are non-biodegradable and have cumulative effects, or maybe even of exotic weeds, their seeds carried afar on ships and trains.

Most human activities, however, do not have such far-reaching effects. The world is too pluralist for that. Not everything is that tightly bound up to everything else. Is it the case, for instance, that, owing to human disturbances in the Yellowstone Park ecosystem, we have lost any possibility of letting the park be natural? In an absolute sense this is true, since there is no square foot of the park in which humans have not disturbed the predation pressures. There is no square foot of the park on which rain falls without detectable pollutants. But it does not follow that nature has absolutely ended, because it is not absolutely present. Answers come in degrees. Events in Yellowstone can remain 99.44% natural on many a square foot, indeed on hundreds of square miles, in the sense (recalling the language of the United States Wilderness Act) that they are substantially "untrammelled by man". Humans can put the wolves back and clean up the air, and humans have recently done both. Where the system was once disturbed by humans and subsequently restored or left to recover on its own, wildness can return.

Nature has not been brought to an end, not yet at least. But we do have to face that possibility in the future. Daniel Botkin agrees: "Nature in the twenty-first century will be a nature that we make". "We have the power to mold nature into what we want it to be. Of course he, like everybody else, urges us "to manage nature wisely and prudently," and, to that end, ecology can "instrument the cockpit of the biosphere". That sounds like high-tech engineering which brings wild nature under our control, remolding it into an airplane that we fly where we please. So it first seems, although Botkin—the ecologist in him returning—does go on to warn that it is important to recognize that "the guide to action is our knowledge of living systems and our willingness to observe them for what they are" and "to recognize the limits of our actions".¹⁶

"We can outdo evolution," So claims David Baltimore, a microbiologist at the Massachusetts Institute of Technology and a 1975 Nobel laureate, speaking of biotech genetics.¹⁷ Edward Yoxen agrees: "This is not just a change of technique, it is a new way of seeing. ... The limitations of species can be transcended by splicing organisms, combining functions, dovetailing abilities and linking together chains of properties. The living world can now be viewed as a vast organic Lego kit inviting combination, hybridisation, and continual rebuilding. Life is manipulability. ... Thus our image of nature is coming more and more to emphasise human intervention through a process of design".¹⁸ The technicians can transfer genetic material between plants and animals, or between diverse animal lines, or between animals and humans. Or make clones of species

that naturally reproduce only sexually, or send genetic information on fiberoptic transmission lines, or make new amino acids, beyond the twenty naturally occurring ones, and incorporate them into proteins.

Perhaps evolution has been overtaken by human engineering, but is it not true that humans will always need an ecology? We have not gotten past the need for a life support system, the environing nature of which we earlier spoke. Nevertheless, humans do not any longer have anything like an ecological relationship to any local ecosystem in which they have an evolved niche. We eat bananas from Central America; the average bite of food eaten in the United States has travelled 1,200 miles. Even the food we eat from closer to home has been grown in radically transformed ecosystems. We can re-engineer our ecosystems. Michael Soulé faces this prospect:

In 2100, entire biotas will have been assembled from (1) remnant and reintroduced natives, (2) partly or completely engineered species, and (3) introduced (exotic) species. The term natural will disappear from our working vocabulary. The term is already meaningless in most parts of the world because anthropogenic [activities] have been changing the physical and biological environment for centuries, if not millennia.¹⁹

Humans have always had to rest their cultures upon a natural life support system. Their technosphere was constructed inside the biosphere. But in the future that could change; the technosphere could supercede the biosphere. The focus of science would no longer be the laws of nature and how we can use them. Classical science has been grouped into the natural and the social sciences, depending on the object of study, nature or culture, interestingly, *today* we have a new domain of science: the sciences of the artificial. Computer science, for example, is a science of artifacts. Other scientists study Teflon, or the transuranic, superheavy elements (like plutonium), or the engineered biotas that Soulé envisions. These sciences do not, of course, violate any laws of nature, neither those of physics or chemistry; thermodynamics and gravity still reign. But they do bring into play forces hitherto unknown in nature; their constructions are not natural kinds, but artifacts. The processes that govern such artifacts are not those of wild nature, but those that scientists have elected to create. Scientists will sometimes need new laws which did not operate and were only potentially there in old nature. Or, if you prefer, they were always there, but there were no empirical instantiations of such laws; they were empty sets,

So it does seem possible to end nature by transforming it into something humanized. This has already been taking place, and the future promises more, at an escalating pace. Over great stretches of Earth, wild nature has been already or likely will be diminished in favor of civilization. In some sense, that ought to be so. This ending may be always, in its own way, a sad thing; but it is an inevitable thing, and the culture that replaces nature can have compensating values. It would be sadder still, if culture had never appeared to grace the Earth, or if cultures had remained so modest that they had never substantially modified the landscape. Humans too belong on the planet; and the epoch of evolutionary nature, and even of ecological nature, is over. That is what is right about the view that with the arrival of humans, their cultures, and their technologies, pristine nature vanishes. Nature does not vanish equally and everywhere, but there has been loosed on the planet such a power that wild nature will never again be the dominant determinant of what takes place on the inhabited landscapes.

7. Once and future nature

But this is not the whole truth. Nature neither is, nor ought to be, completely ended. Or everywhere ended. Rather, humans can and ought at times and places to make nature an end in itself, complementary to their own human ends. We do not want entirely to transform the natural into the cultural, nor do we want entirely to blend the cultural into the natural. Neither realm ought to be reduced to, or homogenized with, the other. We do not want a humanized, technologically controlled nature, shore to shore, ocean to ocean, pole to pole. Humanizing it

all does not make us a part of it; rather, the dominant species becomes still more dominant by managing all. That, *ipso facto*, sets us apart; the one species that manages the place. Rather, we humans, dominant though we are, want to be a part of something bigger, and this we can only do by sometimes drawing back to let others be. This we do precisely by recognizing the otherness of wildness, by setting aside places as wildlands, as wilderness where we will not remain, which we will not trammel.

Humans need to see their lives in a larger context, as embedded in, surrounded by, evolved out of a sphere of natural creativity that is bigger than we are. Humans who cannot do this never know who they are and where they are; they live under some other and inadequate mythology. In that sense, it is important that this nature is independent of humans.

Management does require humanizing the landscapes on which we reside. The future will be, over most of the landscape, inescapably, a synthetic world. We might as well be philosophical about this. The Hegelian dialectic may be useful. Nature is the thesis, culture the antithesis, and cultures harmonized with nature the synthesis. But, as usually formulated, the Hegelian dialectic suggests too strongly that original nature, the thesis, is entirely transformed *in* the synthesis, and passes over into something else. The word "dialectic", used in the Greek sense, is better illustrated with the twin foci of a geometrical ellipse, also with the double arrows of a state of chemical equilibrium. We are after a complementarity; a Taoist would appeal to his yang-yin bipolarity.

Some events are generated under the control of a focus that we label culture; such events are in the urban zone, where "urban" marks those arts and achievements where the contributions of spontaneous nature are no longer evident in the criteria of evaluation, though they remain among the precursor events. This is the political zone, recalling how "political" is derived from the Greek *polis*, town. This is the artifactual, the technological domain.

At the other extreme, a wild region of events is generated by spontaneous nature. These events take place in the absence of humans; they are what they are in themselves—wildflowers, loons calling, or a storm at sea. Although humans come to understand such events through the mediation of their cultures, they are evaluating events generated under the natural focus of the ellipse. The constraint of nature is maximal, the contribution of culture is minimal.

A domain of hybrid or synthetic events is generated under the simultaneous control of both foci, a resultant of integrated influences from nature and culture, under the sway variously of more or less nature and culture. Nature is re-directed into cultural channels, pulled into the cultural orbit. This happens when human labor and craft put natural properties to use in culture, mixing the two to good effect in agricultural, industrial, scientific, medical, and technological applications, or to adverse effect by mistake and spillover. But always culture has to answer to what is objectively out there in nature.

The ellipse with its twin foci is first an ontological and epistemological metaphor portraying events in both nature and culture, and their synthesis; it is also an axiological and ethical metaphor. Humans construct or constitute the knowledge that arises within culture, at that focus. That is the cumulative transmissible culture, without which we know little or nothing. Such culture is real; it is an ontological entity that comes into being where, in wild nature over the millennia of evolutionary history, no such thing before existed. In this sense culture is something apart from nature. Such culture has epistemological powers; humans who enjoy these epistemic powers become cognitively informed in ways that were without precedent in wild nature. They know how to read, and write, and make tools, and books, scientific instruments, automobiles, telephones. These powers operate to expand culture; they also operate to study nature.

But another focus is nature as generator of events, objective to culture, constraining what can be constructed, whether in culture (what kinds of computers can be built) or in nature (what theories of global warming are true). Each of the foci critiques the other; the realities of nature test the wisdom of any culture; differing cultures take differing perspectives on the natural world within which they are situated and which they rebuild.

"Symbiosis" is a parallel biological word, more positive than "synthetic" or "hybrid". René Dubos claimed:

The symbiotic interplay between man and nature can generate ecosystems more diversified and more interesting than those occurring in the state of wilderness. ... By using scientific knowledge and ecological wisdom we can manage the earth so as to create environments which are ecologically stable, economically profitable, and favorable to the continued growth of civilization.²⁰

The result is a humanized nature. In the symbiosis zone, we have both and neither (synthesis), but we do not forget there remain event-zones in which the principal determinant is culture (antithesis), and other zones in which the principal determinant remains spontaneous nature (thesis). We do not want the ellipse to collapse into a circle, especially not one that is anthropocentric.

Nature as it once was, nature as an end in itself, is no longer the whole story. Nature as contrasted with culture is not the whole story either. One can dwell on the extremes in either direction. Much of life does take place in the symbiotic zone, and there we need an adequate theory lest our practices go astray. Wendell Berry raises this fear:

The moral landscape of the conservation movement has tended to be a landscape of extremes. . . . On the one hand we have the unspoiled wilderness, and on the other hand we have scenes of utter devastation—strip mines, clearcuts, industrially polluted wastelands, and so on. We wish, say the conservationists, to have more of the one, and less of the other. To which, of course, one must say amen. But it must be a qualified amen, for the conservationists' program has been embarrassingly incomplete. Its picture of the world as either deserted landscape or desertified landscape has misrepresented both the world and humanity. If we are to have an accurate picture of the world, even in its present diseased condition, we must interpose between the unused landscape and the misused landscape a landscape that humans have used well.²¹

The more perceptive environmentalists have always seen that it is a mistake, in their zeal for nature, to think of all culturally occupied lands as being "disturbed" or "trammelled". Managed they must be, and only semi-natural, but over much of the landscape, the goal is humans in a sustainable relationship (a dialogue, an equilibrium, a synthesis, a symbiosis) with nature. Here culture gardens nature. Nature is no longer wild.

There is truth in the Hegelian model, but only a half-truth, if the result is nature passing away, or culture passing away, the both passing over into something that is neither. Certainly over much of the domesticated landscape, this will be the case. An environmental ethic is not just about wildlands, but about humans at home on their landscapes, humans in their culture residing also in nature. This will involve resource use, sustainable development, managed landscapes, the urban and rural environments. This will produce a policy for the British countryside, the American West, the Australian outback. It will produce legislation protecting wildlife, rivers, mountains, clean air, soil, water by regulating levels of pollutants and toxic substances. But the half-truth of the Hegelian model itself needs to be complemented by the elliptical model, where, even on a planet dominated by human technology, much of what goes on does so under the natural focus. The moral technologist does not wish the end of nature everywhere; we sometimes wish nature as an end in itself.

In conclusion, we should end with a sense in which nature has not ended and never will. This is the truth in the adage that nature bats last. Humans stave off natural forces, but the natural forces can and will return, if one takes away the humans, in that sense, nature is forever lingering around. Given a chance, which will come sooner or later, natural forces will flush out human effects, similarly to the way in which natural effects themselves also are often washed out. Even

if the original wildness does not return, nature having been irreversibly knocked into some alternative condition, wildness will return to take what course it may.

To put this thermodynamically: Nature contains entropic forces that tear down high negentropic structures, unless these are constantly maintained by an informed energy input. Generally, the struggle for life is in countercurrent to entropy; metabolism directs the synthesis and repair of the highly ordered protein structures that compose the organs of the body. At death, the forces of entropy take over and the body decays. If the organism that dies happens to be a human, who also has made extrasomatic artifacts, not only does the body decay but the artifacts too begin to decay, once they are longer maintained extrasomatically by the care of the embodied person. In time, entropy wipes out the remnants of culture, as it does the corpse of the body. Nature is indifferent to whether these high negentropic structures were constructed by genetic information or by cultural information, even that of high technology. This also means that if we humans, while yet alive, withdraw from the maintenance of our cultural artifacts, the entropic forces will take over to flush out the ephemeral effects of cultural intervention.

Nor is it just the entropic forces of nature that return. The self-organizing (autopoietic) forces reappear as well. If you wonder whether nature has ended, watch what happens on a vacant lot when its former owners move away. One might first think that there is no nature left, since the lot is filled with the rubble of artifacts from a technological culture—pop cans and broken concrete blocks. But nature comes back, and soon there are weeds sprouting up, a lush growth of them, if there is rain and the soil is not too contaminated. We could almost say, in a more philosophical mood, that nature still knows how to value the place, or knows, as it flushes out the human disruptions, what values to put in place that can still be sustained there. In that sense, a vacant city lot, which might seem to be a place where nature has quite ended, is, if watched a little longer, a place that testifies eloquently to how nature, managed and mismanaged by humans though it may be, does not and cannot end. In, with, and under culture, there is always this once and future nature.

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