EDITED BY Yrjö Haila and Chuck Dyke

How Nature Speaks

The Dynamics of the Human Ecological Condition

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Speaking of Nature

Susan Oyama

SPEAKING ABOUT SOMETHING is also, to some extent, saying how we think it speaks. To say that humans have unconscious drives, for example, is also to say how we believe people reveal themselves to us—in a sense, how they speak or don't speak. To begin this discussion, therefore, I am going to engage in a little rhetorical exploitation, using Chuck Dyke's essay (this volume) about "natural speech" to make a point about this theme of speaking. Although I am basically in sympathy with his declaration that Nature doesn't speak, I suggest that his denial implies a model of the human subject that we can question. I suspect that Dyke does question it, and that he will forgive this use of his spirited contribution: our agreements are significant, our differences minor. My suggestion is that if, in a systems-informed spirit, we understand our own natures and behavior to emerge in interaction rather than being "expressed" from within; if we are understood not as cleanly bounded, fixed realities but as always changing, always situated in worlds that are stable in some respects, variable in others; if our speaking is not the conveyance of fixed packets of meaning or "information" from one brain to another but just one mode by which we relate to each other, it may turn out that Nature "speaks" in ways not so very different from the ways we ourselves do.[1] Insofar as this is the case, our speech about the "speech" of other people and about the rest of the worlds of which we are part must be rich, nuanced, tentative, and flexible, and we must always be ready to acknowledge the part we play in the generation of the speakings we observe. Nature doesn't speak as an autonomous being with a determinate nature, communicating her fixed truths to us, but then neither do we speak to each other this way; once we recast our view of our own natures and our relations with one another, there is much less difference between our speakings *among*

ourselves and the kind of interactive interrogating and attending used in studying the *rest of the world.*

I begin with a mini-autobiography. The concept of the developmental system was part of an attempt to resolve the difficulties that attend certain more conventional understandings of life processes and interrelationships, so knowing what difficulties I encountered should make it easier to understand my particular takes on systems-talk and nature-talk. It should make clear, for instance, why it has been important to me to rework a variety of inside-outside boundaries; to include the environment in the developmental system rather than making it a location, or a mere container or source of materials and constraints, or even an independent but cooperating "partner"; to realign the definitions of nature and nurture, thus broadening our views of development, evolution, and inheritance. Some of the key ideas in that realignment, often called developmental systems theory (DST), are sketched. Then I mention some challenges faced by those working with this conceptual scheme. If we are trying to develop an alternative view of life processes, how can we use the language of systems, construction, and interaction in a way that is both shareable and true to the vision we are constructing? Finally, I return to our theme with a speculative coda on agency. Along the way, I hope to show how intimately, and interestingly, the question *How does nature speak?* is connected to the ways we speak of nature, as well as the ways we speak of, and to, each other.

(MY) LIFE BEFORE DEVELOPMENTAL SYSTEMS

What I do is probably best described as philosophy of biology, but my undergraduate training was in psychology. Psychology is a field completely informed by nature-nurture dichotomies and shot through with allied oppositions like individual-social and mind-body. My graduate studies in psycholinguistics were housed in an interdisciplinary department of "social relations," which included developmental, social, cognitive, and clinical (but not comparative, experimental, or physiological) psychology; cultural (but not physical) anthropology; and sociology. There is a whole intellectual and social history in that list. On the then existing academic landscape, these were all largely "social" and, to that extent, not "biological." Then as now, the schisms between biology and

culture, between nature and nurture, ordered the content of individual disciplines, shaping their very identities *as disciplines* (and those of their practitioners), and therefore the relations among them. This in turn kept the rifts from being effectively bridged, despite the best efforts of concerned scholars. Meanwhile, successive generations continue to be raised on the intricate geographies, forbidden territories, and blind canyons of these divided conceptual terrains.

A classic nature-nurture question, in fact, was the occasion for my dissertation on a sensitive period for second language acquisition: a restricted period when young humans can learn a language with native proficiency. The notion of a preprogrammed timetable regulating exposure to outside forces evoked both embryology's critical period for tissue determination and ethology's imprinting (think of ethologist Konrad Lorenz's ducklings, faithfully following him because he was the first moving object they spied on hatching). Then as now, such time limitations on development were treated as evidence for a "biological base," indispensable in the era of Chomskian linguistic nativism. As I read in psycholinguistics proper, however, and eventually in various areas of biology, comparative psychology, and philosophy of biology, I became less and less sure of what a biological base could be, or much the same thing, what the alternative was. And if biological bases were unclear, then so were similar terms, such as *innate, maturational, genetic, inherited, programmed,* and so on, as well as their opposites *acquired, environmental,* and revealingly, *developed.* So the basic concepts were surprisingly obscure, and the situation was scarcely helped by the fact that terms were usually not defined but were apparently assumed to be transparent and universally accepted. When a definition was offered, it was typically taken from a closed circle of synonyms, so that if you asked what it meant for something to be maturational, you were told that it was programmed (or biological, or innate), and if you then wanted to know what *programmed* meant, you were told that it was innate, maturational, or in the genes. I need hardly add that innateness was apt to be defined as programmed or biological, and so forth, to everybody's increasing irritation. Ambiguous terms were used in a variety of ways without qualification, and as a result, evidence was sometimes mustered with a cavalier attitude that would not be tolerated under other circumstances. Occasionally such definitional circles were unexpectedly revealing: hearing that *innate* means *physical,* for instance

(as I did once, from a behavior geneticist who ought to have known better), makes one wonder, Physical *as opposed to what?* More often, these (inadvertent) games just annoyed both parties; they revealed that the "common knowledge" was alarmingly murky, and that it was not fun either to ask or to be asked to clarify it.

Common Ground

One thing that made this situation possible was that despite the lack of agreement about particular meanings and usages, many broader assumptions were largely shared. Perhaps most basic of these was what I have called *developmental dualism*, the belief in two sources of developmental causation, one internal and the other external. Whether these were conceptualized as the genes and everything else in the universe, biology and culture, physiology and learning, or some other inside-outside pair, the internal causes tended to be treated as somehow primary. The genes, for example, are usually thought to *control* development with a centralized autonomy that imbues their products with a peculiar kind of necessity. Nature speaks through the genes. Or, in the sometimes grandiose rhetoric of the Human Genome Project, in which science succeeded in sequencing "the" human genome, genes are the language in which God wrote the Book of Life.[2] In comparison, external influences on development tend to be treated as secondary: contingent, capricious, diffuse.

A parallel dualism exists in evolutionary theory, but with the causal polarity reversed. Here, Nature's voice is *external*; she speaks by setting environmental problems for organisms to solve, punishing them when they fail. In the evolutionary story, that is, Nature's voice is the voice of natural selection, typically considered to be life's primary formative agent over the span of millennia. Selection, in this view, confers the genes' extraordinary powers on them. Now the secondary influences are internal, supplied by development itself, in the form of "developmental constraints on selection" (Oyama 2000a, chap. 5).

Consider Nature, speaking. *Logos*, as Dyke notes elsewhere in this volume, no longer belongs only to God, or at least, not to the traditional God of organized religion. Setting aside some complications he mentions, we could say that in today's world (at least that part that doesn't reject evolution as heresy), natural selection has a monopoly on that

precious commodity. Historically God's competitor for authorship of life, natural selection is no idle chatterer; for many people it is the true giver of the Word, the all-knowing, all-seeing shaper of the living world. As Yrjö Haila and Peter Taylor (2001, 95) observe, "If the essence of natural selection is selection of genes, and organisms are 'really' optimization vehicles for their genes, then changes in gene frequencies from generation to generation give a faithful reflection of the environment of the organisms as it 'really is.' " Since the advent of gene-level selection, in fact, as these authors imply, the ultimate goal of all life has become narrowly circumscribed. In Richard Dawkins's (1982) gene's-eye view, what counts is not the reproduction of the mere organismic "vehicle" but only the propagation of the gene itself, for the sake of whose replication the vehicle exists in the first place. Both executor and beneficiary of the evolutionary legacy, the gene aims, in this account, to make other genes in its own image. All else is instrumental to that goal. In many ways, then, DNA becomes the carrier of fate. (Try substituting "It is written" every time you see "It's genetic"—it works shockingly well.)

The gene, then, is hailed as Nature's Chosen (Selected!) Molecule, the agent into which the evolutionary Word is breathed, the worker of the ubiquitous secular miracles of life, including much of development, mind, and behavior. The dominance of the language of *language* in genetics, in fact, is striking and fits all too neatly with our discussion of Logos: geneticists' technical vocabulary (not, they insist, metaphoric) is rife with codes, translations, transcriptions, editing, sense and nonsense, along with comparisons of bases to letters, of genomes to libraries. From cognitive and computer science, meanwhile, engaged in constant conceptual and terminological cross-fertilization with molecular biology, come information, transmission, representations, programs, and algorithms.

Genes as Gods

In this context, the gene is the God of Nature made Word in the heart of every cell. "The ghost in the ghost in the machine" in my *The Ontogeny of Information* (Oyama 2000b) was my attempt to capture something of this gene-god-word-soul connection (see Nelkin and Lindee 1995). The ghost in the machine is the explanatorily redundant entity placed inside a person to account for feelings, wants, actions—the homunculus that

contributing in myriad ways to the organism's life. Relinquishing the traditional dichotomous scheme gives a more precise view of the way genes participate in actual biochemical processes (i.e., by interacting with their molecular milieus), allowing for a more detailed, biologically perspicacious approach to the changing, multifaceted environments in which any organism lives.

4. We also move *from single to multiple scales* of time and size. We may work at the molecular level, say, but are prepared to shift to that of organs or whole organisms the better to follow a causal path. We may look at rapid processes as well as slower ones, including those that take place across many generations, to understand the ways they influence each other. In the systems perspective offered here, both kinds of level shifting readily lend themselves to ecological investigations, for the organism-environment relations are "built-in," so to speak. We can always focus on one level for a particular purpose, for research requires (provisional) limits. It is difficult to know the extent of the relevant context beforehand, however, so it is good to have a conceptual frame that keeps contexts *present*, rather than including them only under duress. What counts as a system—say, for the purposes of delineating the boundaries of the research—is thus a pragmatic matter, to be decided with an eye to the theoretical and practical particulars of the research.

5. The concept of *heredity* in DST is an *enlarged, extended* one. Development and evolution need to be connected by a more generous notion of inheritance than theory now permits. In a developmental system, an organism inherits—has available to it—its developmental *means* or *resources*. Phenotypic characteristics themselves must be developmentally constructed. Because the organism is a significant resource for its own continued development, of course, previous constructions can number among the present resources. Notice that this not only makes explicit what is assumed in discussions of biological continuity, it also eliminates the need to say organisms are created by genes (maybe with some cytoplasm) because that's all they inherit.

6. In the developmental systems perspective, biological "control" is a matter of *interactive, distributed regulation, reciprocal constraint and influence*. Absent is the chromosomal control center that dominates most accounts of development. Yet we can still deal with predictable sequences and outcomes. In fact, one of the virtues of the perspective is that it makes salient all the conditions, entities, and processes that contribute to such stability.

7. The language of *transmission* thus gives way to descriptions of *continual*

construction and transformation: the transformation of organism-environment systems over the life cycle (development) and through successive life cycles (evolution). In a developmental system, means (interactants, resources) are "transmitted" (made available); traits are constructed developmentally.

8. Parity-of-reasoning arguments can be used constructively as well as critically, allowing *theoretical extension and unification*. As we saw, various criteria for inheritance can be applied to developmental factors besides the genes or cytoplasm. This changes the scope, and therefore the meaning, of inheritance itself. Influences that are usually marginalized now participate fully in a unified explanatory scheme. Factors that were formerly endowed with extraordinary executive powers are now part of the large set of developmental interactants, not master controllers. The manner in which these factors are repeatedly assembled (Caporael 1997) then becomes a major research focus, because the framework encourages research into often overlooked "background" factors, providing a nondualistic frame for interpreting results.

CHALLENGES OF ARTICULATING A CONCEPTUAL SCHEME

How we speak about something, I am obviously suggesting, counts, and I am hardly the first to say so (Doyle 1997; Keller 1992; Rehmann-Sutter 2001). The ways we describe Nature (and her opposite, if we think there is such a thing) imply beliefs about the way she speaks, and therefore what we should do to maximize our chances of hearing her, as well as how to recognize whatever truths she may reveal. Scholars in many disciplines are increasingly committed to taking contextuality and complexity seriously, and have of necessity tried to forge a vocabulary to serve their projects. Some, like me, view life in terms of process rather than sharply defined, individuated "units" and "mechanisms"—networks of mutually influencing factors rather than fixed, sharply bounded entities (e.g., Griesemer 2000). These preferences present special challenges, and understandably enough some doubt the utility of systems-talk. Such doubts, along with the misconstruals that often fuel them, are to be expected, and they are not necessarily a bad thing; if they give rise to discussion and clarification, in fact, they are to be welcomed. Given the diverse histories of usage of words like *system*, anyone using them must steer a tricky path, acknowledging ambigu-

ities where they exist (everywhere) and heading off misreadings without being diverted from the task of elaborating a usable alternative vision (Oyama 2001).

Some Objections to Systems-Talk

One objection that has been raised to the use of a systems approach is that it implies uniform units (Lewontin et al. 1984, chap. 10; Peter Taylor, personal communication August 1998) and so is not well-prepared to handle natural diversity in ecology, for instance. But I suspect that such a uniformity assumption, when and if it exists, comes from particular practices of modeling, which put a premium on simplicity and tractability. Modelers may also believe that results are especially impressive if they start with homogeneous units. (If units are not differentiated in the beginning, the eventual result cannot be attributed to special characteristics of some components, but must instead stem from their interactions.) I am not persuaded that this particular objection is widespread, but it does not apply to developmental systems work, in which the *heterogeneity* of the interactants—in kind, magnitude, temporal characteristics—is conspicuous.

A more frequently encountered worry is that speaking of systems is a way of characterizing development as inherently unpredictable or variable. An invocation of systemic interaction can indeed function in some contexts as a reminder of variability, but it shouldn't be taken as a *code word* for it. Any developmental course will be predictable in some ways, unpredictable in others, depending on the inquiry. From study to study, different aspects of the organisms in question will be picked out as recognizably the same, as significant or informative, and variation in other aspects will be ignored as random noise. Yet we know that one person's noise is another's signal. My own version of systems-talk doesn't require denying regularity, or even the extreme predictability found in the production of species-typical features. After all, this is what it *means* to be species-typical, and part of the point is that a systems approach can accommodate both regularity and variability.

There is a final reason for not making unpredictability a constitutive characteristic of systems: to some people, *system* indicates *too much* predictability, not too little; to them, it connotes unfailing self-regulation, perhaps on a machine-like cybernetic model (P. J. Taylor and

García-Barrios 1995; Vayda 1966). For these people, to speak of systems is to invoke a noxious holism (Lewontin et al. 1984), or even harmony, of the sort found in certain writings on the balanced, "natural" environment. But the point is not that a system is predictable or unpredictable, self-righting or not, *by nature* (if you will), but that all outcomes are interactively constructed, and "balance" or stability is related to the particulars of the situation.[3] As Haila (2000) observes, taking a "processual turn" on ecosystems or populations is to see them not as fixed entities but as repeatedly constructed structures. This in turn questions the dividing line between those entities and their environments. The reliability of such (largely faithfully) recurring complexes, which is what a developmental system is, must be established under varying conditions, and processes producing similar results must be studied, not just black-boxed. As Haila (1999b, 340) points out, serious attention to contextuality imposes an obligation to respect the ways in which environments make existence possible.

The Challenge of Articulation across Fields

For a systems approach to be usable, we need a rich articulation of concepts, findings, and relations among processes. Broader cross-disciplinary articulation is needed as well. Earlier, I mentioned ways in which many academic disciplines are ordered by distinctions between biology and culture or body and mind. In fact, new disciplines typically define themselves by contrast and opposition, like late entrants to a political race. But if nature-nurture distinctions are reworked in the ways being advocated, it would seem that such identities and relations can hardly remain untouched. This second kind of articulation, among academic disciplines, has become increasingly important as systems thinking has been taken up in a variety of areas. Here I refer not only to developmental systems-related writings (Oyama et al. 2001), but also to allied efforts such as the dynamical systems and autopoiesis perspectives in biology and psychology (Fogel 1993; Thelen and Smith 1994; Varela et al. 1991), some work in social psychology (Oyama 1999, 2000a, 2000b; Shotter, this volume), and B. H. Smith's (1997) constructivist-interactionist take on science and knowledge. As I note elsewhere (Oyama 2001), DST's treatment of organisms as integrated with their (developmentally and evolutionarily effective) environments makes ecology central to the fu-

ture extension of the approach. Such organism-environment interpenetration, if taken seriously, undoes dualisms in both developmental and evolutionary studies. That is, not only is the "nature" of the nature-nurture dichotomy transformed (as we saw, by being recast as a changing *product of* nurture rather than its *alternative*), but "nature" in the sense of the external environment of ecologists and evolutionists is transformed as well.

A SPECULATIVE CODA: AGENCIES AND RESPONSIBILITY

One way to think about much inter- and intradisciplinary variation is that it represents divergent approaches to the question *How does Nature speak?* and therefore, divergent opinions on the best way(s) to listen to her. Scientists can take the speaking for granted, blithely accepting the notion of a more or less articulate nature, and seek the best way to hear her. If she speaks in (phenotypic) ciphers, we hunt for the (genotypic) code; if her speech is soft and masked by noise, we amass large data sets, average across them, and use statistics to detect her messages; if she favors synonyms and homonyms, we may turn to evolutionary homologies and analogies, or mutated morphologies and their phenocopies. But there are other possibilities.

What Kind of Subject Is Nature?

Acceptance of nature as a unified, authoritative source (authoritative, that is, about her own coherent nature and needs) implies that she has the kind of persistent identity we generally take for granted in our mundane social dealings with each other. As I indicated, if I were obliged to accept this analogy with the autonomous subject, I would stand with Dyke, label myself perhaps a lapsed polytarian, and say Nature doesn't speak: she is not a subject, at least not *that* kind of subject, much less a god. And I would say this as one who has spent considerable time exploring the many ways in which quasi-theological views have persisted in ostensibly secular scientific and popular discourse. We can refuse the metaphor out of hand, as Dyke does. But suppose we pause to reflect on this analogy between a personified nature and traditional notions of the autonomous subject. This is where

long been recognized that the answer is a treacherous one, for it risks depicting as passive and impotent just those who most need to be empowered. When empowerment works, it does so when those people see sensitive points in the network where they can, individually or collectively, directly or indirectly, bring effective pressure to bear, that is, by acting, not like helpless components in an all-powerful system, but as (partially) knowledgeable and (inter)active beings.

Perhaps less familiar than such debates about social or personal reform are discussions of the allocation of blame for accidents. There have been reports in the popular press of individuals whose actions (or inaction) were implicated in some mishap, but who were judged innocent because the system made an accident inevitable. In very complicated situations, the reasoning goes, involving many objects, people, contingencies, choices, and interactions, if the accident had not happened in the way it did, it would have happened in another way, or an equivalent one would have happened instead. What I find worrisome is not the acknowledgment of complex interdependencies. Indeed, I think they must be recognized if we are to behave responsibly. Instead, it is the background assumption that total responsibility can and should be partitioned in this way, for the more power or agency is attributed to the system, the more helpless we may feel *ourselves* to be. And if people believe themselves to be causally irrelevant in this way, how likely are they to be acutely vigilant and painstaking at their duties? The danger, then, is the abdication of human responsibility in the face of complexity.[6]

Speaking for Nature

The "we" in some of the preceding passages, whether it refers to we scientists, or we intellectuals, or we citizens of developed nations, signals a considerable amount of largely unspoken and unexamined agreement. In such cases, explicit references to what nature is, does, says, or needs are perhaps not very frequent. We are probably more apt to invoke the speaker *as such* when there is disagreement or doubt. You do not talk about a friend's *self* until he says something you take to be out of character—that is, inconsistent with your sense of him. Then you say he was *not himself*. Or perhaps an acquaintance seeks to mitigate the impact of last night's abusive remarks by telling you, "That was the whiskey talking, not me." One even hears, "Don't blame me, blame my

genes." As I have been suggesting, the ways agency is attributed in everyday life, as in science, are various, fascinating, and worth investigating, not least because they tend to imply a certain stance toward responsibility. Surely much of the struggle of environmentalist movements is to carve out a speak-aboutable area of the universe so that it will be noticed, so it can become an object of thought, discussion, and advocacy, and surely one way to do this is to give that area a shape, to make it a presence, by giving it a voice: in short, by having it speak. In fact, I once enlisted Bruno Latour's (1987, 71–72) description of the scientist as a spokesperson for that which is studied to show how the developmental-systems framework allows me "to speak for the background—the mute, manipulated materials, the featureless surround"—in short, for "the environment." I continued, "Sometimes, the peripheral is the political" (Oyama 2000a, 126).[7]

We seem to face a mismatch. On the one hand there is the postclassical, systemic sensitivity to the particulars of local context, to permeable and changing boundaries. On the other, the kind of rhetorical vividness and immediacy required for political action or for effective communication with colleagues. We often have the most impact on those who do not share our conceptual preferences when we can name entities and draw definite lines around them, and when we can describe transactions among them that map readily onto everyday ideas of our own affairs. And yet in doing so we are already halfway along the road to falsifying the very vision we are trying to communicate. Haila (1999a, 174) again, on the processual turn and our obligations to nature: our main duty, he says, becomes, not to protect named entities but, rather, to respect processes on which the "recurring self-organization of the entities depends." Elsewhere (1999b) he speaks of scientists' obligation to seek new possible solutions even when things seem hopeless. Obviously, the point applies not only to scientists, but to all of us, whatever our experience or expertise.

NOTES

1 Just such a view of action is discernible in other contributions to this volume.

2 See Kay (2000) on the history of the shift to informational talk in biology and allied areas.

3 Later I look at another potential drawback of regarding systems as superagents capable of ensuring their own development and perpetuation.

4 Though there was the occasional skeptical aside (Oyama 2000a, especially chaps. 9 and 10, and 1999).

5 See Peltonen (this volume) on "agent-centered and structural explanations."

6 I regard the nature and role of human action to be an enormously important topic for those working in a systems framework; the issue of social action, explored in some of the essays in the present collection, is a case in point. Robert Jervis's (1997, 260–94) book on complex systems discusses possibilities for effective action and counsels us to be prepared to find, even after a relatively successful outcome, that the problem is not solved once and for all.

7 In this passage, "the environment" is mainly the secondary term in the contrast between genes and environment, not the environment of the Greens and ecocentrists, though the meanings overlap.

Natural Speech

A Hoary Story

Chuck Dyke

TO CONSTRUCT MY "ARGUMENT," I have to reveal my views on spiritual matters. I'm a polytarian. Polytarians have the same relationship to paganism that Unitarians have to Christianity. That is, there are pretty surely no gods, but if there are, there are lots and lots of them. And they're all over the place.

I completely lack faith. The possibility of faith was efficiently eradicated in early attempts to make me a Christian. Yet, lacking faith, I retain deep sympathy with paganism. Pagans' emphasis on bread, wine, olive oil, and oak trees is particularly sympathetic. So, despite any minor differences, I feel qualified to speak legitimately from the pagan point of view and, in what follows, do so to the best of my abilities.[1]

Monotheism has dominated the dominant world culture for so long that we have lost almost all sense of what this dominance means. Monotheism demands obedience to a defined unity. Unity demands narrow conformity. Plurality, in contrast, admits of variety. The only real possibilities of a freely interacting creativity are pagan. Monotheism, in the end, has no room for creative variety. Even when it waves its hand in that direction as it offers us freedom, it simultaneously constrains that freedom to the straight and narrow. When we dimly feel some of the freedom of movement we lack in understanding the world around us, for example, by asking plaintively how nature speaks to us, we very nearly lack the means to trace the loss to its source. Recalling two key moments in the history of dominant monotheism should jog our memory.

First is the moment when it was decided that the monotheistic god had created us in his image, thus transferring the right of paternalistic dominance to us. We became uniquely sacred at the expense of everything else. This is demonstrated to Adam in no uncertain terms. From a

pagan point of view this is a terrible moment. As Nietzsche might have put it, this is the moment of the death of the gods: the first mass extinction at the hands of humans, the first act of genocide. Later there would, of course, be others.

Second is the moment when the monotheistic god arrogates speech uniquely to himself: "In the beginning was the Word," the *logos* that Faust was later to have so much trouble with. In fact, if you'll remember, from that time on, in all three major monotheistic traditions, the monotheistic god is intricately identified with and as the logos. The earlier Hellenic traditions were deftly tidied up to suit the need, then elaborated.[2]

These two moments complete a circle of identification, god-word-man-god, that is the canonical act of exclusion establishing the radical alterity of all else. That is, the holy trinity of man, word, and god are the root of all the other versions of dualism that bedevil us in our relationship to "the environment."

Once this chauvinistic arrogation of the word to us exclusively is seen, however dimly, an initial impulse of sportsmanship is to relegitimate "nature" by somehow allowing it the word. Nature must "speak" to us to establish a place in our priorities. But this is silly. When nature could speak, it was all the gods who were speaking. Nature can't speak without the gods. Once in a while, a chimp can be induced to croak out a word or two, but that's no help. Any self-respecting pagan can immediately see through the trope of having nature speak, for anything that nature "says" will have to be interpreted, mediated by those to whom the word primarily belongs. So the original act of exclusion will be reenacted over and over again as nature is mediated through one after another interpretive labyrinth. And given the squabbling that goes on among the Daedalian children of interpretation, even in the best of cases, the pagans are not a bit encouraged.

Once sacrilized, the circle god-word-man-god can't be broken, say the pagans ruefully. Prove that to us, say the rationalist monotheists. But what, say the pagans, is a proof? Well, that's an interesting question, isn't it? For proof has long since come to be a thing of words. And that makes it look as if the speakers have all the cards.

To combat that master argument, I'm afraid that we must try to beat the devil and, with Faust, explore the possibility that in the beginning was the act, not the word. For when the act is first, and not the word, once again we can appreciate what it is to interact in a life shared with

early modern period shows as well, the laws that dominate scientific discourse are the *Vox dei* required for monotheistic rationalism. It certainly does make sense that a single all-powerful ruler and creator is thought of as a law*giver*, and the product of his/her creation subject to the laws he/she gives. But there is no such lawgiver in a pagan world. All the many many deities all over the place are more or less a law unto themselves, as it were.

And speaking of those deities, I'm sure you're all breathlessly eager to hear (from a *lapsed* pagan, mind you) what they're like. Clearly, just as the monotheistic god varies from religion to religion, so do the gods of the pagans, though with far greater variety. However, just as there is a generic core of monotheity that can be extracted from the various single godheads, there is a generic polytheity that can be extracted from the varieties of paganism. I won't pretend that my particular extraction doesn't reflect my own biases. As there are no gods in any case, it really doesn't matter.

There's a deity for every difference that makes a difference. Thus, if Feynman is right, there is only one god of electrons. On the other hand, some gods keep coming into existence and passing away. Thus, at one time there was no god of dodo birds, then there was, and now once again there isn't. Those who think that gods are eternal are just wrong, except perhaps about the god of very energetic photons.

In starting this way we've obviously located an immediate major theological issue: what differences are godly, and what ungodly. The pagans are interested in *powerful* differences, not doleful impotent ones. But, of course, it's not always easy to know where the power lies. So, to be safe, we'll have our pagans be willing to believe that there is a deity for every determinate capacity. This generous willingness to open the pantheon wide quite naturally creates the task of identifying determinate capacities, and this may look like a difficult if not impossible task. But the very difficulty has a decisive advantage at the present stage of inquiry.

Paganism has an analogue in one of the most active industries of modern science. The problems involved in locating and counting determinate capacities are, exquisitely and exactly, parallel to those generated by the attempt to find quantitative measures of information. In both cases, the cloaca maxima of potential candidates, gods or bytes, gushes them forth in embarrassing profusion. Counting is thus thwarted by

tangled plural criteria of identity, all of which have their plausibility. Harsh decisions can be made in the pagan context if you're willing to commit yourself to a theory of the nature of the gods, and in the informational case if you're willing to make a decision about what you're willing to consider to be information. But then, of course, all the problems simply slide over to infect the prior decisions. As Susan Oyama (1985, 3) puts it, "Information is a difference that makes a difference, and what it 'does' or what it means is thus dependent on what is already in place and what alternatives are being distinguished."

Well then, how are all our deities related to one another? To say "by laws" would just reintroduce the monotheism again. In fact, it's traditional to introduce this move as an argument for monotheism in the form of a foundation of reason (a unique "arche"). It always sounds good in a context dominated by monotheistic ideology, and like question-begging silliness otherwise. Here, of course, the silliness is patent. The fact is, the gods are related in myriad complicated or even complex ways, and it's the job of a polytheistic science to discover, exhibit, and understand the myriad ways of the gods.

For example, one of the most interesting things we'll find as we browse polytheistic science is the way the gods beget gods. I've already mentioned the birth (and death) of the god of dodo birds. Such engendering (as it were) is typical of the interactivities of the gods. Just as the most usual form of animal reproduction requires the interactivity of two partners, one of whom has the specific distinct capacity we call "biological male" and the other with the specific distinct capacity we call "biological female," so the engendering of a given god will require the interactivity of two or more gods with specific distinct capacities. So, the gods Proton and Electron, in the sanctioning presence of various gods of temperature and so forth, will engender the god Hydrogen. In fact, if the presence of various sanctioning gods is reliable enough, we might even tend to forget about them and say that proton and electron engender hydrogen.

It's really very important to keep in mind that the god Law is engendered, in pagan science, only when "we" are part of the interaction. This isn't any more surprising than the engendering of anything else we'd be inclined to call a human artifact (except, of course, here in the world of pagan science, we, too, are gods). The god Law is the patron of our determinate capacity to forget. In particular, we need incredible

capacities for remembering likeness and forgetting difference in order to engender the god Law. The god Law so engendered is very different from the monotheistic law*giver*. In the case we started with, the existence of the god Law is explained by the interaction of our participatory interaction with the interaction of proton and electron interacting with some other sanctioning gods. It's absolutely crucial to note that these interactions are nowise explained by the existence of the god Law. At some later time, of course, we might remind each other of the expected outcomes under certain reliable conditions of the interaction of the gods Electron and Proton by referring to the god Law, but reminding isn't explaining, we must remind the monotheists.

It follows that one of the most crucial differences between the pagan god Law and the monotheistic law as the word of the one god is that the pagan god isn't related to "idealizations" in the same way the monotheistic counterpart is. To preserve the divinity of their godhead, monotheistic scientists have to protect it from the vagaries and contingencies of quotidian interaction. So life in the monotheistic world of law is life in the subjunctive mood. We're told what the god would do were it not for the dirt and noise. For the pagan, Dirt and Noise are gods, too. Their participation in an interactive process has no less dignity and is no less likely to be decisive than the participation of any of the prettier gods.

To forget, that is, to "abstract" your way to an idealization, is certainly one of the successful research strategies. Monotheistic science encourages the hypostatization of idealizations and their canonization in the language of law. The problem is with the understanding and use of the idealization. The strategies associated with monotheistic idealization are extremely rigid. In fact, they're so rigid that penance and absolution have to be made available for those who fall short of the ideal. In the squooshier monotheistic sciences, such as economics, the use of *ceteris paribus* clauses as boilerplate are ubiquitous and conspicuous.

In pagan science, abstractions and simplifications are available as well, but the strategic imperatives are very different. A pagan has to have respect for all the gods, and treating them like dirt isn't the way to do that—if dirt is thought of in the monotheistic way. So the pagan has to pursue complex strategies allowing all the gods to have their say. Now, if they all talked at the same time, it would be a cacophony. So the pagan has to hush some of the gods, then hush some others, then others still, in an attempt to illuminate the complex nonlinear godly

interactions. The near impossibility of stilling all but a single voice is one of the main reasons pagan science can't produce the illusion of certainty nearly as easily as the monotheists do. In the realm of the linear, both monotheistic and pagan science can sustain the illusion of certainty pretty well, but the realm of the linear is far more limited than monotheistic science had hoped for so long. Although this always should have been obvious in all the sciences except physics, it could be ignored for a long time because of the availability of the dream of reduction of all science to physics itself. The gods of ballistic objects are reliable enough to simulate an all-powerful deity under carefully prepared conditions.

Of course, from time to time, under unusual circumstances, there may be only one god responsible for some phenomenon. Then we could account for what's going on by invoking the specific determinate capacity of that god. We might even get fancy and call whatever happened the result of that god's law. This would mimic monotheistic science. But it would never seem sensible in pagan science to make the search for single-god phenomena the dominant research strategy. There are so few such phenomena, and they're so uncharacteristic of what generally happens, that the resulting agglomeration of caricatures would be embarrassing to the pagans.

A number of people have made an interesting point that has direct relevance to the conception of monotheistic science. For many years, doubts were expressed about the possibility of a scientific cosmology. Among the most serious grounds for this doubt was the "fact" that there was only one cosmos, hence there could be no laws of the cosmos as such, laws needing, as they do, a multitude of instances for their establishment. In just such a way, of course, there can be no laws about the monotheistic deity, only laws by him/her about the world. How physicists overcame this apparent difficulty is very easy to gloss in terms of a reversion to pagan-like science to achieve a scientific cosmology. The gods of photons, the gods of galaxies, and all the gods in between were brought together to display the nature of their interactions. The fact that they haven't yet been brought to a harmonious peace may simply indicate the difficulties of some very deep science.

It should be abundantly clear that a pagan science has a very difficult time producing a dualistic epistemology or metaphysics. Divinity diluted (as monotheists always insist) is tantamount to divinity denied.

The ontological separation between deity and world is nigh impossible with all those deities in the world. Consequently, the pressure to make human cognition or language a manifestation of the divine is minimal. For the pagan, human cognition is something in and of the world. Theories are in and of the world as well. Despite the fact that a lot of language is about the world, this is no decisive argument for its occupation of a world of its own as there is for the monotheistic logos. Language, too, is a complex of interactions of immanent gods. How else, after all, could it be part of the making and doing of things? Of course, if you have the monotheistic word as your paradigm of a creative source, I guess it doesn't bother you that you have no account of the efficacy of the disembodied word.

But the trope has almost certainly exhausted your patience by now. The belief in a gazillion gods is nearly as absurd as the belief in one. So finally, as a lapsed pagan, I have to talk about secularization—something that is supposed to have happened to monotheism in the transition to modern times.

The supposed secularization of monotheistic science turns out to have been no secularization at all. The godhead simply wanders around among inferred existences, subsistences, and persistences, usually summarized as reason and usually certified pure. More specifically, the secularized monotheistic God is whatever it (he, she) has to be to make physics possible on the latest standard models. The priority of the logos is never in doubt. By and large, this means that nature speaks to us with full authority when we hear its (his, her) laws. Expectedly, the attempted secularization of monotheistic science is a colossal failure.

As a polytarian, I have to say that, in contrast, the secularization of pagan science is a smashing success. In fact, what it does is show us the embarrassing redundancy of theism in the first place, charming as it may have been. Why bother with gods of electrons when there are electrons with their determinate specific capacities, differentiated from the determinate specific capacities of everything else, including positrons and muons? The pagan insight that explanation is at root the account of the dynamic interactions of things with determinate specific capacities stands by itself. It really doesn't help one bit to assign the interactions to a plenary pantheon. In fact, paganism is a dangerous distraction from serious understanding, just as monotheism is. Hence my lapse.

this essay is a casual and ephemeral intervention in an ongoing conversation. There's nothing eternal about it, nor could there be.

NOTES

1 A gratifying number of "paganisms" have thrived over the face of the globe. Paganism isn't a pagan word, after all. Here I have to abstract radically from the fascinating particulars to reach a generic conception sufficient for my purposes.

2 In addition to St. John, we can remember Philo of Alexandria, Plotinus, Proclus, Al Ghazali, Ibn Gabirol, Saadya Gaon, the Pseudo-Dionysius, Dan Brooks, and others.

3 This is not to slight Christianity and Islam in the least, but they themselves are presently dominated by rationalist science. What I call rationalist science, because of the direction in which I happen to want the finger to point for present purposes, Donna Haraway calls technoscience, for ultimately more important reasons.

We sow the corn and plant the trees. We fertilise the soil by irrigation. We dam the rivers, to guide them where we will. One may say that we seek with our human hands to create a second nature in the natural world.—Cicero, *The Nature of the Gods*, Book II

Gardens, Climate Changes, and Cultures

An Exploration into the Historical Nature of

Environmental Problems

Ville Lähde

THE ROMAN EMPIRE was hardly the first culture to make noticeable changes in its environment. This excerpt from Cicero's (1972, 195) work is still one of the first texts in *European* history in which an attempt is made to conceptualize these changes. The Greek philosophers had lamented the passing of the great forests that were cut down to build their merchant and battle fleets, but this theme never took a central role. In Cicero's time, the situation was very different, as instead of the Greek mosaic of city-states a true empire was emerging. New agricultural practices spread to a huge area, changing the whole face of the land for good. Grid-like land division, centuriation, was coupled with new forms of local administration spreading to varied environments, such as the Po Valley and Tunisia (Glacken 1990, 146–47).

For Cicero this was evidence of the human ability not only to create singular artifacts, but to establish a new order. In short, the Romans not only changed objects to suit their needs, they created the world *in which* their culture could emerge. Fields, gardens, and meandered rivers were at the core of their culture as much as legions and circuses. "A second nature in the natural world" is not only a quaint phrase, it is an attempt

to understand the relationships of culture and nature.[1] To understand the significance of this idea we should remember the intellectual climate of Cicero's time.

Speaking through the mouth of Balbus, Cicero reflects the Stoic view of the world. For the Stoics, Nature was an ordered whole, one that could be compared to the organization of human societies. The gods had laid down the laws and rules that nature obeyed. Thus, nature expressed inner purposes, reflections of the divine intelligence that governed it (Cicero 1972, 155, 172). Cicero argued that there is ample evidence that the natural order was created most of all to suit the needs of humanity (and the gods). The great rivers made cultures like Egypt possible, many animal species seemed to be suited to the care and use of humans, and even the cycle of seasons gave variety to the nourishment nature offered and helped sailors to navigate the seas (176–77). As Clarence Glacken (1990, 57) has noted, this line of reasoning spawned analogies between the order of nature and the order of society: the world as a city, for example. For the Stoics, Nature was a mirror of the Roman culture.

Our experience with contemporary environmental problems and most of all with the discussion surrounding them easily leads us to value these ideas from a customary perspective. The idea that the world is ordered for the use of humans seems suspect, for doesn't it involve the age-old human hubris of setting oneself at the top of Creation, of valuing nature simply because of its usefulness? This is, of course, true. The idea that human influence simply improves the world seems ridiculous. We are accustomed to seeing the changes that humankind brings about in nature as inherently *either* destructive *or* constructive (e.g., "restoration" of natural systems or removing famine conditions). This duality is at the core of the present environmental discourse, and, as I later suggest, it also is a factor in bringing many issues to political deadlock.[2] But let us arrest this process of valuation for a while and keep our ears open to the faint whispers from the past. Let us whisper together with Cicero and think about some valuable insights in his text.

The term "second nature" is at the conceptual core of the quote. The "first" nature was, in Cicero's view, an orderly whole. Second nature brought about by human practices was also more than just separate artifacts. It was a purposeful order created within a purposeful order. According to Glacken (1990, 60), in this view there is no a priori

distinction between domesticated and pristine nature—the Roman order was seen as a continuation of the teleology inherent in Nature. However we value Cicero's idea of humans as stewards of the Creation, one notion behind the image remains important: human practices inevitably effect changes in the world. And whether we are talking about Roman gardens and aqueducts or twenty-first-century agribusiness and irrigation, these changes are central to the way that human cultures can realize themselves. Human existence is fundamentally artifactual. The problems associated with this world-building activity are most likely an inseparable part of humanity. Of course, this does not invalidate the criticism of some practices, some institutions, and some problematic outcomes. But it does invalidate any idea of "Letting Nature Be."

However, human practices do not change the world at will and whim. In Cicero's terminology, changes are possible only *within* the dynamics of the first nature. One cannot meander the river without the river, and one cannot use the water to fertilize the fields without soil to be tilled and plants to be cultivated. When these changes have been effected, second nature will form the new framework for the future. However, first nature remains active within this framework. It is not a tabula rasa blown away by the force of history.

Our present cultures are in many ways in a similar situation as Cicero's Rome. Great changes in the environment are attributed to human practices, and these changes seem to put our cultures in a new position. Ways to conceptualize this are needed, but the insights of the orator are forgotten. The most contested of these changes is the human influence in the process of climate change. The climate debates have focused on the question of whether a (human-induced) qualitative shift has actually happened, or whether the change is a continuation of age-old climatic processes. The whole debate is, of course, directed by the inherent demands of policymaking: to assess the situation, a problem has to be defined, the cause recognized, and *guilt* attributed. In this definition and recognition various sciences have a pivotal role; scientific communities are being called on to analyze the present problem and demonstrate its primal causes, which will become the objects of policymaking. This is the typical way science-policy mediations work, through clear dichotomies of norm and deviation, problem and cause. In the following, I propose that climate change is one example of en-

vironmental problems where the traditional role of these *dichotomies* needs to be questioned. Here, the word *guilt* is essential.

In the assessments of the causes of environmental problems and in finding the culprits, the division of cultural and natural causes is emphasized. If the practices and institutions of (some!) people are to blame, something may be done. If Nature itself is the culprit, policy retreats, as it resides only in the realm of human action and meaning. As in the case of climate change, "a continuation of age-old climatic processes" will not merit the status of a problem. But this retreat of policy does not make sense. The whispers from the past should teach us that regardless of guilt, regardless of how we value changes, changes *are* taking place. For better or worse (probably worse), Cicero's second nature, another order, is emerging. We have to ask the question: *What* is changing with climate change?

It is my firm belief that a blunt distinction between natural and cultural (human-induced) states of the climate cannot be a fruitful starting point. For if this is our starting point, we are actually counterposing Culture and Nonculture. This conceptual constellation lacks awareness about the long shared history of culture and nature and, most of all, sensitivity to differing cultures and natures around the globe and across the span of history. Human cultures are not built on untouched nature; they are built *in the processes* that make their very existence possible. Second natures are constantly being created when humans engage in their everyday practices. If the aim is to make practical decisions about complex environmental problems, the distinction between natural and cultural is of no use. I am not proposing a view that would try to invalidate the distinction between culture and nature in itself. Conceptual distinctions are a necessity of life, and in some situations the distinction between culture and nature is of course beneficial.[3] I am saying that it isn't a good place to start when we try to make valuations about human action and its consequences. Strong distinctions do not help us understand how changes in the world take place and what consequences they might have. In the following pages I examine how the notion of second nature might aid this understanding.

Act 3: The Intro

After the initial formation of the atmosphere, the audience can see a long period of development, in which the composition of the atmosphere and the states of climate are in constant flux. This is the mythical history before the entry of the protagonists, and it is filled with music and dance, harmonies and disharmonies. While the music and movements flow, most of the audience is still leafing through the playbill. The natural history of the climate is not deemed relevant for the main storyline, the story of the anthropogenic climate change.[4]

There are some spectators who are enchanted by the flow of music and dance and can see that the entire development can be understood meaningfully only as a continuum of *relatively stable states*. The natural history of the climate is not a cacophony; one can discern more or less regular cycles of development within the seemingly chaotic whirl. Ice ages are a good example. From the viewpoint of humans and other beasts fleeing the creeping ice walls, an ice age is an apocalyptic disaster, but in the longer span of history it is a part of the dynamics of the climate. A sheet of ice one to three miles thick represents stability in a sense, but for some creatures their world is brought to an end. There are also periods of steady warming and cooling and transitory periods of steady mean temperatures, and these, too, are "perceived" differently, depending on the situations of the creatures.

The idea of relative stability can be addressed in another way. Translated to the language of the climate debate, it means also relatively *normal*, in the very literal sense of the word. "Normal" is something from which norms can be inferred, on the basis of which actions are valued. What might a relatively normal state of the climate be? As the atmosphere is mainly the result of the formation of life processes, normality can be understood meaningfully only in relation to biological systems. Mere change is not a signal of instability or abnormality; *change itself* must be understood. The dynamic states of climate can be normal or stable only when the biological systems have adapted to them. For short periods, the dancers and the music move in unison.

Act 4: Enter Prometheus

The music and the dance pause, the set is silent, and the spotlight focuses on the entering protagonist. He is Prometheus, "humanity," who changes the State of Nature, thus creating a qualitatively new situation. He rearranges the set and creates a climate that is a human artifact. In the field of climate debate, this "event" is described by saying that humanity has disturbed the natural state of the climate by changing the composition of the atmosphere. This Prometheus not only stole fire from the gods, he is creating vast amounts of emissions by using it. The State of Nature is the norm by which the actions of the protagonist are judged.[5] However, the audience is left baffled and without closure. The main actors engage in an obscure debate in which they argue about the exact moment when the transition took place. In other words, what is the relevant period of human history? When did first nature transform into second nature? Further debates ensue: Who, actually, was Prometheus? What should be done about his creation?

The distinction between the natural and the disturbed state of climate is a common feature of the arguments for the need for climate policy. It does not matter whether the truly banal notion of the natural stability of the climate or a more sophisticated notion of the natural dynamics is proposed: *the normative role of nature* is a recurring background assumption. But there is one serious problem. From the perspective of climate dynamics, the gaseous emissions from human action do not differ at all from natural ones. The burning of fossil fuels, deforestation, and even cow flatulence participate in the same dynamic as volcanoes and forest fires caused by lightning. How can these various sources be distinguished from each other? The obvious answer seems to be that only the human sources should be considered, as only they can be objects of political decision making. They can be regulated and limited through policy, but natural sources cannot sit at the negotiation table. This is, of course, important in the sense that *guilt* is not evenly spread among the human actors, even though clear causal chains cannot be drawn. But from the viewpoint of the climate change phenomenon, guilt is not a straightforward issue. Primary causes for changes cannot be isolated, if change is a defining characteristic of the climate.

In the climate debate, a second line of argument has arisen against

the idea of human-made climate. Because change itself is a natural element of the climate, as the third act of the play clearly demonstrated, the states that include human interference are not artifacts or unnatural as such—no second nature emerges. The opponents of emission limitation often use this argument. Again, "nature" is being used normatively, but very differently from before. For some it is the (balanced) State of Nature, for others a realm of inevitable change. What is this mess really about? Concern over the confusion of the climate debate was voiced by Professor Philip Stott in his 1998 editorial for the *Journal of Biogeography*. After his experiences of the Kyoto Summit, he wrote: "To hear ecologists talking about 'halting' or 'curbing' climate change was deeply disturbing, but for them to try to make the world believe that this 'stability' might be achieved through manipulating just a few variables out of the millions of interlinked and dynamic factors which govern the world's climate is frankly sinister. Let us be blunt; it is a lie, a disgrace to the subject, and a scientific nonsense" (1).

Stott's editorial is clearly meant to be provocative and consciously elitist,[6] but one should note that he doesn't seem to oppose climate policy as such. His argument is simply based on the conviction that changes in the climate are inevitable—the editorial actually opens with a quote from Heraclitus—and that this must influence climate policy, otherwise it is bound to fail. In short, he is concerned that the dominant ways of looking at environmental problems simply block better understanding of them.[7]

I agree that the problematic conceptual constellations of climate policy are not just a philosophical conundrum. They are closely tied to policy. What is at stake in the climate debate is the issue of *governance*, the attempt to get the perceived problem under control. But no phenomenon becomes a problem by itself; it gets this status in a scientific and political process. In the making of an environmental problem, sciences and policy engage in visible dialogues that close up their apparent separation into "specialist" fields. The results of scientific studies are not transported directly into the arena of policy; the customary ways of understanding and handling environmental problems pose expectations on the forms the studies will take (like the emphasis on finding clear causes). In much the same way, the dominant dichotomies used in the sciences affect policymaking. To make the problem into a viable object of decision making, these science-policy mediations strive to

reach a common closure. They are essentially trying to find a common language for defining the dynamics of the problem. The ways this is done dictate the possible strategies of action.

If Stott is even partially correct, the function of simplistic accounts of climate change is to make climate change into a viable target for a straightforward policy. According to this definition, human interference has disturbed the natural state of the climate, and for nature to recuperate that interference must be curbed or removed. Thus, the idea of the State of Nature in climate is an archetypal example of how an immensely complex process is being reduced to an abstract division between a supposed norm and deviations from the norm. This abstraction bypasses the fact that the climate is in a state of flux, no matter what is done.[8] The whole phenomenon of climate change has been totalized and abstracted. In some sense, it is possible to see it as a single phenomenon. But there is not one single dynamic for the sources of emissions, and neither is there a common result of the change; one climate, myriad weathers. But if the State of Nature is dismantled, where can we seek norms for action? One way to seek an answer to this question is to examine another meaning for the term second nature.

CULTURE AS SECOND NATURE: CULTURAL NATURES

Whereas the previous meaning of second nature dealt with separate artifacts or situations and their origins, this meaning is linked to a stronger ontological claim. The emergence of culture is not only a historical development, but also an ontological shift that creates two separate realms of existence. The untouched and pristine first nature is seen in opposition to second nature: human culture or civilization in general. In the history of philosophy, this idea has been introduced by various schools of thought. The fundamental idea is that humanity represents a new world-historical stage of development in the history of life on Earth. Human culture is the end result, the pinnacle of evolution; it is the fulfillment of life itself. (Even though the notion of teleological history is not inherent in the theory of evolution, it lives on surprisingly strong in many popular versions.) Humanity is seen as the telos of Creation, whether it is God's creation or a creation of Evolution or some form of *Weltgeist*.

According to this viewpoint, all norms for human action stem from humans themselves, from a historical mission "given" to them, whether it is the stewardship of the Earth or the utilization of natural resources for human progress. Nature as a basis for normative judgments disappears; indeed, the link between culture and nature is completely severed. It is always "our" decision. There are some obvious problems here. Even though this view emphasizes the eventual human responsibility in making decisions about any environmental problem, people disappear, as do the real situations they live in. Instead of heterogeneous human cultures there is the Culture, and instead of diverse natural elements there is a totalized realm of Nature.

Abstract philosophical ideas such as this do not figure much in the actual debates about environmental problems. Still, the fading of natural elements to the background is a recurrent feature. Again, climate change is a good example. Even if the previous account of the climate is based on a simplistic opposition between nature as a norm and the human-induced state of climate, it still hints at the idea of climate as a historically changing phenomenon. But it is easy to forget this altogether, when the present states of the climate become institutionalized in the arena of international climate policy. The climate becomes an ahistorical haggling ground for policies, where "humankind" tries to decide among strategies. The millions of actors and factors that Stott referred to are muted. Natural elements have no role in the play where "we humans" plan the future. It remains unclear who "we" are, and the actual situation of the climate does not have any history. As before, it is more a piece of the set than an actor in the play.

The fading of nature is a similar problem in viewpoints that resemble some forms of social constructivism. They are based on the notion that nature is always a human creation. When people are talking about nature they are always talking about an image of nature, one interpreted through their own experiences of the world, mediated by their interactions with it and their shared beliefs and discourses. For example, competing metaphors for understanding natural systems have played a key role in the history of biology: competition or cooperation, harmony or constant change? These metaphors have been involved in struggles over important political notions, of which Spencer and Kropotkin are good examples. In other words, we never have direct access

on the basis of the naturalness of change, the whole history of human action disappears into a void. Instead of sticking with old conceptual distinctions, the present state of the climate should be seen as a product of a process. Just as Cicero realized that the changes wrought by the Romans had become part and parcel of the environments within the empire, it should be seen that the present states of the climate are a part of our environment, whether we like it or not. What should be done about them is another matter altogether.

The processual view reveals grave problems in the current climate debate. The problems go beyond the philosophical complexities of the concepts of nature and culture. I try to clarify these problems by examining two main strategies of action that have been proposed as a reaction to climate change: *adaptation* and *limitation*. Fierce contest over these strategies has been an important feature of the climate debate. Representatives of environmental movements have mainly supported the limitation of emissions, the object of which is to slow down or curb climate change. They have mostly rejected the idea of adaptation to the coming changes, as it seems to involve a surrender to the problem. The fiercest opponents to any limitations of emissions have often favored the adaptation strategy, saying, for example, that it is more cost-efficient than expensive limitation measures.[9] Adaptation has thus far mostly been interpreted as economic adaptation to the effects of climate change, centering on future problems of production. Other forms of adaptation have been neglected: social adaptation that makes communities less vulnerable to crises and divides the burden more equally, and improving the possibilities of ecological adaptation of endangered ecosystems.

The basic conceptualizations of climate change are at work again: Should we combat the Promethean creation, or adjust our practices in the midst of natural and inevitable changes? Any common agreement seems to be impossible. But it is truly impossible only if we cannot step out of the boundaries of the present debate and the present forms of climate policy.

To understand the dilemma of the two strategies, let us reenact the play about the history of the climate, but this time with a new script. Now the play shows a stage on which protagonists and various pieces of the set are equally active, reacting to each other's moves.

"THE CONSTANT TURMOIL"

Act 1: The Dancing Protagonists

In this play, being human is not a prerequisite for being a protagonist. The mythical history of the climate merges with the entrance of humankind. There is no need for a curtain, as natural elements and humans alike can be actors. Each and every ecosystem has its main protagonists, reacting/adapting to the dance on the stage. For a long time, human practices engage as participants in these dances. This is the music of discords and harmonies that sets the tone for the following acts.

Act 2: Recurring Discords

Throughout this long historical dance sudden changes take place, regardless of the actions of the protagonists. Periods of discord and harmony vary, and as always, some actors will have to step off the stage. Ecosystems break down and transform, and organisms die off or migrate. Human communities either survive the challenge or disappear, leaving strange ruins for posterity. The dancers try to catch up with the changes, protagonists, and pieces of the set alike.

Act 3: Looking for Harmonic Flows

This act focuses on the actions of the protagonists, as they attempt to adapt to the changes in the flow of music and dance. As always in the history of the world, adaptation to changes remains a necessity, whether the human protagonists participated in the changes or not. As we recall from the previous play, "normality" of the climate can be understood only in relation to how biological systems have adapted to it. Human protagonists are no different from other organisms, in the sense that they also meet the pressures to adapt. However, their methods of adaptation differ significantly from other protagonists'. Still, both human cultures and other biological systems strive for adaptation: if the climate changes, one has to change agricultural and building practices to suit the new environment, die, or migrate to pastures that remain (or turn) green.

Act 4: Crescendo, or, The Dark Satanic Mills

At some point in the play, the actions of the human protagonists change radically. The steps and turns of their dance influence the overall whirl much more than before. A marked difference can be seen in the whirl on the stage. Such changes have happened before, but this time human protagonists are visibly actors in bringing them about, not only seeking to adapt. Adaptation to the changes may still be as hard as in the mythical changes of Act 2. It is up to the spectators, the human protagonists, and the (retrospective) playwrights whether this period is seen as a genuine turning point in world history. But one thing is clear: this turmoil cannot be understood if it is cut off from its history.

Act 5: Future Horizons

While the turmoil of changes and haphazard adaptation takes place, the human protagonists get into a protracted disagreement about the future. They claim to have recognized their own actions or the actions of their colleagues, which have affected the changes around them, and focus their attention on them. Meanwhile, the faceless whirling on the stage goes on. It will go on regardless of what the protagonists do, as the effects wrought by human actors cannot be neatly differentiated from the others. The whole set is alive. This is a difficult moment in the climate debate. Even if the present direction of climate change could be reversed at least partially, some changes *will* take place. The long history of human action, "the carbon memory" of the climate, will not disappear, even if the majority of the present gaseous emissions were to be cut. The resulting new stages of the climate will still require adaptation, even if something is done about the emissions.

So: Should the process of climate change be stalled, and even reversed, or should the human protagonists prepare for the inevitable changes? The mere presence of human effects on the climate and perceived changes do not give clear answers to this question. The inevitable flux of the climate that Philip Stott pointed out cannot be ignored, although his conclusions can be challenged. Even though thus far the strategies of limitation and adaptation have been seen as alternatives that rule each other out, this is not necessarily the case. Limitation may be a

safeguard against some of the worst changes, but only if somewhat bolder policies can be put into action. This in turn could make the hard task of adaptation a bit easier. Michael Glantz wrote some two decades ago that adaptation and limitation strategies are both eventually useful, as they help societies reach other important environmental goals and prepare for other crises. In his recent book he restated this valuable insight (Glantz 1996). In any case, it must be understood that the present state of climate has been passed on by a long history, just as the future possibilities depend on the present state. *The State of Nature of the climate is an empty abstraction with no point of reference in the world today.*

I do not mean that people should not be concerned about the effects of climate change on various human communities, arctic ecosystems, coral reefs, and so on. We can be sure that nobody can even start to predict all of the changes that the future has in store, so complex are the processes in question. It is possible that the present developments will result in the emergence of processes such as the thawing of permafrost that will escalate climate change and warming very rapidly. On the other hand, rapid cooling of local climates may be possible due to changes in sea currents. Nobody in Scandinavia would appreciate the effects of the disappearance of the Gulf Stream, with the exception of some arctic species. As mutually diverging as these scenarios are, they do not dictate an either/or decision about the two alternative strategies.

The significance of the new play is that mere awareness of the phenomenon of climate change does not dictate policy. The play suggests that political actions that aim to react to climate change should not be based on simplistic conceptual distinctions unrelated to the history of the climate. They should be based on the reality of today, which is the ground from which future possibilities emerge. The future is always based on the history of cultural and natural actions that precede us. These actions have been objectified in the present as states of the climate, ecosystems, artifacts such as technological infrastructures, political and economic institutions—and ways to look at the world.

Nature as a norm cannot help here, because it can be meaningfully defined only as forever changing. The change itself can be valued, provided the valuation can be related to the relationships between the climate and social and biological systems. It is not reasonable to see the present state of the climate merely as a human artifact. In the long

Environmental studies/Science studies

"What? Another book on ecology and how we are messing up the world? Is this book really necessary? This is not just another book on ecology. It is a book about how to think about ecology. Philosophical explorations, metaphorical musings, case histories of community action seen in the light of systems dynamics, and mathematical exposition of nonlinear dynamics in clear intuitive terms all converge to help us see the richness of ecology as the paradigmatic science for understanding complexity. And yes, this book is necessary."
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How Nature Speaks illustrates the convergence of complexity theory in the biophysical and social sciences and the implications of the science of complexity for environmental politics and practice. This collection of essays focuses on uncertainty, surprise, and positionality—situated rather than absolute knowledge—in studies of nature by people embedded within the very thing they purport to study from the outside. The contributors address the complicated relationship between scientists and nature as part of a broader reassessment of how we conceive of ourselves, knowledge, and the world that we both inhabit and shape.

Exploring ways of conceiving the complexity and multiplicity of humans' many interactive relationships with the environment, the contributors provide in-depth case studies of the interweaving of culture and nature in socio-historical processes. The case studies focus on the origin of environmental movements, the politicization of environmental issues in city politics, the development of a local energy production system, and the convergence of forest management practices toward a dominant scheme. They are supported by explorations of big-picture issues: recurring themes in studies of social and environmental dynamics, the difficulties of deliberative democracy, and the potential gains for socio-ecological research offered by developmental systems theory and Pierre Bourdieu's theory of intentionality. *How Nature Speaks* includes a helpful primer explaining the basic principles of complexity and nonlinear thinking.

YRJÖ HAILA is Professor of Environmental Policy at the University of Tampere in Finland.
CHUCK DYKE is Professor of Philosophy at Temple University.

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