TOWARD AN EVOLUTIONARY ECOLOGY OF MEANING

by Jeffrey S. Wicken

Abstract. I will discuss some of the implications of the ongoing Darwinian revolution for theology as a constructor and interpreter of human meaning. Focus will be directed toward the following issues: How should we best understand ourselves in the new, evolutionary cosmos? What are the problems with the kind of genetic reductionism espoused by neo-Darwinism? How are those problems resolved by the "relational" understanding of life made available by thermodynamics and ecology? How do we generate meaning-structures in this relationally-constituted cosmos? Finally, how do these developments enrich our understandings of responsibility—to each other and to our private conceptions of God?

Keywords: ecology; evolution, relationality; responsibility; spirit.

I begin this essay with three blunt questions to keep myself honest to the reader. Why is the interaction of science and religion so important to understanding ourselves as a species, and to our survival as a species? Why, outside the small reach of journals and conferences, is this interaction so dismal? What can we do about it?

William Shakespeare, the last great poet of Platonic timelessness, capstoned a period of Grace for humankind. There *was* no theoretical science with which to struggle then. Grace was getting in tune with an eschatology that was *outside* nature.

Since the Copernican-Darwinian revolutions, we find that eschatology—and our senses of common purpose in life—to be smack in the middle of nature. We shouldn't trivialize this plain fact. We are "newborns" trying to figure out our new, religious connection with the Cosmos.

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Nature didn't really exist until there was "time." In Shakespeare's day, time was birthing, growing and dying. If we felt flaws in this process, we could come back metaphysically clean as ghosts, advising. That option is now reduced to minimality. We're stuck in a nature that is *made* of time: evolutionary time, thermodynamic time, and existential time.

Years of struggling with the institutionalized agnosticism that scientific criteria for knowledge impose on the capacity to believe make me feel less presumptuous about writing this paper. Struggle is central to spiritual growth, and hence to the maturation of religious perception. Heraclitus was on his usual poetic money when he said "Strife is the father of all things." Two millennia later, William Blake's "opposition is true friendship" spoke in the same currency. To be a friend, to help one's friend grow, requires both challenge and support.

Science and religion should challenge each other, where challenge is needed, and support each other where support is needed. Neither should knuckle under to the other; rather, each should engage the other fairly and openly in the marketplace of human meaning. They are failing in this for fundamental reasons. I say this with all due respect to the efforts of scientists and theologians who get together regularly in scholarly settings to talk about ways in which their enterprises complement one another.

The goal is right and important. But if the proof is in the pudding of the terrible schism that exists between these different and equally powerful expressions of the human spirit, we are not doing it correctly. Science and religion each reveal the human need to plumb the wellsprings of knowledge and explore the nature that birthed it. Using the depth and imagination of both enterprises to dwell together in the land of experience with steadiness of purpose is our singular task as humans. The world is body and spirit—experiencing, hungering, hoping, and wondering. Our world's present starvation is largely spiritual, and the millions who die each year from physical starvation do so in the wake of this spiritual poverty. We don't know what to do with ourselves as a species.

The Darwinian revolution has changed the mat on which we wrestle with these questions. We are supposed now to be "selfish" creatures. It's the way of Darwinian nature, we are told. In this new dialogue, we must ask carefully about what selfishness means. If we do not, we will consign our world to a collective misery that ill-befits out intelligence and feeling.

Science can never again be the handmaiden of religion. That time is gone. The danger now is that religion will become the handmaiden of science in theological quarters (Wicken 1988), and bolt from it altogether in the fundamentalist counterculture.

The intense dialectic interplay between science and religion over the years has strengthened both at the theoretical level. Now we *do* have epistemological isomorphisms about the ways each does business. Now we know in principle where each can speak with authority, and where the other should shut up and listen.

We haven't absorbed this in practice, by a long shot. Increasingly, people feel obliged to choose between the two. Either that, or let their science and religion run in separate domains of head and heart like parallelist theories of matter and mind. Spirit and matter can't escape each other. As we engage our bodies, we engage ourselves as integration of spirit and matter. Religion and science can't escape each other for the same reason. Religion is the complex Dionysian body from which we draw our energy. Science is its Apollonian alter-ego, trying to play comprehensively from a lyre of one string.

Understanding the depth of the Dionysian-Apollonian myth makes us wonder: Which of the two is the presumptuous child? Who is the Icarus flying to the Sun looking for trouble? Who crafted the wings? Religion and Science speak to us deeply in that encounter. Listening to the subtlety—and the intensity—of their respective voices should compel us all to abjure judging one over the other. The spirit moves to religion's deep refrains, and always will. The crafting intellect of science soars toward the mythic Sun, and always will. We want clarity at all costs.

Hence the danger of scientism in this dialogue. The authority of science is so immense that it threatens to absorb the theological community. Sociobiology, in particular, frightens me in this regard—not because it lacks scientific power, but because it extrapolates that power to a metaphysics of mind and spirit. There is *nothing* scientific or philosophic to suggest that the realm of consciousness—or even of simple sense perception—can be derived from a complexifying neuronal network under natural selection. We don't have the foggiest idea why electromagnetic radiation of 400 nanometers registers "blue" to our senses. We are creatures of sense and sensibility, and should (with René Descartes, David Hume and Immanuel Kant) take the fact of sense, and its organization into higher dimensions of perception and feeling, as the starting point for *any* discourse about mind and matter. That "matter" was defined by our sense. So let's not have the wrong horses pulling the wrong carts.

If we are serious about the subject, we must question carefully the directions this dialectic between science and religion is now taking—and *why* it is that the so-called "common man" is not exactly embracing the evolutionary epic. Ideological polarization between religion and science is presently at the kind of political high seen at the Galileo trial and the Scopes trial. Evangelists can run for President and, if they keep

their noses clean, expect significant voter support. An admitted evolutionist would get academic support, and not much more. The people have spoken. They don't *like* evolution. Why should they? Evolutionary metaphysicians tell them steadily that the realm of spirit is reducible to the realm of matter. We should take pains to tell them otherwise.

Scientists are often ridiculously pompous about the human condition. While arguing that those who give their money to Jesus-talking television showmen are emotional children unable to hear the clear voice of rationality, they present a picture of the cosmic order that looks like buckshot. Molecules bounce around in the primordial sea, and consciousness emerges epiphenomenally from material complexity. If evolution is our age's rejected religion, we scientists have only ourselves to blame. What science has done for us technologically doesn't do a thing to offset its "bad news" that we are not sons and daughters of God breathing the timeless Platonic form of His pure thought into matter.

Let's not be coy about God's gender, either: the western world's perception of God is masculine and phallic—the sower of the seed, the righteous sword of power and conquest. The "penetration" of the Son into the body of Christ just objectifies this age-old theme. Yet the reality of spirit is no less inescapable than the reality of evolution. Evolution is the "mother" of life. And to a degree that mothering *is* a phylogentic nurturing under a bloody hand: the placental goddess, bleeding us into and out of life. I wonder if this mythic encounter with death and process doesn't disturb the western mind as much as does the spiritual separation from God's first-hand approval and benediction.

Understanding the dynamics of evolution can do much for us technologically. Its unification with thermodynamics, especially, allows us to understand the conditions in which the present operates to determine the future (Adams 1982; Wicken 1987). That is, however, a feeble spiritual payoff. In its usurpation of traditional religious polarities, evolution just isn't selling. Scientists and humanists, Guardians of Truth and Beauty that we profess to be, must ask carefully why that is. Maybe we are selling the evolution epic short ontologically, and maybe the people are right in not swallowing it. There is no way to get rid of evolution. It *is* reality. We are biological beings, and the products of history. Our quests for meaning occur within that condition. Biology is as down-to-earth as science gets. But so too is religion, in the sphere of spiritual experience. Why these lonesome Romeos and Juliets stay so determinedly apart is a vexing matter.

Before Charles Darwin, biology was about "essences" in a timeless realm of Platonic forms. Since Darwin, it has been about history.

History is real; Platonic essences are not. Biology is real, and theology must be predicated on what organisms have learned historically. Reciprocally, biology must pay attention to spiritual realities. Those realities include freedom, self-actualization, and responsibility. The problem is that Darwin's ecological functionalism has become the one God to which religion is held increasingly accountable. To understand the prospects of religion, we must therefore be critically attentive to the real teachings of evolution. What *are* they? *Must* they be so materialistically reductionistic that the "religion of the people" takes flight to fundamentalist pews where human worth is articulated apart from nature?

Religion, even more than politics, is an enterprise from which none should feel excluded. Its continuing vitality requires fuel from a diversity of perspectives which must collectively reflect the cultural and biological multidimensionality of what it *means* to be human. It is a uniquely human predicament to be both an ephemeral piece of consciousness in time's merciless flow and a *moral agent* who understands his or her participation in that flow. Since each decade of human activity increasingly determines the course of this planet's evolution, our responsibility for the future cannot be underestimated.

I write this essay as an evolutionary theorist, and as a Blakean friend of religion. Reading evolution fully provides a basis for this friendship. It is a useful working notion on behalf of this theme that evolution might be better understood as a process of ongoing creation than as the gratuitous production of chance. The reasons for treating evolution as ongoing creation (see also Peacocke 1979) will become clear as the essay proceeds. If it is so understood; evolution carries profound implications for fostering "universal" religious sensibilities that might save us against our self-destructive impulses.

Darwin formed a framework for biology by showing that life was a product of history. He also built a foundation for an enduring theology. This is a wonderful irony whose texture must be savored: That an ex-theology student battling the religious establishment on behalf of a materialistic process should set the stage for a theology of process is really the stuff of dialectic progress—and a greater accomplishment than the unification of biology. Darwin, like all of us, was a man of his times. His struggles against the inertial forces of his own time led, however, to the evolution-religion polarity that now threatens to undermine the world's sentience.

Like all great thinkers, Darwin requires continual revaluation in light of the new societal understandings that are ever thrust upon us. Darwin, not Alfred North Whitehead, is the father of a true prolegomenon for process theology, for he saw that any real-world theol-

ogy must be predicated on *competition in ecological contexts*. How do we interpret the interactional arena of ecological competition in ways that might best serve the scientific-theological enterprise? There, we have to expand the Darwinian program in Whiteheadian lights. Wholes are focused into parts, and parts are relationally constituted by wholes.

In advancing this proposition, let me begin with a simple distinction, of the "there are two kinds of people" variety. While such distinctions simplify the world to the point of caricature, they do serve the heuristic function of cutting through the complexity of human experience to a terrain which at least objectifies prejudices.

The world of the religious can be divided into mystics and theologians. There are those for whom God is an ambience like the air—as real, as accessible, as natural to life as breath itself. There are others not so built, whose sense of divine beneficence manifesting in the world is weak, whose consciousnesses tend to get lost in the immense ledger sheet of suffering. For those of us, sustained religious feeling must be earned through the currency of our own empiricism, and taken gratefully on those terms. That kind of developmental "getting in touch" with the world *requires* theology for building a structure of meanings into the ambiguous fabric of experience.

That structure is irreducibly ecological. There is no whole without participatory parts. There are no parts without evaluative wholes. That, simply stated, is the broad message of Darwinism. Creationists contend that Darwinism has become a *theology of its own* for that purpose. Is that fair? Or are we evolutionists missing something terribly deep in the human experience in the stories we tell?

Both accusations apply. Evolution, as portrayed by contemporary popularizers, sells religion in bead-shops brightened over with double-helices while Natural Selection lurks ominously in the closet ready to exit those who cannot pay the price. And theology must either buy those gems under Selection's stare or retreat to the removes of fundamentalism or Whiteheadian process. Bad news on both scores. For if evolution is "telling history like it is," it must engage religion's job of "telling experience as it is." The twain must meet. I will talk about the conditions of this meeting in the context of some new, holistic themes in evolutionary theory that extend Darwin's vision to *process and responsibility*.

The Ecology of Meaning

History has revealed humans to be motivated jointly by the *desire for clarity and the need for meaning*. Mixing reflection and desire was the stuff of T. S. Eliot's lamentations. Mixing clarity with meaning is the stuff of contemporary evolutionary-theological thought. Clarity is a desire.

Like Faust, we want to know, at all costs. Meaning is a need. We need to know what we are a part of. This is our relational identity. The drives for meaning and clarity are, however, philosophically unmixable if clarity is understood strictly in the scientific sense—as increasingly it is in both philosophy and theology. Science is a way of getting publically-verifiable answers through reduction and analysis. Religion aims upward to synthesis. And, regardless of epistemological similarities in the ways sciences and religions corroborate their premises in the world of *praxis*, these two enterprises have very different premises.

Clarity is the analytic province of objective description and deduction from demonstable premises. It points downward toward a mind that, as Henri Bergson (1944) so aptly put it, "ever geometrizes." Meaning points *outward* to higher, unanalyzable dimensions of being. Lower levels can never, by definition, apprehend higher levels. An enzyme, for example, is a chemical machine that catalyzes a metabolic reaction. At the level of description, it binds substrates to active sites and acts on them in certain, discoverable ways. But the "meaning" of an enzyme, its "what-for-ness," can only be understood by considering the functional organization to which it contributes. The functional whole of an organism provides both the regulative context in which its chemical parts operate and the historical, evolutionary context in which they evolve and acquire meaning. So the chemical description of an enzyme *complements* its functional, evolutionary explanation (Varela 1979).

Each level of the organic hierarchy gains its own relational identity, its meaning, in the context of a larger whole to which it is functionally accountable. While the coordinated operations of the lower levels are necessary conditions for higher-level operation, meaning-investment is always the province of the higher level. Upper levels provide functional contexts for the evolution of lower levels.

All meaning depends on some kind of part-whole relationship. This relationship need not be hierarchical necessarily, but it must be one in which parts are invested with relational identities by their participation in a more comprehensive reality. The personal reality of a nitrogen-fixing bacterium is certainly smaller than that of the ecosystem in which it participates; at the same time, it is relationally constituted by that ecosystem. Its meaning derives from its ecological role in cycling nitrogen from heterotrophs to autotrophs.

When we carry the ecology of meaning further to embrace the human condition, we see that it points outward to a spiritual and existential arena humans can never comprehend completely. Unlike the enzyme, we are conscious of that higher realm of accountability and meaning-investment. Human meaning comes from orienting the self to that which is in some sense greater. To suppose certainty with regard

to that "greater" is to reduce it to the categories of the apprehendable. Thus the internal dialectic of each individual in coming to terms with the world, and thus the historical dialectic of those tendencies of thought which can be labelled "scientific" and "religious." Necessarily there is a tension between the two. Necessarily the resolution of this tension serves to define the realms of each; science aiming to map out the full configuration of conditions—physical, biological, social—in which meanings can be organized; theology contextualizing the essential incompleteness of this knowledge within a meaning-framework.

Evolutionary theory is central to this mapping-out of conditions in which theology must operate, for evolution locates humans in nature as products of, and actors in, cosmic process. Mainstream neo-Darwinian theory is unable to provide this bridge (Wicken 1985), since its genetic reductionism prevents it from connecting life with the rest of nature. Neo-Darwinism is hopelessly over its head in connecting the human spirit with its resources. Evolutionary theory too is a victim of its own history.

That history began when Darwin saw that life's origins were beyond the powers of nineteenth-century science to address, and that to make evolution a science (as opposed to a philosophy), he had to begin with biological organization as a primitive ingredient in nature. The understandable thrust of Darwinism then became to establish an "autonomy of biology" perspective about evolution that cut it off from the physical sciences epistemologically. The internal contradictions of giving evolution—the science of connection—its own ballpark unaccountable to the physical sciences are amply seen in Francisco Ayala (1971) and Ernst Mayr (1982). I have critiqued the autonomy of biology perspective loudly (Wicken 1985), because it interferes with understanding the importance of evolution as *that which connects* the physical and biological, and that which has great potential for connecting the biological with the spiritual.

Discontinuities beget discontinuities. The neo-Darwinian philosophy of biology begets an evolutionary philosophy that is very hard to digest theologically. Two ingredients stand out: first is "genetic selfishness," which insists that we behave as we do to propagate our genes. Altruism and morality must get in through the back door, and find their ultimate basis in that selfishness.

This is a partial truth. We *do* behave selfishly in certain contexts; but we can give our hearts to enterprises that do *nothing* to advance our genomes. The poor representation of the ecological and spiritual contexts of our selfishness in the literature contributes to the science-religion conflict.

I am critical of sociobiology in this regard, because it seems to preach a reductionist materialism that elevates matter to spirit. We exist as

spiritual beings, so the story goes, because of the selective payoff for moral regulative principles that keep us from running wild in the social arena (Wilson 1978). The spiritual dimension of life is epiphenomenology predicated on physics, chemistry, and selection. Given this premise, we can retro-think further to life's emergence and appeal to replicating molecules as the "first cause" by which the organic world is built.

This is not the message of Darwinism; nor is it the message we should convey to the laity. Two fundamental aspects of our experience of the world become epiphenomenal in this understanding. Altruism is one. Consciousness of the *importance* of that altruism in survival-reproductive terms is the other.

E. O. Wilson (1978) has done an extremely good job of explaining human behavior on the basis of these precepts. But the theoretical midsection for the humanities and theology in his treatment is weak, because he urges us to ignore our own experience. The proper study of humanity for Wilson is through an "inverted telescope" (Wilson 1978, 17) so that we can see ourselves in taxonomical relationship to other species.

This is not enough. The sociobiological message scares humanists away from the power of sociobiology in particular and the message of evolutionary theory in general. The existential human is not visible through an inverted telescope. The Oracle at Delphi does not use them. It tells us to face ourselves for spiritual understanding about life's significance.

I want to be clear here: Wilson's sociobiology is convincing scientifically. It is hamstrung, however, by a genetic reductionism that tells us we are less than we are. Fortunately, new sciences contributing to the evolutionary vision drastically reduce this propagation of discontinuities between the physical, biological, and the spiritual so that the Delphic Oracle can be heard more clearly—and that Wilson's own voice can be heard more clearly and more productively as well.

The neo-Darwinian program is coming under extreme scrutiny these days from two important fronts. One is developmental biology, which from the days of Karl von Baer on, has been a conservative voice (Webster and Goodwin 1982) against an adaptationalism that treats organisms as putty in the hands of natural selection. The other front is thermodynamics and information theory. These sciences have been applied to genealogies (by Brooks and Wiley 1986) and to the ecology of evolution (by Ulanowicz 1986 and Wicken 1987).

The sense of this dipolar scrutiny is that neo-Darwinism errs in the direction of genetic reductionism to the sacrifice of organisms as both historical and self-referentially ecological entities. The evolutionary metaphysics spun since the mid-century "hardening" of the "synthetic

theory" heavily reflect that reductionism, and present a "this is what evolution implies for the world, and you might as well accept it" metaphysics that scares humanists, polarizes evolutionists and creationists to extremes, and puts theologians in a miserable middle that must justify the ways of molecules to religion.

Although scientists may officially eschew metaphysics, they love it dearly and practice it in popularized books whenever they get the chance. Unfortunately, the authority of science is such that, however philosophically ingenuous scientists might be, their pronouncements have great impact on those who want better to understand their own lots in the cosmic setting. When we add to this the fact that the evolutionary quest has always been as much metaphysical as scientific, we see the importance of understanding evolution in the most spacious, humanistic way possible. The experiencing, subjective self is an irreducible dimension of life. We've constructed our universe through it and should preserve it similarly.

The Reductionist Story

Let us introduce this dialectic between evolution and religion as gloomily as possible with Jacques Monod's pronouncement of the "message" of science for humankind. "If he accepts this message [the message of science]—accepts all it contains—then man must at last wake out of his millenary dream; and in so doing, wake to his total solitude, his fundamental isolation. Now does he at last realize that, like a gypsy, he lives on the boundary of an alien world. A world that is deaf to his music, just as indifferent to his hopes as it is to his sufferings or his crimes" (Monod 1972, 172). Lest I be accused of letting emotional response interfere with dispassionate analysis of this passage, let me say at once that Monod's conclusions are necessary consequences of looking at evolution in the reductionist "molecules yield organisms yield humans and human values" theme that has played with such regularity over the past three decades. Monod's great contribution to the theology of evolution is expressing that consequence plainly, and with eloquence that grips our attention. So *this* is what evolution means for the human condition! Come to terms with it, ye who think that we count in the cosmos—and, conversely, ye who think the cosmos counts for us. Science has spoken.

There are two separable claims in this thesis. The first one betrays the philosophic innocence of so many evolutionary metaphysicians—namely, that the universe is ontologically just what we are able to say of it scientifically. This notion carries no philosophical weight, especially in light of Kant's critical realism about the limits of science. Only the naivest of realists would claim that the universe is exhaustively constituted by relations made available to detached description.

The second claim is implicit, imbedded in a hoary lore of neo-Darwinian reductionism. Its thrust is that organisms develop around replicating strands of nucleic acid for the sole reason of abetting their replication. If this proposition is granted, then all the spiritual epiphenomenality of which Monod speaks follows as does the night the day. If the referent of all purposive activity is the propagation of selfish genes, then the referent of all so-called spiritual feeling too is the propagation of selfish genes, and the spiritual is subsumed without real resistance by the material.

The first claim is a serious epistemological mistake. It inverts the knower-known relationship established by Descartes, then nailed down by Kant, by supposing that the knower as meaning-investor might be generable from a matter *which is defined* by objectifiable relationships in space and time.

The second claim comes naturally from what Whitehead called "misplaced concreteness" on genes, rather than organisms in ecological contexts. In neo-Darwinism, the referent *is* genetic, the nucleic acids are the gods to which human behavior and values are finally accountable. The same theme appears in Richard Dawkins (1976) and, to a smaller extent, in Wilson (1978). The concept of "organism" winds up serving the replicator-god. When this move is made, evolutionary theory becomes spiritually empty.

Dawkins treats organisms as "survival machines" throughout his book, and states—without *any* scientific (let alone philosophical) argument—that they "began as passive receptacles for the genes, providing little more than walls to protect them from the chemical warfare of their rivals and the ravages of accidental molecular bombardment" (Dawkins 1976, 49). Everyone is entitled to his opinion. The trouble is that this particular opinion is read by the educated laity as the "message" of evolution.

This isn't an isolated aberration from middle-of-the-road neo-Darwinism, either. Always, there is the overriding metaphor of genotypes *producing* phenotypes in that scheme—the magic molecule generating the organism. The thread of that theme back-extrapolates to life's emergence as the building of phenotypic bodies around genotypic replicators. Manfried Eigen and Peter Schuster's (1979) immensely influential "hypercycle theory" is the best example of this back-extrapolation. Again, one has the Dawkins theme of organisms evolving for the propagation of replicators whose only referents are themselves. That chemically and logically the theory is wrong (Wicken 1987) reduces its appeal only slightly, since it exerts its influence though steady appeal to the wonderful clarity of genetic reductionism. This temptation must be resisted.

For theology, the problem is not only one of fitting the self to that which is greater and gives it meaning, but making that fit intelligible in light of current scientific understandings. A big Darwinian message was that nature does not make saltations. There can be no greater saltation than the jump from selfish individuals acting under the determinism of selfish genes to the Kantian moral imperative of treating every human being as an end, in whose behalf society should act.

Fortunately, genetic reductionism is not the message of Darwinism, and I do not think Darwin himself would have liked it. We are ecological beings, and our survivals and reproductions require ecological accountability. A Darwinian picture of nature that accommodates the spiritual instead of hand-waving it away as epiphenomenology requires that we understand what an organism *is* in appropriate ecological terms. Then, a way is paved for connecting the evolutionary process continuously to the spiritual noosphere adumbrated (however poetically) by Teilhard de Chardin (1975) that does not break with nature's ways. Anything else really *is* supernaturalism, for it asks us to break the world of nature from the world of religion.

Adopting the replicator-first perspective commits one to an ontology which accords primary reality to matter and motions and contingent reality to all that is sensitive and vital, leaving us strangers in the nature that gave us birth. That reverses the ontological order of things, since the "experienced" cannot precede the "experiencer." It also fuels the academic rift between the humanities and the sciences. If the evolutionary epic doesn't do justice to the human condition, then humanists *might as well* ignore it and perpetuate the two-cultures schism. The inverted telescope reduces us below our experience, and sells out meaning for fast clarity. Only by recognizing the irreducible reality of the subjective dimension of nature can we take the acts of perception and conception seriously enough to bring the teachings of science into the realm of human meanings.

In the introduction to his classic *Moral Man and Immoral Society* (1960), Reinhold Niebuhr observed that individuals are possessed of a moral sense that requires them to consider the interests of others in their ethical decisions—even where they know that such consideration may operate to their own detriment. This is an empirical truth that evolutionary theory must absorb to make its teachings consonant with the human condition. So too is the relative immorality of group behavior. The moral sense *is* individual because it is based on "heart," not reason. Heart leaps in when ratiocinating algorithms grind out "no" to the obvious needs of others to say: "Yes, I'll help this person, although it won't promote my personal fortunes a whit." If "heart" is an evolutionary product, we need to understand our natures in more spacious terms than reciprocal altruism and reciprocal exploitation.

It is not the case that the manifest failure of the social sciences to deal effectively with the challenges of our age reflect their inabilities to keep pace with the disclosures of the natural sciences. It is the case that the natural sciences have given humanists very reductionistically limited models with which to work. Our message is not that culture can be reduced to survival mechanisms. It is rather that culture coevolves with survival mechanisms. Together, they give each other meaning. Individuals behave altruistically because their survivals and reproductions are nested in ecological settings that give a high selective premium to eusocial behavior. Self-interest has been nurtured evolutionarily within social contexts of group interest.

If the history of philosophy teaches us one thing, it is that Kantian moral imperatives do not work. It is splendid to say that we should treat each individual as an end. But if this imperative is not absorbed in our evolutionary hearts, then it is as easily transgressible as quitting smoking. The Kantian imperative *is* a heart-imperative, and that is the message evolutionary theorists ought to be sending out to the religious community.

In what follows, I will suggest an ecological perspective on meaning-investment that aids this cause. The aim will be to show the deep relevance evolution has for promoting the kind of global perspective on life we need to make the world work. What *are* the implications to our religious sense that come from taking evolution seriously as a process within a valuational scheme that takes equally seriously the irreducibility of the moral agent? Addressing this question requires that we understand evolution not as a crassly materialistic process, but as an ongoing process of creation which must embrace both the physical and spiritual dimensions of our being.

For this, it is necessary to get a non-reductionist understanding of what it means to be an organism. Kant said it well, but prefatorially, within the capacity of the science of his day. That science was Newtonian physics, and could not engage the reality of evolution. Organisms were "natural purposes" for Kant—jointly their own causes and effects, their own ends and means. For Kant, this meant that organisms could *not* be understood in evolutionary terms. His philosophy of biology was a mechanistic updating of Aristotle: organization requires organization for its propagation. Kant was not sanguine about evolutionary theory's giving us a knowledge of nature.

Darwin changed all this, but at the considerable cost of establishing biology as an "autonomous" science apart from physical dynamics. Today, we can do better. The importance of the thermodynamic paradigm (Prigogine 1980; Wicken 1987) to this project is that it allows a natural, evolutionary crossing of the Kantian barrier by integrating self-organization with irreversible energy flows. Organisms are ecolog-

ical entities which evolve and maintain themselves as *informed autocatalytic organizations*. They are not entities *in* environments. Rather, they are continuous *with* environments, both historically and ecologically.

Organisms have two referents. One is the organizational whole in which genes play crucial informational roles. The other is the ecosystemic world of thermodynamic flows that nurture them. Organisms are informed patterns of thermodynamic flow that sustain themselves through energetic transactions with their environments and gain information from that ecological interaction under natural selection. They are information-acquiring dissipative structures. The information individuals acquire is nurtured within environmental and social contexts that require their "reaching out" for higher levels of justification. The "no man is an island" theme underpins all of nature.

Organisms emerged from prebiotic nature by learning to replace their chemical divots and not burn the ecological homeland down. Human life amplified this theme importantly by its technological capacity to command energy flows for its own imperialism over nature. With this large-brained capacity to exploit nature for human uses came also a self-reflectivity that might foster the real ecology of Spirit that our age so desperately needs in confronting the problems we face as a species.

I will develop this spiritual ecology in the pages that follow.

The Spiritual

The "spiritual" doesn't necessitate the supernatural—although an ecological naturalism of spirit should at least allow room for the possibility of noumenal waters. That which is conscious and valuational *is* spiritual. It is the principle of human life. Whatever the spiritual means ontologically, and however it came to be evolutionarily, it stays sturdily preconditional to everything we do that bears the stamp of humanity. Spirituality requires no dualism; neither does it deny the possibility of dualism. That is the province of faith, not science. The animating breath of what we feel, know, and invest with meaning, simply *is*: the spiritual is the fundamental ground from which all discussions of life and life's significance must begin. The reality of evolution cannot diminish that which *is* experientially. Explaining "that which is" is the job of theology. Theology and evolution must each work accordingly in the other's non-negotiable lights.

Reductionist ideas have dominated evolutionary thought for a long time and have carved out more than their proper share of metaphysical turf. In doing this, evolutionary theory—the connective vision and tissue that binds past with future and life with nature—actually

threatens to subsume the theological enterprise itself in the name of scientific clarity. The complementarity of meaning and clarity must be maintained if science and theology are to dialogue constructively. Theology can't do its part if it plays handmaiden to science.

Wilson (1978) directs our attention to the historical roots of behavior and the functional importance of moral systems. But his excellent science is sandwiched in some hard physicalist bindings that are not extrapolable from the science itself. Monod's materialism, as we have noted, errs similarly. The evolutionary epic leading from molecules to morality to God commits just those kinds of category mistakes. In this science/religion dialogue, the worst mistake we could make is having existential-spiritual self be contingent and epiphenomenal to selfish genes. Yet we do it.

In concluding his book, Wilson quotes from the ever-enigmatic *Job*, where God, speaking through the wind, lashes out the following admonition for humankind:

> Have you descended to the springs of the sea
> or walked in the unfathomable deep?
> Have the gates of death been revealed to you?
> Have you ever seen the door-keepers of the place of darkness?
> Have you comprehended the vast expanse of the world?
> Come, tell me all this, if you know.

"And yes, we *do* know and we have told," responds Wilson (1978, 202). Fine science followed by scientistic presumption does not provide a bridge for linking science with humanities with religion. That few humanists and social scientists will walk on the bridge sociobiologists claim to have erected is not a measure of their close-mindedness to Science's brilliant light. It rather testifies to the hopelessness of any bridge-building enterprise that does not take into account the non-negotiable understandings of those on the other side. Here, the other side is the existential and the spiritual.

No wonder evolutionary theory is misunderstood by humanists as grimly reductionistic. No wonder it is seen by creationists as the work of the devil. Scientists would do well to follow Galileo's admonition to "pronounce that wise, ingenious, and modest sentence 'I know it not'," rather that to allow to "escape from their mouths and pens all manner of extravagances" (Burtt 1954, 102). This is an especially important responsibility for science, since scientists are now the ones in holy garb. The difficulty in conveying the message of evolution to those who want to preserve their religious or humanistic sensibilities is immense enough anyway. It is certainly now helped by proclamations in which the authority of science appears to speak from the podium of theology. If this is the collective message of the scientific-theologic establishment,

one can hardly blame people for saying, "Give me that old time religion."

When the world becomes one of process rather than of design from Platonic essences, the idea of our having a privileged relationship to a Creator who had ordered the cosmos as our special moral stage and provided a special heaven to accommodate immortal souls, becomes complex. This complexity must be engaged at both ends of any possible bridge between the humanities and the sciences. To be sure: evolution is inconsistent with privilege, and makes dualistic conceptions of souls inhabiting bodies problematic. This doesn't alter the fact of life's sentient spirituality, or detract from the reality of moral consciousness.

Descartes began modern philosophy from just this recognition more than three centuries ago, and he was quite right. As Tillich (1952, 46) expressed it, "Spiritual self-affirmation occurs in every moment in which man lives creatively in the various spheres of meaning." Spirituality is the capacity to invest with meaning. We seek clarity within a world of meaning. That we understand ourselves as parts of an evolutionary process that is *not designed* demands a different, more "adult" kind of self-perception than required by the closed creationist world. This orientation might be most succinctly described as one of *responsibility*—for taking care of the process and for moving it in worthy directions.

This is an *ecological and historical* view of spirituality, where the preconditions for meanings are established in the genesis of part-whole relationships. Ecology, not molecular biology, is the cultural bridge between science and theology.

Consider the remarks of Wolfhart Pannenberg (1986, 303): "On the assumption that the word 'God' is to be understood as referring to an all-determined reality, substantiation of talk about God requires that everything which exists should be shown to be a trace of divine reality. This requirement applies, however, not to objects in abstract isolation, but to their unbroken continuity." The theme is ecological to the core: parts are constitutive of wholes, and the meanings of parts are determined relationally by their participation in the whole. A teaching of ecology is that a "part" can never know the full extent of the whole that invests it with meaning. This would seem to me a teaching of theology as well.

What we do know is that the priority of our own consciousness in any conceptual framework we create, and its categorical contrast to objectificable matter, *however* organized, is so fundamental to experience as to brook no serious argument. In this sense, science dealing with material behavior and religion with the spiritual, valuative self move necessarily in separate but equal tracks—the essential core of each

enterprise secure from the disclosures of the other. The activities of the two are complementary and mutually informative. However deep-running our need for clarity in the Heraclitean world of becoming might be, and whatever isomorphisms religions bear with sciences that suggest common cognitive faculties at work in each, those common faculties are necessarily polarized toward analytical clarity for science and spiritual meaning for religion. The importance of maintaining this essential tension between clarity and meaning has been insufficiently respected by both science and religion over the years.

What taking evolution seriously does is to provide us with a naturalistic sense of cosmic location: where we came from, what our prospects are, where our freedoms and responsibilities lie. Taking religion seriously demands that we understand the real-world importance of the spiritual. In this sense, evolution establishes boundary conditions for theology. It makes a huge difference to human self-identity that we were not created in the relatively recent past by divine fiat but are instead linked to a tree of life whose roots extend billions of years into the history of the cosmos. It makes a difference too if we see ourselves as involved in this ongoing process of creation in a basic way—with respect to the responsibility we feel for the rest of life—than if we feel ourselves as spectators to a deterministic unfolding of things.

At the same time, the reality of the spiritual places boundary conditions on evolutionary metaphysics. We can't explain, and we certainly shouldn't try to explain away, that which is fundamentally constitutive of ourselves. In the ecological view of the relational, bilaterally forming part-whole interaction by which we know ourselves as valuational creatures, our own spiritual self-affirmations point ineluctably toward a deeper Ground of Being of which we are jointly participants and creators, mist and substance.

The mutual adjustment of meaning and clarity presented tremendous problems for early evolutionists. Herbert Spencer, to use a very important example, regarded matter and mind as expressions *in* nature of forces that ran *beneath* nature. Therefore, he had no ontological ground for granting real autonomy to the moral agent in the course of things, and hence no ground for an ecology of meaning. What was natural for Spencer *was* the inexorability of evolution. The moral sense was thus a product of ineluctable forces beyond its control and as such, possessed no independence to act "naturally" against their decrees—unless seduced away from nature by the interventions and conventions of society. T. H. Huxley, on the other hand, regarded human societies as organizations *apart from* nature, and morality as a covenant between man and society that stood in opposition to the blind forces of natural selection. The opposition between Spencer and Hux-

ley is just the evolutionary continuation of the opposition between stoicism and epicureanism: do we adjust the "ought" to the "is" or the "is" to the "ought?"

The status of human society within the evolutionary process presents no less a problem for us today. It *may be* that the thrust of the evolutionary process is toward the perfectability of humanity within the "just" society. But if such a society is conceived as that state of balance between the forces of economic production and human reproduction such that natural selection within Malthusian economies of scarcity is effectively conquered, we enter some deep moral waters. Governed as they are by a network of laws and institutions that are concerned with preserving some core of the present, societies all have a temporal parochiality that impedes that evolutionary agency of "choice." What are the boundary conditions under which choice can operate?

If Darwinism is to be taken seriously, consciousness and volition must be *for* something. If humanity is to take itself seriously within this framework, the sensitive self acting according to *motives* rather than impressed forces must be taken as a first principle of ethics. For that, we need an evolutionary ecology of mind.

Mind and Meaning

Phenomenal reality is built of meanings which are in turn built by selves. Yet ever since Parmenides, the materialist tendency has been to talk about "being" as single-layered, autonomously-existent, and as resolvable into "building blocks" with some claim to physical ultimacy. While modern science denies the possibility of this at every level of its operation, such quests for unconditional existence die hard.

We read much about the participation of life in world-building today in connection with quantum theory, with subjects "collapsing" the indeterminate wave functions of the micro-world as particular observations or measurements. This quite significant truth distracts attention from the deeper sense in which life creates realities as meaning structures. These structures, born of the goal-directed activity of life to produce and reproduce itself, are the concrete objects of knowledge of all life, and their "objective descriptions" are assuredly not detached descriptions but contain always the formative impress of the knower. It is only in this sense that one can legitimately talk about the objective and subjective as "segregating" from a common ground of being. The segregation is irreducibly connected with the teleological activity of selves, creating new meaning structures by exploring new conditions for survival and reproduction. These meaning structures emerge in a context of *value* that merges into those human systems of values that

are religions. There are, however, certain deficiencies in the neo-Darwinian picture of nature that act to obscure this continuity.

Each of the two general tendencies for which the neo-Darwinian program is criticized contributes to its impoverished picture of our existential location in the cosmos. First is a compulsion to explain everything under the sun in terms of present adaptive benefit: any anatomical structure, any behavioral attribute requires a "just so" explanation in terms of present utility. The assumption underlying this leap of faith is that organisms are the infinitely plastic substrates of selective forces, and the philosophical correlate of this assumption is to deny the essential historicity of evolution in which an adaptive move is an irreversible choice that opens certain evolutionary pathways and closes others. In this, the present is not abandoned as a point on a geometric coordinate, but pulled into the future as constraint on possibility. The adaptationalist program denies history its due, and we will consider the ethical and theological implications of this denial presently.

Second is a view toward organism that grants life insufficient participation in its own evolution, that takes the molecular flow of information from DNA to RNA to protein as evidence of the causal sequence by which new adaptive zones are explored in nature. It is suggested that through random mutations new morphological organizations and new behavioral capacities arise, which are then tested for adaptedness. The alternative view, which we owe originally to Lamarck, is that each organizational type has a certain range of behavioral responsiveness that allows it to explore new adaptive possibilities and hence determine the conditions of its own selection. This perspective permits us to consider evolution less as a process of blind chance than of *discovery*, each behavioral leap correlating with the effective *invention* of new resources—a new Malthusian "economy" (Wicken 1987). With invention and discovery come also new, more richly textured "realities." Such meaning-creation occurs within a context of part-whole relationships that may be best understood within the framework of ecology.

The Ethics of Ecology

The process of evolution is one in which we find ourselves first effect then cause, first end of a meandering course of adaptive inventions and meaning-creations, then means by which further such developments can occur. The movement is Spencerian in the sense that human evolution is inseparable from cosmic process. But it is anti-Spencerian in the role it accords humanity within the process. Moral agency, the self-determination that allows individuals and groups to select the courses of events that become the future, is an emergent evolutionary

quality into whose hands more and more of the fate of the cosmos is bequeathed.

To understand the relevance of all this to the problems set forth in the Introduction, it is necessary to consider the relational way in which the world of meanings elaborates in the ecology of evolution. The word *ecology* itself has a revealing etymology, coming from the Greek *oikos* or "house." Ecology can be regarded as the science of relationships that determine the stabilities and the compositions of partly self-sufficient ecosystemic "households" which weave together in higher orders of integration into the biosphere as a whole. Ecology is the science of part-whole relationships, in which individuals are invested with meaning in relation to the global boundary conditions of their existences. The stability of the individual, and by extension the viability of the adaptive strategy of the species to which it belongs, is nested in the stability of its eco-community. Conversely, the *value* of the individual is assessed by its contribution to this community.

This idea of value, so central to any understanding of the human condition, has evolutionary roots that include, but at the same time far transcend, simple payoffs in survival and reproduction. To talk about mythico-religious structures, as some sociobiologists are wont to do, as being selected by virtue of their contribution to societal coherence, misunderstands this transcendent character of value in a way that undermines much of what is genuinely right in their perspective.

We have two general evolutionary sources of value, both of which contribute to the relational ontology of life. One reaches downward from individuals to the raw materials of environments, relating life as meaning-investor to nature as elaborating repository of meanings. The other reaches outward from individuals as "selfish" surviving-reproducing systems to ecosystems, and systems of ecoysystems, that contextualize selfish interests within higher-order functional frameworks—so that there is a sense in which the whole of community interest is written into the individual adaptive strategy.

Nitrogen-fixing bacteria, to use a simple example, achieve their own reproductive successes by contributing to a chain of processes that serves to restore nitrogen to autotrophic populations. Its "value" *is* its existence. That within this functional framework of co-defining parts and wholes much cheating and gamesmanship go on does not alter the basic truth that life is, even in its simplest expressions, the creator of meaning and value. Moreover, cheating and gamesmanship are precisely the arena in which the moral agent emerges, able to assert itself existentially *as* a carrier of value beyond simply physical survival.

This penetration of ecologically-derived part-whole relationships into the human-existential domain as well is implicit in Tillich's (1955)

discussion of what it means to be a self-affirming being in the world. Tillich argues that it is *only* the individual self that is the referent of acts of self-affirmation . Such acts, if they are genuinely conducted in the human arena of public discourse, must reach out to the community. But community interests are asserted only as they are *focused* in selves that posit their meanings in community identification.

This saves pointless moralizing about denying self-interest for community or world interest. The trick is to bring the two to some coincidence, so that the human individual perceives his or her own meaning as inextricably woven with some larger whole, just as the selfish activity of any ecosystemic creature is penetrated by the operation of its biological community.

The ontological as well as existential meanings of "ultimacy" (Peters 1982) have their ground in an evolutionary nature. That nature *produces itself* from previously unactualized potentiality by the agents of life acting on whatever possibilities the ultimate makes available: the potency, for example for particular kinds of physical interactions, for sensitivity, and for consciousness. These potencies themselves we will never understand in the sense of explication in more basic elements, and they must be granted primitive status in nature. But as they are actualized in the evolutionary process, they become nature's agents for further evolution.

Ultimacy-as-potentiality is thus the ontological ground of nature-as-meanings. As they grow in the human-existential domain, meanings map out terrains for values and religions. Here is the special human sphere of evolution, for only we humans (even if we insist on regarding ourselves genetically as the hairless sibling species to the chimpanzee) make our livings by turning natural meanings (that is, those synthesized by the operations of perception and self-referential action) into symbolic meanings, and use these symbolic meanings as the wellsprings of our behavior. Human life is thus essentially valuational, and to talk about religions as being superstructures that exist for the adaptive payoff of fostering societal cohesion is to indulge in the same kind of one-dimensional reasoning that talks about selfish genes in abstraction from the ecological relationships that bring the whole to focus in the individual. Certainly, religious traditions promote societal cohesion. But it is the nature of the human strategy to be societal in a symbol-mediated way. Given this, a religious sense is as indigenous to the human condition as is the ever-heralded technological capacity to manipulate the environment.

This truth tends to get lost in physicalist interpretations of scientific method, which equate objectivity with external detachment and description. Once this move is made, all science becomes the epistemological equivalent of plane geometry, meaning moves into the

subjective realm of the beholder's eye, and value becomes always relative, justifiable only in terms of payoff to societal stability.

This denies history its proper due. The individual is born into a strategy whose "selfish" (the anthropomorphism is itself misleading) adaptive value depends fundamentally on the creation and transmission of symbolic meaning. Constantly to puzzle over the adaptive sources of "altruism," as most evolutionists do, betrays a certain peculiar inability to understand the historical sense in which wholes are manifest in parts. The individual has instinctive moral capacities which both bend to, and struggle against, the particularities of any age. Thus Huxley's problem is resolved: laws and moral codes are not really for curbing the cosmic process at all; rather they constitute the human contribution to the direction of this process in the generation of meaning. They define, in general terms, the domain of human responsibility.

The Problem of Knowledge

Theory crystallizes thought in the public language of concepts, symbols, and argument, and the light of public discourse reveals the crank as well as the genius. The dynamic of entering a world whose boundaries one cannot see, through the special windows of the valuational self is shared by both religious and scientific intuition. So too are the processes of justification. Science and theology both refer phenomena to that which is less contingent. For science, that ground of reference is natural law; for theology, it is the source of life. In each case, there is a transcendent pointing from the particular and contingent to the universal and ultimate.

Here, ecology blends with theology. Philip Hefner writes in this vein about the concepts of "openness and ecstatic, ecological self-transcendence" as the way to God. The following passage is especially suggestive about the ecology of theology: "The evolutionary pathway is one in which the organism interfaces with its physical world through its own physical shape (phenotype), it is continuously being drawn outward. This 'drawing out' is the biological basis for and correlate of openness, and in the course of being drawn out, the organism has no recourse but to transcend itself" (Hefner 1989, 142).

This is so, but the evolutionary process gives it particular consciousness only (as far as we know) in the human sphere. We are challenged always to draw out of our integuments toward a bigger, more relationally constituted world. We want, in the terrible constraints of those integuments, to get inside others and know their feelings as we know our own. Each individual meaning is nested within the whole of human meaning which collectively points toward God.

Similar claims of science for pointing toward the ultimate lie too in this old tension between the one and the many. The more science can explain, with the least number of primitive assumptions or propositions, the more the manifold world of phenomena points toward the coherence of cosmic order.

Religious systems have it harder. Establishing fundamental grounds of transaction (or covenants) between the self and a valuational belief fabric to which the conduct of moral life can be related is immensely important for any religion. But the evolutionary prescription that it be both self-interested and ecologically-spiritually transcendental is especially challenging to what we do as humans. And although an ecological ethics would *seem* to work in providing a meaning-ful order to the human condition, the fact is that we do not often live by ecological propositions. We would rather cut down the Brazilian rain forests for short-term parochial interests and put up with an escalating "greenhouse effect" than think globally. Evolutionarily-derived criteria of meaning have not worked well for us at the level of *praxis*. Reciprocal altruism and reciprocal exploitation are hard-wired neo-Darwinian modes of thought that must be transcended if humanity is to have a future.

Scientific theories carry with them primitive assumptions about the way things are. This is fine, since the propositions that develop from such axiomatic cores can be correlated in specific ways with certain observational terms—for example, the connection of electron jumps to spectral bands—that allow them to be tested even if we never really understand what an electron jump is ontologically. In this way, scientific theory points in the direction of deeper physical realities and taps some portion of the ultimate.

This is less clear when we talk about some of the abominations that occur within the meaning-structures conferred by mythico-religious systems or by pathological political orders. Unfortunately, human meanings can be anchored in false gods that point away from the universal. So it may be fruitful, after all, to consider religious truth too in full connection with the criterion of progress.

Science is an inherently progressive enterprise, and its truth claims are inseparable from this quality. It was invented as progressive enterprise by those, like Galileo, who saw the need to look through the skin of particularity into the heart of generality. This is the stuff of world-building. The Bohr atom is filled with concepts which reach beyond their original contexts of application to the study of matter generally; in turn, it has provided concepts, such as angular momentum quantization, that have been essential ingredients in all subsequent development of atomic and subatomic theory. Galileo and Bohr both

dealt in truth by conceptualizing in ways that opened up new possibilities for truth—in consonance with Julian Huxley's (1953) discussion of the progressive human branch of evolution. We are progressive precisely because we open up new avenues along which to progress.That is the human challenge.

I suggest that we assess the truth claims of religion in an analogous way, by supposing that religions are true, or grounded in ultimacy, to the extent that they implicitly direct themselves outward to deeper truths beyond their own necessarily culture-bound frameworks. In concluding this paper, I offer a speculative extension of the evolutionary view of meaning-building set forth previously, with the hope that it might stimulate further interest in the science-theology community.

The Relative and the Ultimate

We live in a religiously pluralistic world, and since each religion is a closed and self-confirming system of valuation with its own special vision of ultimacy, how are we to assess the truth of religions and their various claims to serve as guides for our moral lives? Should not the ultimate also be universal—true for all places and times?

Peters (1982) has concluded that a Darwinian perspective reconciles the idea of ultimacy with the fact of pluralistic religious expressions and appreciations. Partly, it does. Whatever the ultimate is ontologically, it can only be perceived through the particularity of context provided by a given culture at a given time. But in the ecological framework I have been discussing, we should make more "absolute" value judgments on religious systems according to the manner in which they lead our thinking from the particular to the universal. Pannenberg has spoken pointedly to this issue, arguing that "the immediacy of religious experience is an expression of the fact that man stands in constant relation to the fundamental mystery of life, which transcends any immediate situation" (Pannenberg 1976, 301).

In talking about that which is historically contingent and that which is directly "felt," we must again think ecologically about parts, wholes, and the sense in which they co-define each other. Some insight into this problem can be gained by returning to the evolutionary process as a meaning-builder. All life creates meanings by inventing or discovering the sources of its survival and reproduction. Particular living systems do this within a higher-order framework of ecosystem function which, by contextualizing self-interest within community interest, gives "selfishness" a transcendent quality pointing from part to whole. This evolutionary ecology of religion has been a *leitmotif* of Pannenberg's work (1976; 1985). In both evolution and religion, "progressiveness" always involves an "opening up" of possibility, in which potentialities

for futures are made available by adaptive decisions which lead to new modes of life, escapes from old Malthusian economies (Wicken 1987). Each act of invention-discovery brings more "raw," value-less nature into the orbit of life and its network of meaning.

This movement describes the intuition of the global from the immediacy of the parochial. Julian Huxley (1953) described progressive evolution as a movement toward increasing autonomy from and control over the environment. This is only partly true. Progressiveness in evolution as it can lead to a naturalistic theology means increased consciousness about the wellsprings of our own "selfish" behaviors. How should we humans best understand our responsibilities in a part-whole framework? This is instructive from an existential point of view, because autonomy from the particularity of circumstance and control over destiny contrast to the contingency and external determination that characterize the lower forms of life. Progress is a movement toward self-determination within a context of increasing global awareness.

We see much of this general dynamic in the development of religious systems from tribal myths. The latter *are* parochial, bound to the particularity of culture and social structure. The former attempt to accommodate the "whole" human experience in a more trans-cultural way. The evolution of our own Judeo-Christian tradition is very much the story of growth from parochiality to global awareness, from a consciousness formed by impressed law to one of moral agency that participates in the evolutionary progress of "opening up." After all, it is the sheer bloody parochiality of the Israelites' tribal god that astounds and offends us most in those early books of the Old Testament. The paucity in these books of valuational criteria for good and evil apart from the pragmatic consequences of His Wrath are staggering. Here we do see the survival value of religious systems that sociobiologists stress. Yahweh is militantly devoted to the survival of loosely-knit tribes under hostile conditions. A gentle God would not have worked so well, any more than a devoutly ecological ethic would have worked very well for the early industrialization of America.

There is nevertheless a fragmentary value seen in these books that dimly adumbrates the moral whole toward which we presently strive both ecologically and theologically. The network of laws and protocols in Exodus and Leviticus reveals the basic core of all moral life: that "good' involves a relational orientation of individual to community, that the community in turn comes to focus in the individual, investing it with meaning. We can perhaps appreciate in this light the apostle Paul's famous passage from 1 Corinthians 13, where he talks of "when the perfect comes": "For now we see through a glass darkly, but then face

to face; now do I know in part; but then shall I know even as I am known." Universal truth there may be, but it comes in culture-bound fragments. We can only hope that with the evolution of our global awareness these fragmentary insights become more whole, less dim.

They certainly become more manifold: there is an irreducible cultural relativity to religions that, far from undermining the notion of an ultimate ground for being, reveals the special contributions each culture has to make in tapping into this ultimacy. The existential human, dwelling within a world whose contours we can see only fragmentarily through the particular windows of our own experience and our culture's collective experience, is but a probe into an ultimate we will never fully comprehend and of which we can perceive only particular manifestations. The Aboriginal consciousness, structured by the cosmogonic "two brother" myth into a clairvoyant, time-transcending and group-centered reality, has a far different perspective on ultimacy than does the Christian consciousness concerned with personal freedom and moral agency in an indeterminate world. Yet each contributes to a trans-cultural understanding of what it means to be human in a cosmos that demands our participation and denies us total knowledge.

The history of any religious tradition can be interpreted as the creation of values-as-regulative principles by which a culture achieves its identity and asserts itself in the world. But even here the moral sense that has formed an essential part of the human adaptive strategy for knowledge and control shows forth clearly. This regulative role of religion must be emphasized. We all have, as part of our evolutionary heritage, a moral sense which wants to reach out on behalf of others. But which others, and for what ends? An historical function of religion has always been to educate this sense for community identification and coherence. As the world becomes smaller and more functionally interwoven, so too must our sense of community expand beyond its parochial, Old Testament identifications to a picture in which the interests of parts are understood as connected with the well-being of other parts in a global eco-community.

A religion would seem to be "relatively true" insofar as it promotes the ecological home by bringing life's global conditions and responsibilities into focus within the individual consciousness. A religion is false insofar as it encourages us to seek limited identification, limited commitments to the human condition. This seems much of what Christ's teachings are about: not privilege or afterworld payoffs, but the responsibility of opening up, of love.

Opening involves a recognition of indeterminacy, love, and risk. These were the metaphysics of Mohandas Ghandi. Ghandi brought these moral understandings into the explicitness of political expres-

sion, and dealt in risk within a global context of value. This is the ecological-moral stance: love and opening-up may be unrequited, the self *may* suffer, but finally the self has no identity apart from the whole of humanity.

For this reason, there has always been a tension between parochiality and universality in human identifications that is of the same character as gamesmanship within the ecological context of function. But the source of the moral in the part-whole relationships of community dynamics is clear. Josiah Royce expressed the sentiment of these dynamics eloquently: "It must be my community that, in the end, saves me. To assert and to live this doctrine constitute the very core of the Christian experience" (Randall 1977). Separations of selves from communities and from histories are disastrous to an ecology of spirit. In the individual self, the community and the entire evolutionary history of humanity is brought into particularity with a potentiality for moving the world. The corporeal self does not necessarily equate to existential self, and to risk one may be to assert the other.

Of course, Christ and Ghandi knew this, but so too have the centuries of political and religious fanatics that have systematically robbed our liberties. There is no point in moralizing about the way individuals ought to perceive their relationship to history and community: they will perceive them according to the manner in which their consciousnesses are affected by the particularities of their experience.

This does not, however, make a global ethic a chimera to romanticize over in scholarly journals. To the contrary: it means that we must take seriously Plato's proposition that knowledge is the precondition to all moral action. It then becomes the job of evolutionary theory to spell out the fullness of its implications for the human agent such that "correct" existential identifications can be made.

With its penchant for talking about evolution as a process lacking intrinsic direction and driven by blind chance and selfish genes, the neo-Darwinian edifice fails here abysmally. However, Neo-Darwinism is only the Newtonian formulation of evolution, which makes us strangely purposeful players on an Ionescan stage of the Absurd. Its Einsteinian formulation, emerging from the fields of cosmology and irreversible thermodynamics, recognizes that biological evolution is part of a deeper dynamics that has steadily moved nature from the blind and deterministic to the free and the self-determining.

Being and Becoming

The reality of evolution in part-whole contexts establishes the physical realm of responsibility. The ecological home is not a static one. The major reason for this is that we humans—especially in our technologi-

cal garb—are parts of a trans-ecological species. So necessarily, and in spite of what anyone might want, the domain of human valuation and responsibility becomes more global with the passage of time. Let us now consider the sense in which this human condition fits with the temporal dynamics of evolution.

One of Spencer's real problems in formulating a unified theory of evolution was that he had no real understanding of temporal directions. He was not alone in this. The second law of thermodynamics, which governs irreversible processes, had been given official formulation by Rudolph Clausius in mid-century, but the implications of this law for the courses organic processes take in time have only recently begun to reach a level of articulation where one can talk about specific causal relationships between irreversible thermodynamic flows and self-organization. Self-organization is itself a complex issue, involving the emergence of functional relationships between systems and environments. But the building-up or anamorphic tendency in evolution can be understood rather simply: the forces of nature are for the most part "associative" ones, so isolated elements—from quarks to protons to atoms, tend to have higher potential energies than when combined in specific ways. For this reason, the integrative or building-up processes provide a general means for the conversion of potential energy to entropy: structuring through dissipation. Self-organization is more complex, but proceeds according to the same general rationale.

In these processes, we can discern the conditions of life's fit with cosmic dynamics, serving through its own self-production and reproduction and the general directive of entropic dissipation. Life emerged from, and operationally fits with, nature through thermodynamic flows from high-energy sources to low-energy sinks. This recognition reduces the existential *angst* of Monod's position on the "strangeness" of life in the cosmos. The second law of thermodynamics is above all a principle of potency, by which the possible is made actual. Nature bursting on the scene with its particular structure of basic forces and enormous thermodynamic potential is necessarily evolutionary, for self-organization provides a general means for dissipation.

I have discussed this issue at length (Wicken 1987). The question here concerns the sense in which this self-organization relates to the increasing freedom and self-determination of nature whose torch humanity now carries. Let us first of all consider the "intelligence" of nature for producing life, which is an important ontological source of our genuine at-homeness in the cosmos. One can, with no concessions to the instincts of soft-headedness, interpret this intelligence as ultimate potentiality, for whose actual expressions the evolutionary process is responsible. Consider for a moment the so-called Anthropic

Principle (Carr and Rees 1979), into which cosmological data pour these days.

We live in a world that, if not expressly made for us, is at least amenable to our having evolved in it. The conditions required for this evolution constitute such a slender shard in the great slate of a priori possibility as to render utterly preposterous any simple chance-necessity interpretation—quite apart from the other, ecological considerations mentioned previously. Life depends crucially upon carbon, hydrogen, nitrogen and phosphorus. A slight reduction in the magnitude of the strong nuclear force would have given us only hydrogen, and perhaps a little helium. Similarly, the tolerances in the electromagnetic force which could provide for the stable linkages of these elements into biopolymers is quite slim. And at the cosmological level, slight reductions in the gravitational coupling constant would have made suns and planets impossible as well, whereas slight increases would have yielded stars too massive and fast-burning to support planetary life.

Then there is the matter of escape velocity: if the big bang (to use that infelicitous mechanistic metaphor) proceeded with insufficient initial kinetic energy, it promptly would have undergone gravitational collapse; if kinetic energies were too large, none of the local asymmetries of galactic clustering could have occurred. Some of these apparent coincidences seem on the verge of being tied together by unification principles. If there is to be a grand unification, that unification would serve to increase the sense of a presiding "intelligence" in the evolutionary unfolding of nature, not diminish it.

This intelligence in the evolutionary arena expresses itself within a framework of increasing possibility and freedom. Through entropic dissipation, a primordial world of elemental particles in random interactions yields to one constituted by atoms, molecules, and then life. This is not simply a process of progressive complexification; it also involves a shift of causal agency inward from forces and impressed actions toward selves and decisions.

Under the free energy gradient imposed by solar radiation and the thermal sink of space, the prebiotic phase of evolution proceeded with an inexorable kind of determinism toward increasing thermodynamic potential and chemical complexity (Wicken 1987). At threshold levels of these parameters, autocatalytic systems based on primitive proteins and nucleic acids appeared with the capacities to *pull* resources into their own productions—the emergent self, acting on the environment and moving into the environment.

Now, the relationship of cause and effect changes. Classical physics, and the extravagances of physicalism that have spawned from it, deal

in so-called "linearities": the assumption that all effects will be proportional to impressed forces. If this were the full domain of nature, freedom and moral agency would be quite impossible. But evolution is in fact an elaboration of non-linearities. Autocatalysis is the first expression of this, systems reaching into environments, discovering resources for transformation into self and seed. Around the autocatalytic core of life grows a superstructure of nonlinearities—volition, decisions, strategies—for bringing raw nature into the living orbit. These express themselves most acutely in the human realm, and within that realm most acutely in technological society.

Karl Marx insightfully wrote that the true natural history of humanity is history. There are no essences. Everything in the human condition is engendered by human transaction with the environment, in which we convert physical resources into economic resources. There is much to this, and it extends into our phylogenetic past as well. What we refer to as mind is born of the transaction between behaving, autocatalytic selves and environments that need to be internally mapped within the response-initiating capacity of the subjective. What Marx understood less clearly is the sheer indeterminacy of history, the sense in which its dialectics do not point to some special Utopian resolution where we become one with our labors.

That supposition has been the fundamental mistake of all pre-Darwinian philosophies. What the increasing nonlinearity of humanity-in-nature (Prigogine 1980; Wicken 1987) demonstrates is that history *is* particularity. History is that which cannot be deduced from the past but which must be discovered or invented through decisions by individual actors interpreting their environments in particular ways (see Pannenberg 1988). This is why there can be no "hard" science of politics or of sociology in the model of classical physics. Every situation encountered by these sciences engages a realm of irreducible nonlinearity, where the human agents do not respond deterministically to impressed conditions. They respond self-actively, as they see fit. Whatever real predictivity these sciences possess comes from their implicit understanding of the historical nature of humankind, and the manner in which it responds to social conditions. Whatever control over history we have as a species requires coming to terms with these psycho-social ingredients that operate in our consciousnesses.

This is not behaviorism but participation. The free human agent is an historical entity, constrained in what he or she can do by personal and evolutionary history. Through that history, we open ourselves to the formation of new history. The trick of education—in its broadest and least institutionalized sense—is to cultivate in each individual an

understanding of the full implications and responsibilities of his or her participatory construction of the future.

The evolution of the human consciousness has been too remarkable to conclude with archaic responses to new challenges. Our neocortexes feed into our limbic systems and color our sense with sensibility in such a way that the subjective potentialities of nature have, in us, a potentiality for power that is really able to use the past to intelligently open our future.

"Opening" is the word. As the world increases in freedom, so does its consciousness and its moral capacity. Evolution has moved from the blind and necessary to the seeing and volitional. It has been an opening-up of possibility, and of conscious exploration of that possibility. The human responsibility is to continue this process of conscious manifestation—not just for our children or for any specific others, but for possibility in the ongoing process of Creation whose torch we carry.

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