

ONTOLOGY RECAPITULATES ECOLOGY:
THE RELATIONAL REAL IN EVOLUTION
AND ECOPHILOSOPHY

by

Alfred Seegert

A thesis submitted to the faculty of
The University of Utah
in partial fulfillment of the requirements for the degree of

Master of Science

Department of Philosophy

The University of Utah

August 1998

Copyright © Alfred Seegert 1998

All Rights Reserved

ABSTRACT

Relationships are often construed to be extrinsic, inessential properties of “things.” In this thesis I argue in contrast that certain relationships are essential to the identity of the things related. I invoke ecology and evolutionary biology to support this and to ultimately promote a relational ontology and a holistic ecological ethic.

In Chapter 1 I lay the groundwork for understanding the “units of selection” debate in evolutionary biology as fundamentally not biological, but metaphysical, a dispute involving criteria for identity. Influenced by the work of Gregory Bateson, I argue that since there is no such thing as an “objectively adaptive trait,” the relationship between traits and their context is the overriding factor in natural selection. “Fitness” is a relational property; whole ecological contexts are the unit of selection. Moreover, since species through coevolutionary interaction shape each other, their relationships are not external to their identity. This ecological conception of species identity implies that some relations are ontologically prior to the things related. Hence, “ontology recapitulates ecology.”

In Chapter 2, I argue for the relational real, i.e., for a relational ontology in contrast to an object ontology. I contend (along with Arne Naess) that the “man in environment” paradigm must be replaced with a “relational,

total-field view” that conceives entities as constituted by their relationships. I stop short of advocating the “doctrine of internal relations” because of what I perceive to be an important ontological discontinuity between living and nonliving things. Instead, I make two arguments in support of a modified form of the doctrine that applies to living things and natural systems. First, because organisms are thermodynamically open and constantly exchange matter and energy with their environment (as Ilya Prigogine’s “dissipative structures”), they are constituted by—not merely externally related to—their external environment. Second, since organisms are autopoietic networks which are organizationally closed (cf. Humberto Maturana and Francisco Varela), they can exist only in structural coupling with their medium. Organism and environment are inseparably related and codetermined.

Chapter 3 explores the ethical implications of this relational ontology. In ethics, the debate over moral considerability generally focuses on those properties possessed by an entity considered in isolation. I discuss the moral considerability problem as Kenneth Goodpaster formulates it, and conclude that since entities are constituted by certain relations, criteria for moral considerability must include specific relational properties (biotic function, for instance). I then explore the role that Aldo Leopold’s land ethic and deep ecology have played in rooting environmental ethics in relational ontology rather than in ethical axiology.

“Things derive their being and nature
by mutual dependence
and are nothing in themselves.”

–Nagarjuna,
2nd century Buddhist monk

TABLE OF CONTENTS

ABSTRACT.....	iv
ACKNOWLEDGMENTS.....	viii
INTRODUCTION.....	1
Notes.....	7
Chapter	
I. EVOLUTION AND THE CONTEXT OF SELECTION.....	8
Conceptions and Misconceptions.....	8
Darwin, Neo-Darwinism and Natural Selection.....	10
Context.....	22
Fitting In.....	27
Notes.....	45
II. THE RELATIONAL REAL.....	51
Parts, Wholes and Relations.....	51
The Doctrine of Internal Relations.....	64
Relational Identity: An Argument From Thermodynamic Openness.....	68
Relational Identity: An Argument From Organizational Closure.....	74
The Individual in Ecological Context.....	89
Notes.....	92
III. RELATIONS, MORAL CONSIDERABILITY, AND ECOPHILOSOPHY.....	98
Moral Considerability in a More-Than-Human World.....	98
Moral Extensionism.....	100
Moral Considerability and Relational Properties.....	113
The Land Ethic: Obligation Through Felt Relation.....	119
Deep Ecology: Realization of the Ecological Self.....	130
The “Substitution” and “Dilution” Problems.....	143
Relations in a World of Circuitry.....	149

Notes.....	158
WORKS CITED.....	166

ACKNOWLEDGMENTS

It would be impossible to thank everyone internally related to this project, but I will do the best I can. I am grateful to my committee—Leslie Francis, Fred Montague and Tom Reed—for their care and thoughtfulness. Leslie provided valuable responses to my work, kept me on track, and encouraged me all the while. Fred bought me coffee and persisted in keeping my mind on the bigger picture. His excellent wildlife ecology course provided the necessary context for this discussion. Tom provided essential feedback in both writing and in conversation and he kept me smiling. I thank Tom Malloy for introducing me to systems theory, “survival of the fitters,” and the work of Gregory Bateson. His class and his book *Curtain of Dawn* provided much of the groundwork for what follows.

Much of my thinking about these matters was stimulated by internet discussions involving Matt Berlin, Jason Cook, and Paul Hartzog. I owe a debt of gratitude to Nikita Balashov, Matt Berlin, Kathryn Bezzant, Matt Bishop, Bryan Carr, Jason Cook, Tamra Frei, Paul Hartzog, Britt Miller and James Sage for reading and commenting on the early manuscript. Matt Bishop cheerfully provided detailed written comments on the entire thesis draft. Thanks go to Vaughn Lovejoy for lending and suggesting so many books. Without his input my project would have taken a much different—and

in my mind a far less interesting and important—direction. Vaughn’s concerned engagement in the world has invigorated and inspired me, as it has so many others. Thanks to Leslie Francis, Bryan Carr and Paul Hartzog for jointly suggesting the title. Neil Coen deserves special thanks for planting this seed ten years ago in his high school environmental ethics course.

This project was generously supported by the O.C. Tanner Research Fellowship, for which I thank the University of Utah Department of Philosophy.

INTRODUCTION

If today is a typical day on planet earth, we will lose 116 square miles of rain forest, or about an acre a second. We will lose another 72 square miles to encroaching deserts, the results of human mismanagement and overpopulation. We will lose 40 to 250 species, and no one knows whether the number is 40 or 250. Today the human population will increase by 250,000. And today, we will add 2,700 tons of chlorofluorocarbons and 15 million tons of carbon dioxide to the atmosphere. Tonight the earth will be a little hotter, its waters more acidic, and the fabric of life more threadbare. By year's end the numbers are staggering: The total loss of rain forest will equal an area the size of the state of Washington; expanding deserts will equal an area the size of West Virginia; and the global population will have risen by more than 90,000,000. By the year 2000 perhaps as much as 20% of the life forms extant on the planet in the year 1900 will be extinct.

—David Orr, *Earth in Mind* (1994)¹

I begin this thesis with such an unedifying quotation because it puts what follows into some kind of context. All too often, philosophical discussions remain detached from real-world concerns and applications. Consequently, I hope this thesis has some practical bearing, even though it is not a work in applied ethics. In a best case scenario it will qualify as “applied ontology.” Gregory Bateson once said that “The major problems in the world are the result of the difference between the way nature works and the way man thinks.”² If so, it follows that changing our thinking about nature is a necessary precondition to solving our ecological problems and living in harmony with our planet. As things stand, our story has befuddled

us, our perceptions have failed us and our maps have served only to get us more and more lost.

In response to our rapidly worsening ecological crisis, many have suggested that we need a new, “environmental” ethic. Some have proposed that we develop this by extending moral consideration to a particular subset of nonhuman beings (e.g., sentient animals), but not otherwise tampering with our present world-views. Others have argued (as I do) that the problem runs far deeper than merely ethics. For instance, John Livingston in *Rogue Primate* writes,

...the “antidote” to our modern ways of dealing with the world is not technological, not scientific, not even ethical. The modern challenge is metaphysical and ontological—indeed, cosmological.³

This implies that the present global eco-catastrophe is not fundamentally a crisis of ethics, but of *perception*—of what we understand the world to be like and how we conceive our role within it.⁴ Our ecological crisis has its roots in a defective “First Philosophy.”⁵ Therefore, as the foundation for our total world views—including our ethics and epistemology—ontology is a good place to begin reconstructing our relationship with the world.

Supporters of deep ecology, for instance, argue that we need to completely reorient how we perceive and interact with our world. Their goal is not to push for “environmental ethics,” but to promote an “ecological consciousness” where one experiences the world in terms of *relationships* rather than in terms of *things*. Fritjof Capra explains that deep ecology sees

the world “not as a collection of isolated existing objects, but as a network of phenomena that are fundamentally interconnected and interdependent.”⁶

Deep ecology founder Arne Naess outlines this distinction in the following:

...the dominant way of conceiving reality is roughly that of a vast supermarket stocked with individual things that are extrinsically related to each other: like primitive atomistic conceptions. These relations are no longer conceived to be Newtonian and mechanistic, but are still largely seen as extrinsic relations between things in themselves. Many supporters of the Deep Ecology movement, however, are inspired by ways of experiencing reality which clash with this dominant way of conceiving reality.⁷

This “alternative way of conceiving reality” rejects the understanding of things “in-relationship” in favor of conceiving things as *constituted by relationships*. This implies a *relational* rather than an *object* ontology.

Thanks in large part to the science of ecology—the study of the *relationship* of organisms and their environment—the atomistic paradigm of the “individual,” or the “self,” is slowly giving way to a notion of the individual as forged by its *relationship to its context*. As Naess puts it, “speaking of interaction between organisms and the milieu gives rise to the wrong associations, as an *organism is interaction*.”⁸ Similarly, in general systems theory, the universe is conceived not as made up of “objects” but rather as consisting of flows and relationships. It is these relational patterns, not “things,” that persist.⁹

Experiencing phenomena as fundamentally relational (as is directly suggested by the science of ecology) hints at a preferred and nonrelative

reading of the world as “text.” Moreover, ecology has not only ontological but ethical implications; how we conceive the world *to be* both informs and infects our values and interactions. Although no *logical* link may exist between “is” (or one’s perception of “is”) and “ought,” there does exist a *psychological* link. Different ontologies suggest different perceptions of the world; different perceptions in turn suggest different kinds of ethics and alternative notions of moral considerability. A relational ontology inverts our standard notions of what it means to be human in a more-than-human world.¹⁰

In this paper, I move from evolution and ecology to ontology, and from ontology to ethics. In Chapter 1, I set the stage for understanding the “units of selection” debate in evolutionary biology as fundamentally not biological, but metaphysical, a dispute involving criteria for identity. I conclude that “adaptive traits” and “units of selection” are only meaningful when invoked in relation to a particular ecological context. Since organisms only survive by being in particular vital relationships with such contexts, organisms must be conceived as “organisms-in-environment” rather than solely in terms of their constituent parts. In Chapter 2, I explore the ontological implications of relational properties and conclude that many relationships are not extrinsic, but essential to an entity’s identity. (By *essential*, I mean merely that these relational properties must exist for this entity to continue being what it is. I do not mean to imply a doctrine of “essences.” Relational properties are not “things” or “substances”). I further suggest that relationships are in certain

cases ontologically prior to “things.” In Chapter 3, I argue that the “relational real” has implications for environmental ethics and ecophilosophy. I contend that there is a nonaccidental connection between a culture’s conception of the unit of selection and what it deems to be morally relevant, since both presuppose particular criteria of identity which are bound up in a particular ontology. I conclude that since certain relational properties are essential to an entity’s identity, these must be taken into account when determining moral considerability. I argue that this in turn implies a kind of ethical holism.

Because distinctions between academic disciplines are often artificially imposed, I have relied on a number of sources outside traditional philosophy. For instance, I draw heavily from the work of anthropologist and systems theorist Gregory Bateson, neurobiologists Francisco Varela and Humberto Maturana, biologists Ilya Prigogine, Richard Lewontin and Lynn Margulis, atmospheric chemist James Lovelock, historian Morris Berman, physicist Fritjof Capra, Buddhist scholar Joanna Macy, Zen poet Gary Snyder and naturalist Aldo Leopold. The philosophers who have influenced this work the most are Arne Naess, David Abram, Holmes Rolston, J. Baird Callicott, Kenneth Goodpaster, Michael Zimmerman, and John Rodman. They are each intimately aware of the important interplay between ontology and ecology, and its implications for ecophilosophy.

John Rodman says that “It is probably a safe maxim that there will be no revolution in ethics without a revolution in perception.”¹¹ In what follows I argue that an object ontology and our subsequent failure to acknowledge the relational as real is in large part responsible for our ethical failings and our inability to “fit in” with our broader ecological context. We must conceive the world in a fundamentally different way if we are to engage it in an effective and ethically responsible manner. I believe that a relational ontology plays a vital role in promoting this perspective.

Notes

- ¹ David Orr, *Earth in Mind* (Washington, DC: Island Press, 1994) 7.
- ² Gregory Bateson, cited in Bill Devall and George Sessions, *Deep Ecology: Living as if Nature Mattered* (Salt Lake City: Gibbs M. Smith, Inc., 1985) 1.
- ³ John A. Livingston, *Rogue Primate: An Exploration of Human Domestication* (Toronto: Roberts Rinehart, 1994) vi.
- ⁴ See Fritjof Capra, *The Web of Life: A New Scientific Understanding of Living Systems* (New York: Anchor Books, 1996) 4.
- ⁵ I owe this insight to Nikita Balashov.
- ⁶ Capra 7.
- ⁷ Arne Naess, "Ecosophy and Gestalt Ontology," *Deep Ecology for the 21st Century: Readings on the Philosophy and Practice of the New Environmentalism*, ed. George Sessions (Boston: Shambhala, 1995) 244.
- ⁸ Arne Naess, *Ecology, Community and Lifestyle: Outline of an Ecosophy*, trans. David Rothenberg (Cambridge: Cambridge University Press, 1989) 56.
- ⁹ Joanna Macy, *Mutual Causality in Buddhism and General Systems Theory* (Albany: State University of New York Press, 1991) 108.
- ¹⁰ The expression "more-than-human" I take from David Abram, *The Spell of the Sensuous: Perception and Language in a More-Than-Human World* (New York: Pantheon Books, 1996). I find it highly appropriate since it is inclusive of human beings while embracing a world not limited to human beings..
- ¹¹ John Rodman, "Four Forms of Ecological Consciousness Reconsidered," *Deep Ecology for the 21st Century*, 125.

CHAPTER 1

EVOLUTION AND THE CONTEXT OF SELECTION

Life that survives is life that fits with other life.

—Tom Malloy, *Curtain of Dawn*

Conceptions and Misconceptions

Charles Darwin left the world two distinct legacies when he put forth his theory of evolution by way of natural selection: one was to science and the other to the popular imagination. In the popular mind, for instance, the term “evolution” often implies either that the process of life has an ultimate goal or that life is at least demonstrating some kind of “progress.” To some, “natural selection” promotes the idea that an actual agent or force exists which does this selecting, and “survival of the fittest” has been invoked by everyone from Social Darwinists to Nazis in an attempt to justify aggression, oppression, competition, eugenics and the maintenance of a status quo on behalf of an elite that conceives itself to be the most “fit.” None of these conceptions are accurate. When scientists attempt to clear up such misconceptions, however, they often makes things murkier by replacing one misconception with another. For instance, where evolutionary biologists (primarily neo-Darwinists) are quick to remove any hint of teleology from the notion of evolution, they still tend to emphasize how evolution remains essentially a

one-way process where organisms adapt to their environment. In contrast, I argue that evolution works in *both* directions with organisms and environment dynamically interacting in a selective context which is both mutual and concrete. Species select for each other and for an environment which in turn selects for them—it is not an abstract “nature” which selects, as “natural selection” would lead one to believe. Finally, the descriptive power of “survival of the fittest” depends entirely on what one construes “fitness” to mean in the first place. To some biologists it denotes success in producing offspring, to others it operates at a level beneath this and indicates the possession of specific traits that lead to a high probability of reproductive success, while still others interpret fitness in the longer term as a species’ “expected time to extinction.”¹ “Fitness,” however, can result from any number of different anatomical, physiological, and behavioral traits—and in radically different contexts. Moreover, what might constitute “fit” behavior on the level of an individual organism might mean suicide at the species level (or vice versa).

In this chapter, I hope to clear up some of the confusion surrounding these issues by examining evolution and natural selection first from the perspective of Darwin himself and then from that of neo-Darwinism, ecology and systems theory. I hope to demonstrate that the “units of selection” controversy in biology is ultimately not a biological debate at all, but rather a *metaphysical* dispute because it turns on fundamental questions about what

it means to be an individual “unit” of selection in the first place. I hope to demonstrate that since in all instances the survival of an organism (or of a population or species) ultimately depends on how it relates—or “fits in”—with its ecological context, units of selection should be construed in terms of whole contexts of interaction. I contend that such a relational perspective is relevant both ontologically and ethically, and is urgently important for the continued survival of both the human and the more-than-human world.

Darwin, Neo-Darwinism and Natural Selection

...in the humblest parasite which clings to the hairs of a quadruped or feathers of a bird; in the structure of the beetle which dives through water; in the plumed seed which is wafted by the gentlest breeze...we see beautiful adaptations everywhere and in every part of the organic world.

—Charles Darwin, *The Origin of Species*, Chapter 3.

It was Charles Darwin’s endless fascination with the riddle of where all these “beautiful adaptations” came from that eventually gave us *The Origin of Species* in 1859. Of course, for Darwin to call such things “adaptations” in the first place already presumed a lot; namely, it conceived organic structure to be the result of some kind of process rather than as a predetermined, possibly divinely contrived condition. But this way of thinking was not unique in Darwin’s era. More than a quarter of a century before Darwin even happened upon his first Galapagos finch, Lamarck had posited that characteristics acquired by individual organisms were passed on from generation to generation. The idea of “evolution,” where species were

conceived to undergo gradual transformations over time, was already in the air. According to Lamarck, organisms endeavored (consciously or not) to adapt themselves to their environment through the use and disuse of particular organs each possessed (the paradigm example being that a giraffe's long neck has resulted from generations of stretching to reach ever higher leaves). Eventually, thought Lamarck, the inherited results of such striving would bring forth a wealth of wildly divergent species. This mechanism has since been rejected by most biologists, but Lamarck's theory of organic evolution nevertheless greatly influenced Darwin's thinking and that of others who sought a natural explanation for the diversity of beings on our planet.

Two other ideas figured prominently in Darwin's developing thought process. One was Charles Lyell's doctrine of uniformitarianism. Stating that "the present is the key to the past," uniformitarianism asserts that all geologic phenomena (Grand Canyon, Cliffs of Dover, etc.) are the product of natural forces operating over enormous stretches of time with high (though not total) uniformity.² Until then, it had been widely assumed that catastrophes (such as the supposed deluge in the time of Noah) had been wholly responsible for the highly weathered appearance of a planet then believed to be only about six thousand years old. The other idea that greatly affected Darwin's outlook on the world was put forth by Thomas Malthus, who had argued that populations increase geometrically (either doubling: 2,

4, 8, 16... or at some other constant multiple) while food supply increases only arithmetically (1, 3, 5, 7, 9...) This means that growing populations inevitably outstrip food supplies.³ The limitless increase of any population is therefore necessarily prevented either by starvation or through limitations on reproduction. Since reproductive restraint is rare among humans (let alone in nonhuman animals) the logical implication of Malthus' theory on the natural world was that more offspring would be produced than could survive. The politics of survival under such scarcity Darwin called the "struggle for existence."

On the Galapagos Islands, Darwin had encountered varieties of finches that not only differed in structure from birds on the mainland, but differed from island to island—often with these islands being within sight of one another. Species in close proximity to each other varied widely from slender-billed insect-eaters to thick-billed seed-eaters, from ground-feeders to tree-feeders, from large to small-bodied finches to even a woodpecker-like finch that fished for insects using a stick.⁴ Since these islands all shared an identical climate and region, this ruled out the possibility that variations in finch structure were the result of differential climatic change (which Darwin had up until then assumed to be the prime mechanism in evolution⁵). The impact of these encounters, in addition to his exposure to ideas found in Lamarck, Lyell, Malthus and others gave Darwin five basic ideas about evolution to work with:

- 1) Variations (amid similarity) occur within and among species in a manner that (generally) appears to adapt each particular organism to its environment.
- 2) Variations among closely related species may be highly local, and not confined to different climates or regions.
- 3) In the “struggle for existence,” organisms embodying these variations tend to produce more offspring than can survive.
- 4) These variations are inheritable.
- 5) All of the variations so far observed occurred across enormous spans of geologic time.

Darwin recognized that although some offspring survive and some don't, and some organisms successfully reproduce and some don't, the conditions determining reproductive success and survival are usually not arbitrary. For instance, in the “struggle for existence,” competition for food frequently occurs both between members of a given species (intraspecific competition) and with members of other species (interspecific competition). Similarly, with respect to the perpetuation of particular variations into the next generation, competition for reproductive partners comes into play. In both cases, even the slightest favorable variation could tip the scales in favor of one organism surviving (or reproducing) and another meeting its demise (or not reproducing). Number (1), above, should therefore be amended to add that “some variations are more adaptive than others.” In this model (which will later be called into question), the “accumulation of slight but useful variations” (a process of change now popularly known as evolution) over long spans of time typically results in a population of organisms becoming progressively better adapted to its particular environment.⁶ The Galapagos finches were, for instance, all descendants of a common ancestor (a relatively

recent one, since the islands were volcanic and therefore younger than the mainland) who now had through evolution become adapted to more highly specialized niches. In short, with the assistance of a world that Darwin perceived to be equipped with plenty of time, plenty of inheritable variations, plenty of offspring, and plenty of competition for resources, he formulated his theory of natural selection to explain the origin of species.

As many more individuals of each species are born than can possibly survive; and as, consequently, there is a frequently recurring struggle for existence, it follows that any being, if it vary however slightly in any manner profitable to itself, under the complex and sometimes varying conditions of life, will have a better chance of surviving, and thus be *naturally selected*. From the strong principle of inheritance, any selected variety will tend to propagate its new and modified form.⁷

Or, as summed up by one writer⁸: variation + selection (over vast stretches of time) = evolution.

Darwin was conscious of his use of metaphor in putting forth the expression “natural selection.” As he understood it, organisms evolved and diversified “as if” nature selected in a manner analogous to the artificial selecting done by humans on domesticated animals.⁹ He called it “natural” selection to demonstrate how similar its effects were to those employed by human selectors, but conceived it as having a far grander effect: “Natural Selection...is immeasurably superior to man’s feeble efforts, as the works of Nature are to those of Art.”¹⁰ Darwin insisted that (in contrast to artificial selection) the predominant factor in natural selection was competition.¹¹ However, as we have seen, the notion of a “struggle for existence” (which for

Darwin included a struggle at leaving progeny¹²) was by no means original to Darwin; it had ideological forebears in Lyell, Malthus, and Lamarck and was a mainstream notion by the mid-nineteenth century. It is therefore hardly surprising that the cultural emphasis in Darwin's era on competition resulted in natural selection being popularized by Herbert Spencer as "survival of the fittest." Darwin's unique contribution lay, according to Loren Eiseley in *Darwin's Century*,

not in the application of the struggle for existence to the entire animal creation, but rather in his discovery that biological variation combined with the pruning hook of selective struggle might be the key to endless organic divergence.¹³

For evolution to occur by way of natural selection, something must 1) continually bring about variations for selection to operate upon and 2) conserve the variations selected for. In short, evolution is a stochastic process. A stochastic process is "ratchet latching," i.e., it involves a sequence of events which combines a random component with a selective process so that only certain outcomes of the random are allowed to endure.¹⁴ In the case of evolution, variation is (in large part) the "random component" and natural selection is the "selective process" of differential reproduction.

Unfortunately, Darwin was stuck with an understanding of inheritance popular in his time which held that biological characteristics of offspring were a "blended" combination of the characteristics of both parents. He therefore never had a theory of genetics adequate to explain how what he called "descent with modification" could conserve variations without

becoming hopelessly diluted in the process (in such a model an individual's children would receive 50 percent of a given characteristic, grandchildren 25 percent, and so on). Only with Gregor Mendel's later-popularized "units of heredity" (discrete trait-producing elements eventually called genes) could particular variations be preserved intact in future generations. Today, the orthodox formulation of evolutionary theory (called neo-Darwinism) synthesizes Darwin's idea of gradual evolutionary change with an updated interpretation of Mendel's theory of particulate genetic inheritance.¹⁵

All of this, however, demands an explanation of what creates variations in the first place. From the standpoint of neo-Darwinians, it is vital to recognize that genetic information flows in one direction only, from the nucleic acid (DNA and RNA) to the body, and never the other way around.¹⁶ This denial of backpropagation is the antithesis of Lamarck's notion that acquired characteristics are inheritable (a view which, remarkably, Darwin eventually found himself forced to embrace for lack of a better mechanism). On the contrary, the one-way flow of genetic information implies that the only way for variations to occur (other than those resulting from the shuffling around of parents' genes) is through random errors in DNA replication, i.e., mutation. Biologist Richard Lewontin characterizes this one-directional paradigm as follows:

Darwin's variational theory is a theory of the organism as the object, not the subject, of evolutionary forces. The variation between organisms arises as a consequence of internal forces, but these are autonomous and alienated from the organism as a

whole. The organism is the object of these internal forces that operate independently of its functional needs or of its relations to the outer world.¹⁷

As Francis Crick puts it, in this model “Chance is the only source of true novelty.”¹⁸ There is at least one other possible avenue for the bringing about of “true novelty” which neo-Darwinists ignore which I shall address later. For now, since my topic is not genetics, it will suffice to indicate that mainstream evolutionary theory emphasizes that mutation and natural selection are together what effectively drive evolutionary change.

As we have seen, natural selection does not create variability; it only acts to preserve particular variations. What then does natural selection select for? Before I address this, it might be said that putting the question this way misconstrues the issue because, properly speaking, natural selection is quite incapable of selecting *for* anything. It can only select “against.” Being more like the sculptor’s chisel than the painter’s brush, natural selection “rules in” only by “ruling out.” In the neo-Darwinian synthesis, while mutations “add,” natural selection only subtracts.¹⁹ Since many more variation-bearing organisms are produced than can survive (a point I will continue to belabor), most will usually not survive to reproduce. Those variations favorable to survival and reproduction thereby persist into future generations and eventually become dominant in the population. Bearing the “sculpting” analogy in mind, however, it is important to recognize that although adaptive variations tend to survive, it does not follow that every

variation which survives is therefore adaptive. In addition to adaptive characteristics, any number of neutral (i.e., nonmaladaptive) traits might persist in those who survive and bear offspring—but neither of these are (strictly speaking) selected *for*; they were simply not selected *against*. As biologist Francisco Varela puts it,

...we need to move out from the classical framework to see that natural selection was never intended as a trait-by-trait optimization. It states, rather, minimal conditions which will be satisfied under the conditions of differential reproduction among the members of a population. This amounts to setting broad boundaries within which many pathways may be taken, as in a proscriptive rule (what is not forbidden is allowed). But this is a far cry from a prescriptive rule (what is not allowed is forbidden).²⁰

One should consequently not expect *every* characteristic embodied by a creature to have adaptive value either with respect to capacities for survival or for reproduction. However, one will not expect to find highly maladaptive characteristics (such as congenital blindness in a mammalian predator) to be very well represented in the gene pool. In what follows, I will for the sake of convention continue to speak as though natural selection selects “for” particular characteristics, even though nature cannot truly prescribe, but only proscribe.

Let us return to the question, “what does natural selection select for?” Those attempting to respond frequently invoke Herbert Spencer’s dramatic characterization of natural selection as “survival of the fittest.” This seems simple enough—in this model those who are fit, survive—therefore natural

selection selects for fitness. Understanding natural selection in this way, however, only results in an instance of true but useless knowledge: “which organisms are fit? Those that survive. Which survive? Those that are fit.”²¹ The resulting tautology, “survival of the survivors,” does not shed very much light on the matter! Things are complicated further when we recognize that not all natural mortality falls strictly under the rubric of natural selection. Darwin himself said that “I am convinced that Natural Selection has been the most important, but not the exclusive, means of modification.”²² Sometimes old fashioned good luck (or lack thereof) will make all the difference. For instance, in the natural world simply being in the wrong place at the wrong time will sometimes be the undoing of many an individual organism or even for entire populations of organisms. Some selective pressures (like the impact of a large meteorite) are equal-opportunity decimators—in such cases it won’t matter what an organism’s genetic makeup is if it happens to be in the way. Those who are unaffected hundreds of miles away will unquestionably go on to survive and leave more offspring than their pulverized compatriots, but this should not imply that these survivors are necessarily any more “fit” than their fellows were.²³

Thus it would seem that for natural selection (but *not* for evolution) to occur, at least two things must be the case. First, a *potential* for differential survival and reproduction must exist—a factor which is lacking when something eliminates everyone else at the same time that it eliminates you

in particular. Second, this differential survival must depend at least in part upon the compositions of the surviving organisms and not just upon their good fortune in happening to be in a particular place at a particular time. So, leaving nonqualifying cases aside, this brings us back to the question of what natural selection selects for. As we have seen, “fitness” is not an adequate answer. When pressed further, biologists will speak of “units of selection” which are usually understood to consist either of particular organisms, parts of organisms, or groups of organisms.

With the possible exception of the development of human morality, Darwin did not construe natural selection as favoring some *groups* over others. For the most part he construed selection as pitting one organism against another,²⁴ and therefore conceived the individual organism to be the fundamental unit of selection. With the development of the science of genetics, the unit of survival began to be associated with certain properties of the genome. More recently, some have argued that altruistic traits have in fact arisen through group selection, since groups of altruists may do better than groups of selfish individuals.²⁵ Possible candidates are by no means lacking, as one group of writers explains in the following:

At one extreme there is the selfish DNA hypothesis, which views genes themselves as the main units of selection. At the other extreme is the Wynne-Edwards notion of group selection invoked to account for the maintenance of altruistic traits. A full list of units looks rather formidable: DNA short sequences, genes, whole gene families, the cell itself, the species genome, the individual, “inclusive” groups of genes that are carried by different individuals, the social group, the actually

interbreeding population, the entire species (as a potentially interbreeding group), the ecosystem of actually interacting species, and the global biosphere.²⁶

My goal is not to make this list of “contending units of selection” any longer by proposing a new unit of selection, *per se*. Rather, it strikes me as curious that in all the above cases it is some *thing* or *group of things* which is alleged to form a unit of selection. And while this might work in practice, focusing on things selected may obscure why such-and-such a unit is selected for in the first place. There might in fact be many different bona fide units of selection, depending on the situation and depending on how big you draw your box. Organisms have to cope with a variety of physical factors such as cold, heat and humidity, as well as biotic factors that include predators, parasites and food availability, not to mention the many factors involved in sexual selection.²⁷ *Anything* that responds to selective forces as a unit—whether for instance a cell, organism, or population—might well qualify as a unit of selection.²⁸ In each instance, however, a selective pressure reveals itself to be a selective pressure occurring in a particular circumstance; every so-called adaptive trait is adaptive (and thereby selected for) only in a particular environment. Bearing this in mind, I intend in what follows to show how *context* is the crucial consideration in every instance of natural selection, and how units of selection are therefore best construed in terms of *relationships* rather than in terms of *things*.

Context

There is no such thing as bad weather, only poor clothing.
—Siberian proverb

There is a story about how one day Konrad Lorenz was in his yard conducting an experiment on how baby ducks learn.²⁹ He was attempting to teach the young birds how to quack and flap their wings. To do this, he himself went around the yard flapping and quacking to encourage the young ducklings to do likewise, which they eventually did. Although *in context* his behavior made perfect sense, he probably appeared quite insane to any passersby. The point of this example is that understanding the *relationship* between a certain way of being and a particular set of conditions is essential to understanding the relevance and importance of the elements involved. One cannot analyze each component separately and get the same information one would by analyzing the whole—the whole is more than merely the sum of the parts.

Let me use an example relevant to our discussion. One of the most celebrated instances of evolution occurring through natural selection is that of industrial melanism in the peppered moth (*Biston betularia*).³⁰ Until 1845 all specimens of this moth were light-colored, but that year in the center of rapidly industrializing Manchester, England, black specimens began to be observed. Smoke particles had begun to pollute and kill the light-colored lichens on nearby trees, and blackened even the rocks on the ground. A rare, recurring mutation was responsible for the existence of a few black peppered

moths, which had previously been easily spotted and gobbled up by birds but which now happened to blend in nicely with the blackened tree trunks. In the darkening heart of Manchester and other industrializing cities, being black meant possessing far better camouflage against birds than did being white. Thus, increasingly fewer black peppered moths were eaten than white ones, and by the 1890s black peppered moths made up over 95 percent of the peppered moth population.

In this example it is vital to recognize that black peppered moths, however, were not selected for simply because they were black. They were selected for because 1) they were black *and* 2) the tree trunks were black—the result being that moth-hunting birds could no longer discriminate (in many cases) between tree and moth, and had to find their meals elsewhere. Although certain specific genetic traits as well as individual organisms might each be understood as relevant units of selection in this example, it is only the broader context (moths/tree trunks/birds) that makes such units *meaningful*. In this instance a particular set of genetic constituents (the peppered moth's genotype) tends to promote certain observable properties (its phenotype) which in this particular ecological context makes for a favored variation. Without a context which invokes the relevance of a particular color in not being eaten, both the genes and the organism itself each leave nothing to select for.

This relevance of context in determining what is “fit” or “adaptive” means that the *organism-in-context* (e.g., black peppered moths on black tree trunks, being preyed upon by birds who search for them optically) must itself form a unit of selection. Thus, for the peppered moth there is no such thing as bad coloration, only poor camouflage.

Evolutionary biologists might argue that this is too obvious for words—namely that my stress on the relevance of context is old hat in evolutionary theory, a tacit assumption. If so, it might be better to make it explicit rather than to leave it tacit. As we will see, this old hat can (in Arthur Koestler’s words) produce some lively rabbits. Moreover, the terms “natural selection” and “survival of the fittest” both argue against understanding evolution’s mechanisms contextually. “Natural selection” seems to imply that someone or something constitutes a force “out there” engaged in the selection business. We need to remind ourselves that the “nature” in natural selection is merely an abstraction. In practice it is always particular conditions which select indirectly for and directly against particular organisms, and as Robert Wesson argues, these particular conditions usually involve other organisms: “Adaptation usually depends less on fitness for physical conditions than on interactions with other species.”³¹ In different contexts, different selective pressures come to bear—there is no “selection for objectively adaptive properties” going on anywhere. This is borne out by the recognition that adaptations are in certain contexts quite

useful but are in others highly maladaptive—even if the population doesn't move anywhere.

Bison of the North American Great Plains, for instance, spent thousands of years adapting to their life conditions. One adaptive tactic they invoked was, when threatened, to stand completely still and to frequently display themselves broadside in order to appear as big as possible. This helped to intimidate wolves who were after their calves.³² Although this trait worked to help deter wolf-attacks, when the broader context changed upon the human recolonization of North America, it merely provided gun-wielding white settlers with a big stationary target which was that much easier to hit. This assisted in bringing the bison to near-extinction, extinction being the penalty—deserved or not—of not fitting one's context.³³ (This is unfortunately the case even if the context in question happens to be an inappropriate one.) The bison had, over long stretches of time, come to adapt to selective pressures posed by wolves, but had no time to adapt (if any such adaptation was possible) to the selective pressures imposed by humans equipped with rifles and misfit ideas.

In a similarly misleading fashion, “survival of the fittest” seems to imply that some set standard of “fitness” applies in every case. Being “fit” might however in one instance mean being extremely aggressive (as are female grizzly bears protecting their cubs) while in another it might simply hinge on being a particular color, as we've seen in the case of peppered

moths. While many interactions are competitive, many are not: “being fit” often means “fitting in.” Most importantly, the emphasis in “survival of the fittest” on the individual organism as *the* unit of selection has promoted a confusion of the levels of species and individual.³⁴ At different levels different rules apply; that which might be competitive at the individual level (for example predator/prey relationships) frequently emerges as cooperative at the level of species interactions. Therefore what might be a survival advantage at the level of the individual may not be, for example, at the species or community level (or vice versa). This is an important point, for as Robert Wesson indicates,

Organisms evolve as part of a community, that is, an ecosystem, and evolutionists have recently given increasing attention to the entirety, which evolves together. One might better speak not of the origins of species but of the development of ecosystems...³⁵

What we must take into account is the entire *context of survival*.

Limiting the focus of evolution and natural selection to the level of individuals on down (which “survival of the fittest” seems to do) might in effect make one miss the forest for the trees. Organisms only survive as *organisms-in-environment*—as David Brower has said, “Condor in a cage is not condor anymore”—and this environment itself evolves. Eugene Odum’s emphasis on this point in *Fundamentals of Ecology* is worth quoting at length:

The first ecosystems three billion years ago were populated by tiny anaerobic heterotrophs that lived on organic matter synthesized by abiotic processes. Following the origin and

population explosion of algal autotrophs, which converted a reducing atmosphere in to an oxygenic one, organisms have evolved through the long geological ages into increasingly complex and diverse systems that (1) have achieved control of the atmosphere and (2) are populated by larger and more highly organized multicellular species. Within the community component evolutionary change is believed to occur principally through *natural selection at or below the species level*, but natural selection above this level may also be important, especially (1) *coevolution*, that is, the reciprocal selection between interdependent autotrophs and heterotrophs, and (2) *group or community selection*, which leads to the maintenance of traits favorable to the group even when disadvantageous to the genetic carriers within the group.³⁶

In what follows I will explore 1) how selection works at levels above the individual and 2) how in contexts of interspecific interactions organisms effectively select for each other—and in so doing ultimately select for *themselves*. Species identity is constructed through long-standing evolutionary relationships.

Fitting In

When a flower is fertilized by the wind, it never has a gaily colored corolla...if insects had not developed on the face of the earth, our plants would not have been decked with beautiful flowers....

—Charles Darwin, *The Origin of Species*, Chapter 6.

A fundamental tenet of set theory is that no class is a member of itself.³⁷ The class of chairs is not itself a chair; the twelve disciples are not each “twelve.” It is not therefore surprising that some properties emerge in wholes which are absent in the parts alone, e.g., a population of elk has a “density” (understood as the number of animals per unit area) whereas

individual elk do not, and although water in general might be plentiful on our planet, *this* water in my glass is not itself “plentiful.” To put this in terms of the previous discussion, contexts involving *relationships between classes* and contexts involving *relationships between individuals* constitute wholly different levels of abstraction with different rules applying in each. In different contexts “fitness” and “survival” mean different things, so in order to communicate such terms appropriately one must both be aware of and signify the logical level at which one is speaking. In language use, violating the rules implicit in particular contexts often forms the basis for humor. An example would be “I met a beggar who said he hadn’t had a bite in three days—so I bit him.”³⁸ Or if I said “to biologists, teleology is a four-letter word” and used this to discredit biology on the grounds that biologists don’t know how to count properly (“teleology” has nine letters) I would of course be equivocating on the term “four-letter word.” In addition to equivocation, confusing logical levels can result in fallacies of misplaced concreteness or misplaced generality, an example of the latter being when Homer Simpson attempted to assuage his vegetarian daughter with respect to what’s for dinner: “Don’t worry, Lisa—it’s *lamb*, not a lamb!”

In discussing evolution and natural selection, confusing logical levels is especially easy when terms like “cooperation” are invoked. At the level of individual organisms, a predator does not of course benefit its prey or a parasite benefit its host. But at a higher logical level, that of relations

between *species* (i.e., interspecific relations rather than relations between individuals), such interactions are frequently “either innocuous or mutually advantageous.”³⁹ Although individual prey in prime condition are still sometimes killed and eaten by predators, a long-standing relationship between predator and prey *species* frequently (but not always) helps stabilize population numbers, results in the culling of sick and weak individuals and brings about healthier populations overall for each.

In addition, through long spans of time a kind of “arms race” occurs between predator and prey species in which the predator becomes stealthier, the prey swifter and more alert. Predator and prey species respond to one another through a variety of behavioral and anatomical adaptations: it is no coincidence that a buffalo conveniently keeps track of what’s going on through eyes on the sides of its head while a wolf finds its next meal with front-facing binocular vision. The keen eyes of the pronghorn, the acute hearing of the elk, the bulk of the moose, the bounce (and fecundity) in the bunny all exist thanks to genetic variation in the context of coevolutionary interaction. Predator and prey shape and refine one another.⁴⁰

Such coevolution, more technically, is a stochastic system of evolutionary change in which two or more species interact in such a way that changes in species A set the stage for the natural selection of changes in species B. Later changes in species B in turn set the stage for selecting of more similar changes in species A.⁴¹ Limiting oneself to observing selection

at the level of the individual animals misses the grand effect of such a vital reciprocation. Through the survival of the fittest *individual* organisms, two or more *species* can begin to “fit” together, with the evolution of one being tracked by another. In this way relationships between species make these species into what they are; the relationships are not something species merely *have*. Interspecific interactions are not relations which can be simply predicated of static, determinate objects—species are both subjects and objects of evolution. Through eons of weeding out of particular individuals, a population (and ultimately a species) gradually evolves—both behaviorally and physiologically. Selection at one level thereby determines evolution at a higher logical level; individual organisms, while selected, do not themselves evolve. The rules applying to individuals therefore do not apply to the species as a whole—while a particular predator, for example, must kill prey to survive, a predator *species* that kills off its prey *species* will more than likely destroy itself in the process.⁴²

Another instance of species selecting for each other through coevolution is found in the plant kingdom. As the quotation from Darwin at the beginning of this section indicated, we have insects to thank for a world of beautiful flowers. As beautiful as these are, however, humans (due to our particular range of spectral perception) only recognize a small part of the colorful plenitude potentially out there for the perceiving. An explanation lies in the coevolution of ultraviolet sensitivity in honey bees and ultraviolet

reflectance patterns in flowers.⁴³ Flowers attract pollinators by the food they contain and must make themselves conspicuous yet distinct from flowers of other species. Bees searching for food in turn need to be able to recognize flowers from a distance. According to one group of writers,

These two broad and reciprocal constraints appear to have shaped a history of coupling in which plant features and the sensorimotor capacities of bees coevolved. It is this coupling, then, that is responsible for both the ultraviolet vision of bees and the ultraviolet reflectance patterns of flowers.⁴⁴

The survival and flourishing of both bees and particular species of flowers is thereby bound up in their closely coupled *relationship*. Like two dancers, they “not only fit their moves to the beat; they fit their moves with each other.”⁴⁵

This example is merely a subset of a general survival strategy that plants have used to reproduce themselves. As Lynn Margulis and Dorion Sagan put it, “Plants indeed seem very adept at seducing us animals, having tricked us into doing for them one of the few things they cannot: move.”⁴⁶ This is in turn a subset of an apparent tendency in nature toward ever greater complexity by way of tightly knit coevolutionary relationships. Lynn Margulis has persuaded most biologists, for instance, that *eukaryotic* (nucleated) cells are themselves the legacy of a long term symbiosis involving prokaryotes (non-nucleated cells) living as bacteria in larger cells. In *The Web of Life*, Fritjof Capra argues that since an entirely new, eukaryotic form of life emerges from this (in what has been termed *symbiogenesis*), mutual

dependence demonstrates itself to be a much more effective force in evolutionary change than mutation.⁴⁷ This is not merely the case at the level of the individual cell. Multicellularity is itself a grand symbiosis, as are intra- and interspecific interactions among single- and multicellular organisms—which leads to ever greater biotic diversity.⁴⁸ Gene mutation may be the driving force in producing novel variations in phenotypes, *but the contexts emerging through the interactions between phenotypes are themselves truly novel variations subject to selective processes*. Variation and selection therefore occur at both individual and contextual levels. Fritjof Capra explains the implications of this.

This new view has forced biologists to recognize the vital importance of cooperation in the evolutionary process. While the social Darwinists of the nineteenth century saw only competition in nature—“nature, red in tooth and claw,” as the poet Tennyson put it—we are now beginning to see continual cooperation and mutual dependence among all life forms as central aspects of evolution. In the words of Margulis and Sagan, “Life did not take over the globe by combat, but by networking.”⁴⁹

Bearing this in mind, the evolutionary process is best characterized in terms of increasing specialization—finding different ways to “fit in”—rather than just in terms of competition. Again, logical levels come into play. Although individuals do themselves frequently compete, the process of speciation (which begins at the level of populations) frequently involves greater specialization and is thus itself a mechanism for *avoiding* competition. As ecologist Paul Colinvaux puts it,

Animals and plants are not after all engaged in endless debilitating struggle, as a loose reading of Darwin might suggest. Nature is arranged so that competitive struggles are avoided. This is apparently why separate species are the result of natural selection. A species lives triumphant in its own special niche from which none can displace it. Only the stragglers into the niches of others must be removed by brutal struggle. Natural selection designs different kinds of animals and plants so that they *avoid* competition. A fit animal is not one that fights well, but one that avoids fighting altogether.⁵⁰

Cooperation frequently plays a strong role in survival not only at the level of interspecific interactions, but also at the level of individual organisms—in symbiosis.⁵¹ Cattle, deer and termites for example each harbor microorganisms in their gut that digest vegetation which they could not otherwise break down. The microorganisms in turn benefit by being shipped around to where the food is, in a moist, comfortable environment. Fungi and algae join up when nutrients are scarce to extract what they can from a rock or bark substrate, making lichens. In another example, the acacia provides certain species of ants with food and shelter, and these ants in turn benefit the acacia by driving away other insects and browsers, and even sometimes get rid of competing vegetation. However, obvious self-interest is not always the root of cooperation. In cases of obligate mutualism, relationships are so tightly knit that even though the cooperation involved might only benefit the next generation, the individual organisms act with a specificity and self-restraint which is hard to account for. The yucca plant, for example, relies wholly on the yucca moth, which not only pollinates by brushing against organs of different flowers, but by active transfer.⁵² The

moth (*without* nectar as a reward) scrapes pollen from the flower's anthers and balls it up with specially modified mouth parts, flies to another yucca and rubs it directly on the stigma of another flower. In repayment she lays only a few eggs (fewer than she could) on the yucca ovary and the subsequent larvae eat only a small proportion of the seeds the yucca produces. These examples are but a few which indicate a general tendency toward interdependence in the mechanisms of evolution, even at the individual level—although this is most evident at the level of interspecific interactions. “*Bios*,” as Holmes Rolston III has said, “is intrinsically symbiosis.”

By focusing so much on symbiotic interactions I expect to be accused of presenting what Wittgenstein called a “one-sided diet of examples.” Therefore in an attempt to avoid painting a “happy face” on the natural world I cite these seemingly less-than-symbiotic instances from Donald VanDeVeer and Christine Pierce.

Burying beetle couples prepare the corpses of small animals for their young to eat. When the young are born, the parents eat the members down to a size that the food supply can support;... thus, cannibalism gives the surviving youngsters a “head start” so to speak.... Two woodpeckers often share a nest, but when one lays an egg the other destroys it (perhaps to destroy the advantage the first one has). This continues until both lay an egg at the same time. A female praying mantis may start chewing off her partner's head while he is still mating.... The female *Ormia* fly can detect a male cricket's sounds, drop down on it, and deposit it on a squirming maggot that bores into the cricket and eats it. The mother fly may have an extra incentive to succeed: if she fails, the hungry maggots begin to devour her from the inside out.⁵³

Such instances would be a hard set of counterexamples for me to deal with it if I were arguing that nature is a friendly place or that organisms seek to benefit one another. Thankfully, I am not making such arguments.

However, although I do not deny that individual organisms each seek to maximize their own survival and reproductive success, I emphasize that *success in doing this requires cooperation* either at the individual level (as with ruminants and rumen microbes) or at the species level (e.g., predator/prey or parasite/host interactions). Historian Donald Worster comments that according to ecologists such as Eugene Odum,

Nature's strategy leads finally to a world of mutualism and cooperation among the organisms inhabiting an area. From an early stage of competing against one another, they evolve toward a more symbiotic relationship. They learn, as it were, to work together to control their surrounding environment, making it more suitable as a habitat.... Odum called that point "homeostasis." To achieve it, the living components of an ecosystem must evolve a structure of interrelatedness and cooperation that can, to some extent, manage the physical world—manage it for maximum efficiency and mutual benefit.⁵⁴

Although any number of physical and behavioral possibilities exist (predatory, symbiotic, parasitic, etc.) that promote survival and reproduction, for these to be sustainable over the long haul they must fit their contexts and thus not destroy the very thing they depend on. As the saying goes, "a frog does not swallow up his whole pond."

Predator/prey and parasite/host interactions are *from the species' point of view* a kind of symbiosis, no matter how terminal such interactions might be from the individual's perspective. An example of such a higher level

symbiosis where “your enemy makes you stronger” can be found in the relationship of the myxoma virus and the rabbit.⁵⁵ Shortly after rabbits were brought to Australia they became serious pests which began to overrun and destroy a great deal of rangeland. Since they (not surprisingly) bred like rabbits, they were notoriously difficult to control. After poison and predators proved useless, the Australian government introduced the myxoma virus (which was similar to smallpox and killed rabbits quickly) into the rabbit populations. Myxomatosis quickly spread (thanks to mosquito carriers) and soon 99.8 percent of the infected rabbits died. However, the following season only 90 percent of the remaining population was killed, followed by only 40 to 60 percent mortality in the third outbreak. Ecologist Robert Ricklefs explains that the reason for the declining effectiveness in the myxoma virus is found in coevolutionary responses by both the rabbits and the virus. A small percentage of the rabbits was genetically resistant to the disease before the population was even exposed, and these rabbits were the ones that tended to survive. Simultaneously, the virus strains that began to predominate were less severe because reduced virulence let infected rabbits survive longer and gave mosquitoes a better chance of dispersing the virus (mosquitoes only bite living rabbits). Ricklefs further points out that

Left on its own, the Australian rabbit-virus system would probably evolve to an equilibrial state of benign, endemic disease....currently, pest management specialists keep the system out of equilibrium and maintain the effectiveness of the myxoma as a control agent by finding new strains of the virus to which the rabbits have yet to evolve immunity.⁵⁶

Particular symbionts like fungi and algae make the advantages of cooperative interaction obvious at the individual level. Though less obvious, interactions that appear antagonistic from the point of view of *individuals* still tend to promote conditions that similarly ensure a long-term relationship between *species*. If the myxoma virus killed off all the rabbits, it would itself disappear. The response of the rabbit and the subsequent rejoinder of the virus ensure that this doesn't happen and that the dialogue continues.

Species therefore depend on each other, select for each other and shape each other. They are formed from their relationships. Poet Gary Snyder in *The Practice of the Wild* goes even further and asserts that species ultimately “call each other into being” by making new relationships possible.

Relationships bring about new species, which in turn bring about new relationships, in a never-ending cycle.

It would appear that the common conception of evolution is that of competing species running a sort of race through time on planet earth, all on the same running field, some dropping out, some flagging, some victoriously in front. If the background and foreground are reversed, and we look at it from the side of the “conditions” and their creative possibilities, we can see these multitudes of interactions through hundreds of other eyes. We could say a food brings forms into existence. Huckleberries and salmon call for bears, the clouds of plankton of the North Pacific call for salmon, and salmon call for seals and thus orcas. The Sperm Whale is sucked into existence by the pulsing, fluctuating pastures of squid, and the open niches of the Galapagos Islands sucked a diversity of bird forms and functions out of one line of finch.⁵⁷

As Joseph Campbell has said, “Everything arises in mutual relation to everything else.” Such a contextual understanding of evolution therefore emphasizes less with respect to “natural selection” and “survival of the fittest” in favor of what might instead be called “mutual selection” and “survival of the fitters.”⁵⁸ Tom Malloy (who coined the term “survival of the fitters”) argues that “At most, ‘survival of the fittest’ is but one lower level mechanism by which the higher level process of ‘fitting together’ is accomplished.”⁵⁹ It is worth noting that this notion, even though largely downplayed, still makes sense in traditional evolutionary theory, as Robert Wesson explains:

If organisms depend on one another, they form a unit of selection, whether totally integrated, like [eukaryotic] cells, or partially integrated, like siphonophores, or related individuals, like members of an ant colony, or interdependent species, like moth and yucca. The evolution of the symbiotic unit is more complex than that of an individual, and its ability to make difficult adaptations is enlarged.⁶⁰

Biologist Richard Lewontin emphasizes that since organisms inevitably alter the external world as they interact with it, organism and environment necessarily mutually select for one another.⁶¹ When the one calls, the other responds. For instance, plant roots change the structure and chemical composition of the soil; grazing animals fertilize the ground with their droppings and stimulate the growth of particular plants by cropping them. In ecological succession, nonclimax species of trees shade themselves out and allow only shade-tolerant species to grow beneath them. The most

dramatic effect of organisms on their environment is found in the composition of the atmosphere, which is 78 percent nitrogen, 21 percent oxygen, with traces of carbon dioxide and methane. This arrangement is highly chemically unstable; if the atmosphere were left to its own devices and allowed to reach chemical equilibrium, oxygen and methane would disappear in a reaction that would blanket our planet in CO₂ and water vapor. But through the biotic processes of photosynthesis and carbon-fixing (both done by plants, especially marine algae), oxygen is added to the atmosphere and CO₂ is taken out in proportions that keep it relatively dynamically stable. Such discoveries strongly support Margulis and Sagan's conception of evolution in terms of symbiosis.

We are beginning to see the biosphere not only as a continual struggle favoring the most vicious organisms but also as an endless dance of diversifying life forms, where partners triumph.⁶²

This notion of coevolution by way of mutual selection finds its culmination in James Lovelock's Gaia hypothesis, which proposes that "the physical and chemical condition of the earth, of the atmosphere, and the oceans has been and is actively made fit and comfortable by the presence of life itself."⁶³ One striking example in favor of this hypothesis is that while the sun's output has allegedly increased by about 30 percent in the last 3½ billion years, earth's climate has (apparently) remained relatively stable over this same span of time. Simple negative feedback loops (often composed entirely of nonliving elements) may have been involved in keeping

temperatures within a fairly narrow range. For instance, greenhouse gases such as CO₂ (spewed forth in massive quantities by volcanoes) and water vapor trap heat and warm the planet, but as temperatures increase, more and more clouds form which reflect solar energy back into space, helping to prevent a runaway effect and subsequent planetary overheating. This alone, however, would probably not have been sufficient to deal with the massive amounts of CO₂ present. More intriguingly, both biotic and abiotic factors may have worked together in a giant feedback loop to actively pump CO₂ out of the atmosphere in a process involving rock weathering and marine phytoplankton.⁶⁴

When rock weathering occurs, rainwater, rock and CO₂ all combine to form carbonates which take CO₂ out of the air and bind it up in liquid solutions. At this point the process is wholly abiotic. Interestingly, Lovelock and others found out that soil bacteria greatly increase the weathering rate, and that as temperatures increase so to do the soil bacteria, which thereby increase the rate of weathering which removes more CO₂. Eventually the carbonates produced wash into the ocean where oceanic algae (coccolithophores) absorb CO₂ both from these carbonates and from the air itself, acquiring calcium carbonate (chalk) shells in the process. Since the coccolithophores soon die and then sink to the bottom of the ocean where they become limestone sediments, this effectively fixes CO₂ and removes it from the cycle. Moreover, as part of their life cycle coccolithophores excrete

dimethylsulfide (a product of their metabolism) which provides condensation nuclei for clouds; by reflecting sunlight, clouds make the earth that much cooler.⁶⁵ In this manner, global temperatures are stabilized through the actions of both living and nonliving elements interacting dynamically, with elements at one part of the circuit selecting for all the others. Lovelock concludes since living and nonliving elements interact seamlessly, to make a sharp bifurcation between biotic and abiotic elements in the biosphere as a whole creates a false dichotomy.

The atmosphere is not merely a biological product, but more probably a biological construction: not living, but like a cat's fur, a bird's feathers, or the paper of a wasp's nest, an extension of a living system designed to maintain a chosen environment.⁶⁶

I have proposed using the term “mutual selection” instead of “natural selection” in order to emphasize how organisms select for each other and for an environment which in turn selects for them. In contrast, philosopher/ecologist David Abram prefers to do away with the selection metaphor entirely and argues that the “mutual participation between the organism and the Earth” (such as we see in the Gaia hypothesis) is more like an “open dialectic,” a *discussion* between two parties:

We are now beginning to discern that if the so-called environment “selects” the organisms that inhabit it, so those organisms “selectively” influence the environment; perhaps, then, given this more open, circular causality, “selection” is not such a useful term. The interaction is a much more reciprocal phenomenon than that suggested by the metaphor of selection—it is more a sort of dialogue wherein the environment puts questions to the organism and the organism, in responding to those questions, poses new questions to the environment—to

which that environment, in turn, responds with further questions....⁶⁷

This is a telling metaphor because in a true dialogue the focus is not on the individual speakers, but on the conversation itself, which *emerges* through the interaction of the individual speakers with one another.⁶⁸ Traditional notions of evolution emphasize a one-sided adaptation of an organism to its environment, but as we have seen, the process is mutual. Coevolution does not consist of juxtaposed monologues. However, even the term “mutual selection” seems to focus on *relata*, the things related through selecting and being selected for, rather than on the *relationship* that exists between them. Lovelock has commented that “So closely coupled is the evolution of living organisms with the evolution of their environment that together they constitute a single evolutionary process”⁶⁹ and this hints that the crux here is not the *product* of evolution, but the evolutionary *process* itself. “Close coupling” implies that the morphologies and behaviors of coevolving predator and prey, for instance, are best understood as the product of a certain kind of “dialogue” or interaction rather than as evolution’s focus. A particular organism is, as a specimen, a “summation of its species’ historical, adaptive relationship to the environment”⁷⁰ and as such it bears artifacts of the selection process. However, since the prey species has been constantly tracking the predator species’ evolution (which results in more reciprocal tracking by the predator species), *it is more accurate to say that*

what has been selected for all this time is in fact the relationship between the predator and prey species.

In *Steps to an Ecology of Mind*, Gregory Bateson uses a similar example (with horse and turf instead of predator and prey) that may shed light on this conception.

...the evolution of the horse from *Eohippus* was not a one-sided adjustment to life on grassy plains. Surely the grassy plains themselves were evolved *pari passu* with the evolution of the teeth and hooves of the horses and other ungulates. Turf was the evolving response of the vegetation to the evolution of the horse. It is the *context* which evolves.⁷¹

Bateson continues,

We should not think of this process just as a set of changes in the animal's adaptation to life on the grassy plains but as a constancy in the relationship between animals and the environment. It is the ecology which survives and slowly evolves.... The paradoxes...of systemic process arise precisely because the constancy and survival of some larger systems is maintained by changes in the constituent subsystems. The relative constancy—the survival—of the relationship between animals and grass is maintained by changes in both relata. But any adaptive change in either of the relata, if uncorrected by some change in the other, will always jeopardize the relationship between them.⁷²

The idea of the coevolution of organisms and their environment is hardly new. The father of theoretical ecology, Alfred Lotka, indicated in 1925 that

...we should constantly take in view the evolution, as a whole, of the *system*... It is not so much the organism or the species that evolves, but the entire system, species plus environment. The two are inseparable.⁷³

Despite this, the importance of understanding the evolution of whole systems has been (until recently) usually overlooked.

Such “skin-out”⁷⁴ interspecific relationships (horse/turf, predator/prey, etc.) make up units of organization very much like membrane-bound systems such as cells and organisms. Such systems are essentially patterns of organization, sets of *relationships*. (It is worth remembering that with every breath you take, you are composed of a different set of particles than you were the moment before, while still maintaining the same relational structure.) Like a vortex that forms over a drain, these kinds of systems (dubbed “dissipative structures” by Ilya Prigogine) persist only by way of a constant flow of matter and energy. But in the same way that a vortex is maintained by a steady, energized influx of water informed by angular momentum, the individual members constituting a horse/turf or predator/prey relationship necessarily change over time as they select for one another. Like a top in motion, they have to stay moving in order to remain balanced. As Malloy puts it, “The relata change; the relationship remains.”⁷⁵ The pattern, flowing like a river, endures and slowly evolves in response to changes in the contour of things related.

In the next chapter, I move from biology to ontology by exploring how understanding *things* in terms of their relationships revises standard metaphysical notions of what it means to be a part, a whole, and an individual.

Notes

- ¹ John Beatty, "Fitness: Theoretical Contexts," *Keywords in Evolutionary Biology*, ed. Evelyn Fox Keller and Elisabeth A. Lloyd (Cambridge, Massachusetts: Harvard University Press, 1992) 115-119.
- ² Loren Eiseley, *Darwin's Century* (New York: Anchor Books, 1961) 353.
- ³ Technology can, of course, ameliorate some of the consequences of a supposedly limited food supply in the short term (e.g., industrial farming with massive monocropping), but since any additional food supply just turns around to feed a growing and breeding population, it makes the problem worse in the long run. Without reproductive controls of some kind, population will *always* eventually outstrip the availability of food.
- ⁴ Eugene P. Odum, *Fundamentals of Ecology*, 3rd ed. (Philadelphia: W. B. Saunders Company, 1971) 241.
- ⁵ Eiseley 172.
- ⁶ Fred Montague, *Wa-Maka-Skan* (n.p: n.p., 1997) 66.
- ⁷ Charles Darwin, *The Origin of Species By Means of Natural Selection* (New York: D. Appleton and Company, 1896) 5.
- ⁸ Michael L. McKinney, *Evolution of Life* (Englewood Cliffs, New Jersey: Prentice Hall, 1993) 32.
- ⁹ Darwin 99.
- ¹⁰ Darwin 77.
- ¹¹ Darwin 77.
- ¹² Darwin did, however, distinguish sexual selection from natural selection, since sexual selection in certain instances favors traits which actually diminish an organism's own chance at survival.
- ¹³ Eiseley 53.
- ¹⁴ Gregory Bateson and Mary Catherine Bateson, *Angels Fear: Towards an Epistemology of the Sacred* (New York: Macmillan Publishing Company, 1987) 211.

¹⁵ Capra 224.

¹⁶ Robert Wesson, *Beyond Natural Selection* (Cambridge, Massachusetts: The MIT Press, 1991) 8.

¹⁷ Richard C. Lewontin, “The Organism as the Subject and the Object of Evolution,” *Scientia* 118 (1983), 67.

¹⁸ Francis Crick, cited in Wesson 9.

¹⁹ Richard Dawkins, *The Blind Watchmaker* (New York: W. W. Norton & Company, 1987) 169.

²⁰ Francisco Varela, “Laying Down a Path in Walking,” *Gaia: A Way of Knowing. Political Implications of the New Biology*, ed. William Irwin Thompson (New York: Lindesfarne Press, 1987) 55.

²¹ Elliot Sober, *Conceptual Issues in Environmental Biology* (Cambridge, Massachusetts: The MIT Press, 1984) x.

²² Darwin 6.

²³ In his (fictional) book *Galapagos* (New York: Dell Publishing Co., 1985), Kurt Vonnegut makes much of this. In his story the only hope of the human race (which had otherwise gone sterile) is in a group whose only survival advantage is that they happen to be in the right place at the right time during a war and who find refuge on the remote Galapagos island of Rosalia (they are thereby far away from the sterility-inducing bacteria ravaging the rest of the planet). The composition of this surviving remnant of humanity consists of the following: one pregnant woman whose mother had been exposed to radiation from the Hiroshima atomic blast, another woman who is far past fertility, an unpleasant older man with dwindling sperm count whose genes carry Huntington’s Chorea, and a number of mainland tribeswomen who the man isn’t willing to have sex with. Not very promising! But with a little bit of clever artificial insemination (clandestinely performed by the older woman), the population one million years later evolves into a thriving species of streamlined, smaller-brained furry aquatic creatures. This degree of evolutionary influence is not what one would intuitively expect from such a seemingly “unfit” group of organisms. But again, luck always helps.

²⁴ Sober x.

²⁵ Elliot Sober, “Holism, Individualism, and the Units of Selection,” *Conceptual Issues in Evolutionary Biology* 188.

²⁶ Francisco J. Varela, Evan Thompson and Eleanor Rosch, *The Embodied Mind* (Cambridge, Massachusetts: The MIT Press, 1991) 192-193.

²⁷ McKinney 33.

²⁸ Elisabeth A. Lloyd, “Unit of Selection,” *Keywords in Evolutionary Biology* 336.

²⁹ Barbara Gail Hanson, *General Systems Theory Beginning With Wholes* (Washington, DC: Taylor & Francis, 1995) 19.

³⁰ Helena Curtis, *Biology* (New York: Worth Publishers, 1983) 889.

³¹ Wesson 157.

³² This example comes from Fred Montague.

³³ Malloy.

³⁴ Malloy.

³⁵ Wesson 157.

³⁶ Odum 271.

³⁷ This applies most specifically to Bertrand Russell’s “Theory of Types.” See Morris Berman, *The Reenchantment of the World* (Toronto: Bantam, 1984) for a discussion of the relevance of the Theory of Types to communication and cybernetics. My treatment is inspired by many of Berman’s insights.

³⁸ Berman 229.

³⁹ Wesson 157.

⁴⁰ These specific examples come from biologist Robert Schmidt, Utah State University. This “mutual shaping” of course involves more than just *two* species interacting. At play is an entire network of mutually conditioning interactions and adaptations acting simultaneously. Being hunted by both scent and by sight at the same time, for instance, requires that a unique

accompanying adaptation occur for each. As Paul Hartzog points out, this shows how evolution operates by way of parallel processing.

⁴¹ Gregory Bateson and Mary Catherine Bateson, *Angels Fear*, 207.

⁴² Malloy.

⁴³ Varela, Thompson and Rosch 201.

⁴⁴ Varela, Thompson and Rosch 202.

⁴⁵ Malloy.

⁴⁶ Cited in Capra 249.

⁴⁷ See Capra, chapter 10.

⁴⁸ Margulis' work implies that since organisms are themselves made up of groups of smaller organisms, group selection is something that already *de facto* occurs in "individual" selection.

⁴⁹ Capra 232.

⁵⁰ Paul Colinvaux, *Why Big Fierce Animals are Rare* (Princeton, New Jersey: Princeton University Press, 1978) 144.

⁵¹ I owe much of the following account to Wesson 160-161.

⁵² Robert E. Ricklefs, *The Economy of Nature*, 3rd ed. (New York: W. H. Freeman and Company, 1993) 400-401.

⁵³ Donald VanDeVeer and Christine Pierce, "Do What's Natural, You Say?" *The Environmental Ethics and Policy Book* (Belmont, CA: Wadsworth, Inc., 1994) 227-228.

⁵⁴ Worster, Donald, "The Ecology of Order and Chaos," *Environmental Ethics: Divergence and Convergence*, ed. Susan Armstrong and Richard G. Botzler (New York: McGraw-Hill, Inc., 1993) 41.

⁵⁵ Ricklefs 386-387.

⁵⁶ Ricklefs 387.

⁵⁷ Gary Snyder, *The Practice of the Wild* (San Francisco: North Point Press, 1990) 109.

⁵⁸ Tom Malloy coined the phrase “survival of the fitters” in *Curtain of Dawn*. “Mutual selection” is a term I have chosen to use to emphasize how in coevolution species effectively select for one another.

⁵⁹ Malloy.

⁶⁰ Wesson 162.

⁶¹ See Lewontin, “The Organism as the Subject and the Object of Evolution.”

⁶² Lynn Margulis and Dorion Sagan, *From Gaia to Selfish Genes: Selected Writings in the Life Sciences*, ed. Connie Barlow (Cambridge: The MIT Press, 1991) 45.

⁶³ James Lovelock, *Gaia* (Oxford: Oxford University Press, 1987) 152.

⁶⁴ See Capra 104-105 for a full account.

⁶⁵ Richard Monastersky, *From Gaia to Selfish Genes*, 26.

⁶⁶ James Lovelock, *From Gaia to Selfish Genes*, 12.

⁶⁷ David Abram, “The Mechanical and the Organic: On the Impact of Metaphor in Science,” *Wild Earth* Summer 1992, 74-75.

⁶⁸ Thanks to Matt Bishop for discussion.

⁶⁹ Lovelock, cited in Capra 227.

⁷⁰ J. Baird Callicott, “The Metaphysical Implications of Ecology,” *In Defense of the Land Ethic* (Albany: State University of New York Press, 1989) 110.

⁷¹ Gregory Bateson, *Steps to an Ecology of Mind* (New York: Chandler Publishing Company, 1972) 155.

⁷² Bateson, *Steps to an Ecology of Mind*, 338-339.

⁷³ Alfred Lotka, cited in James Lovelock, “Gaia: A Planetary Emergent Phenomenon,” *Gaia 2: Emergence. The New Science of Becoming*, ed. William Irwin Thompson (New York: Lindesfarne Press, 1991) 38, emphasis mine.

⁷⁴ I take the terms “skin-in” and “skin-out” from Holmes Rolston, “Why Species Matter,” VanDeVeer and Pierce 489.

⁷⁵ Malloy, *Curtain of Dawn*.

CHAPTER 2

THE RELATIONAL REAL

An individual is usually defined as an indivisible, self-contained unit, with a separate, independent existence of its own. But individuals in this absolute sense are nowhere found in Nature or society, just as we nowhere find absolute wholes. Instead of separateness and independence, there is co-operation and interdependence, running through the whole gamut, from physical symbiosis to the cohesive bonds of the swarm, hive, shoal, flock, herd, family, society.

—Arthur Koestler¹

Parts, Wholes and Relations

Although biologists will probably never stop arguing about “units of selection,” it is important to recognize that this controversy is fundamentally not biological, but metaphysical. What counts as a “unit” in the first place depends on particular ontological considerations, namely criteria for identity. These considerations provide an interpretive framework that informs how biology (or any discipline, for that matter) goes about its business. It is particularly relevant to note that the criteria for natural selection in neo-Darwinism—individual units divorced from their systemic context—have an analogue in ethics, as we will see in the next chapter. In this chapter I assert that traditional part/whole distinctions fail to recognize how relationships of parts to one another (especially in living systems) are essential to the

function and identity of these parts. Even though living things are *composed* of material parts, the nature of these parts is determined by their place in broader relationships; material components are substitutable placeholders that reveal pattern to be ontologically primary. To support this I invoke two arguments—one from thermodynamic openness and the other from organizational closure—to support the notion that although biological entities and their environment might be distinguishable for the purposes of a given methodology, ontologically speaking organisms and their environment are inseparable. I conclude that—at least with respect to living systems—whole contexts of interaction must be considered when making ontological claims about identity.

In the last chapter I maintained that the “units of selection” debate in biology was misguided because it construed the issue in terms of *things* instead of in terms of *relationships* between organisms and their ecological contexts. Although understanding a *relationship* as a unit of selection may be highly unorthodox from the standpoint of neo-Darwinian evolutionary theory, from the perspective of systems theory and ecology it makes perfect sense. Systems theory has as its focus the *relationships* of parts and wholes within a context of wider circuitry. Morris Berman reminds us that “In cybernetic theory...the unit to be considered is the whole system, not this or that individual component.”² Similarly, ecology is a science that concentrates primarily on the *relationships* of organisms and their environment. More

abstractly, environmental philosopher J. Baird Callicott indicates that one of the hallmarks of an ecological metaphysic is that it construes relationships as ontologically prior to “things.” He elaborates in “The Metaphysical Implications of Ecology,”

From the perspective of modern biology, species adapt to a niche in an ecosystem. Their actual relationship to other organisms (to predators, to prey, to parasites and disease organisms) and to physical and chemical conditions (to temperature, radiation, salinity, wind, soil and water pH) literally sculpt their outward forms, their metabolic, physiological, and reproductive processes, and even their psychological and mental capacities... This observation has led [Paul] Shepard to claim that “relationships of things are as real as the things.” Indeed, I would be inclined to go even further;...one might say from an ecological perspective, relations are “prior to” the things related, and the systemic wholes woven from these relations are prior to their component parts.³

This is to say that relations are not something species merely *have*.

Relationships are *constitutive*; they make species *what they are*.

While the idea that “relationships constitute things” sounds radical, it actually infects our everyday interactions (and our ordinary use of language) to a tremendous degree. Bateson explains that we—without realizing it—mistakenly ascribe to objects themselves the qualities that only arise by engaging in a relationship with them.

...I can know nothing about any individual thing by itself... I can only know something about relations between things. If I say the table is “hard,” I am going beyond what my experience would testify. What I know is that the interaction or relationship between the table and some sense organ or instrument has a special character of differential hardness for which I have no ordinary vocabulary, alas, but which I distort by

referring the special character of the relationship entirely to one of the components in it... It is a man-made notion that “hardness” is immanent in one end of a binary relationship.⁴

As Malloy puts it, “The relationship is the thing”—or at least the thing’s properties. A table may be hard for my hand, but it is soft for a diamond drill. While the table may appear to change its properties depending on the circumstances, these properties are not really possessed by the table at all. *They are properties of an interaction; they emerge* through relationship. What we know, we know *in context*, in terms of the relationship of one thing to another.⁵ Kant expresses this notion in his *Critique of Pure Reason*:

since through our outer sense we are given nothing but mere relational presentations, outer sense can, by the same token, contain in its presentation only the relation of an object to the subject, but not the intrinsic character belonging to the object itself.⁶

Relations therefore are a (if not *the*) source of our predications, and as such should not be ignored as a legitimate basis for ascribing properties pertaining to a thing’s function or its identity.

These examples so far involve perception, but this is only to make a preliminary point. Relational properties do not merely apply to the “secondary qualities” inhering in subjective perceptions. Arne Naess points out that even so-called “primary qualities” are relationally dependent.

...if we take characteristics like ‘oblong’ and ‘square’, for example, they cannot objectively be qualities of a table, as the quality cannot be separated from the concepts of time and velocity in the theory of relativity. The mentioned characteristics are not subjective, but, like smell, *bound in an*

interdependent relationship to our conception of the world. This is what is meant by calling them ‘relational’—rather than ‘relative’ or ‘subjective’. It is justifiable to refer to them as objective in the sense of being independent of a person’s likes or dislikes. We arrive, not at the things themselves, but at networks or fields of relations in which things participate and from which they cannot be isolated.⁷

Naess concludes that all statements of the form “thing A is B” should be reformulated as “thing A is B *in relation to C*.”⁸

The most significant kind of relational property for the purposes of this discussion is *relational identity*. This is often bound up with causal considerations, as was demonstrated in my example of predator and prey species shaping the identity of one another through coevolutionary interaction. Relational identity is often not an issue of causal relation, however, but simply of contextual relatedness. For instance, although a bunch of H₂O is not itself a watershed, water in relation to a particular topographic context *is*.⁹ An island is not just a heap of earth and vegetation; it is this heap surrounded by water. Camouflage does not consist merely in patches of color; it consists in these colors being situated next to similar colors. Two tokens of the species type *Canis latrans* is not a coyote population, unless they interact. A cup of dirt next to a box of worms is not a habitat; put them together and it (arguably) is. An essential point in each instance is that relational properties pertaining to identity are not summative; in the above cases *x and y do not bring about z unless x is related to y in a particular way*. That is to say, z is not a mereological sum composed

of x and y. To use a tactless but effective example, a pile of sand can be stirred up without affecting its “pileness,” but a frog in a blender will not retain its “frogness” for very long once the switch has been flipped. A frog’s being a frog depends on more than just its parts; it depends essentially on how these parts are related to one another. Relations therefore are, in at least some cases, ontologically requisite for a thing to be the very thing it is in the first place. One reason that the relevance of relations to ontology has experienced such a long legacy of neglect might simply be the lack of early precedent: there is no Platonic form of “to the left of,” “before,” or “between.”

This is all to say that identifying something in terms of its relationships rejects the thesis that what a thing is should be understood solely in terms of the properties of its parts. A relational basis for identity depends rather for its justification on the successful defense of some kind of *holism* wherein the nature of the whole is determined by the relationships of its parts to one another and the nature of the part is determined by its relationship to the whole to which it belongs.¹⁰ Whether conceived as mere methodology or as a full-blown metaphysical posture, holism is to be contrasted with atomism, which holds that entities should be conceived only as collocations of components. Metaphysical atomism (which makes ontological and not merely methodological claims) construes composite objects—for instance, organisms, chairs, clouds—to be ontologically reducible to their most simple constituents.¹¹ Moreover, as Callicott puts it, in

metaphysical atomism “the career of a composite body—its generation, growth, corruption and disintegration—is reducible to the local motion of its constituents.”¹² Things are “nothing but” the sum of their parts. In this view a whole, being conceived merely as a collection or an aggregate, is a unity only in abstraction; since the parts are the only fundamental reality there exists no ontologically legitimate “one in the many.”

If (as atomists contend) wholes are no more than abstractions and identity is to be construed solely in terms of component parts, then the relations of parts to one another and to wholes can play no role with respect to the identity and function of these parts. Not all aggregates, however, are equal. Some collections of parts form functional unities and some do not. The “nothing-but-ness”¹³ of atomistic reductionism is thus quite useful methodologically and may even be sound ontologically, but only in certain cases—those not involving actual wholes, but *heaps*. Wholes are distinguished from mere heaps by the fact that wholes are the sum of their parts *plus the interrelations of these parts*. Hence our reason for treating a whole as more than “just the sum of the parts.” As we have seen, a pile of sand is a heap and not a whole because in it the relationship of any given sand grain to another is wholly arbitrary; the heap as a unity arises through summation and subsequent abstraction. A frog, on the other hand, is an articulated and patterned composite unity; its parts are integrated and organized in such a way that a frog could not be the thing that it is if these

relationships did not exist. Such wholes formed by the integration of component parts are not mere sums because the relationships between component parts bring forth something distinctive *in addition* to the parts themselves—emergent properties that belong to an entirely different logical type than that of the parts. Bateson explains, for instance, how binocular vision does not result from summation.¹⁴ Rather, a qualitatively distinct third thing, namely, *depth*, emerges through the relationship between the image acquired by one eye and that acquired by the other. Such cases demonstrate how atomists fail to recognize that wholes possess properties that the parts in isolation lack. Stephen Jay Gould explains that although a nonreductionist approach to biology must not violate laws of physics or chemistry,

the principles of physics and chemistry are not sufficient to explain complex biological objects because new properties emerge as a result of organization and interaction. These properties can only be understood by a direct study of whole, living systems in their normal state.¹⁵

This has particular bearing on the study of purported holistic entities such as ecosystems. There are two principal (and seemingly incompatible) ways in which to understand ecosystems, the “population-community” approach and the “process-functional” approach, which respectively embody the atomism/holism distinction outlined above.¹⁶ The “population-community” model is individualistically Darwinian and construes the biota as coextensive with the ecosystem and understands the abiotic components

such as soil, water and sediments as external influences. This suggests an object ontology where relations are what things “have.” The “process-functional” approach (popularized by Eugene Odum) in contrast emphasizes energy flow and nutrient cycling, and subsequently implies an ontology of relation—relations make things what they are. As historian Donald Worster points out, the current trend in biology is toward an extreme version of the population-community model, an “ecology of chaos” where ecosystems are construed to be “mere mosaics of environmental conditions” in constant disequilibrium such that disturbance is the rule rather than the exception. As fluctuating, nonharmonious aggregates composed of discrete individuals, ecosystems in this view possess no “emergent” properties; ecosystems are patchy conglomerates, not true wholes.¹⁷ I cannot hope to resolve this issue here, but the following criteria for wholes—which do not require that ecosystems be conceived as a kind of “superorganism”—do I think unquestionably apply to ecosystems, whether or not they are loose patchworks or tightly knit entities. As we will soon see, individuals and wholes are not so distinct as one might imagine.

In *Sex, Ecology, Spirituality*, Ken Wilber points out that a whole is not only *composed* of integrated parts, but can in addition “*influence and determine*, in many cases, the function of its parts.”¹⁸ This is another way of saying that *context determines content*. For instance, a written word derives its meaning not only based on the characters that compose it but also from its

relationship with a sentence as a whole. The meaning of “fly” will for instance differ in the sentence “I fly” from that in “A fly makes buzzing noises.” As we have seen with respect to evolution, whole contexts are what make particular traits function as adaptive or maladaptive; a bison standing broadside signifies intimidation in the context of wolves, but means easy target practice in the context of white settlers in the 1880s. The distinction is not in the behavior, but in the behavior’s function and significance, which are invoked by the broader context. Examining things solely in terms of their component parts to the neglect of their contexts violates our everyday expectations in a similar way that violating logical levels does, and likewise can provide the basis for humorous situations. For instance, consider the man who insists that he be allowed into the black tie event, even though a black tie is *all* that he is wearing. Or the spell checker that fails to flag the misspelling in “The spell checker is hear to stay.” The relationship of whole to part in living things is therefore analogous to that of context to content in grammatical structure; both specify what a thing is in terms of its relationship to the totality to which it belongs. The relationship is ontologically prior to the function and significance of the relata.

Wilber relates one more important property that wholes possess: wholes in one context are at the same time parts in another. “Fly” is a whole with respect to the letters that belong to it, but is a part with respect to the sentence that it itself belongs to. The significance of this is recognized when

we realize that our standard notions of parts as fragmentary and of wholes as being independently existent does not seem to map accurately onto the world.

As Arthur Koestler puts it,

“Wholes” and “parts” in this absolute sense just do not exist anywhere, either in the domain of living organisms or of social organizations. What we find are intermediary structures on a series of levels in an ascending order of complexity: sub-wholes which display, according to the way you look at them, some of the characteristics commonly attributed to wholes and some of the characteristics commonly attributed to parts.¹⁹

It appears that Heraclitus was right when he said that “the way up and the way down are one and the same,” for the entire universe from quark to quasar seems to be stratified in terms of such nested hierarchical systems. Koestler calls these part/whole structures *holons*. For example, beginning with an arbitrary starting point (such as that of subatomic particles) we recognize that such things compose other things, namely atoms. These atoms in turn form molecules, molecules form organelles and cells, cells compose organisms, organisms make up populations and ecosystems—all the way up to planets forming star systems, star systems interacting to form galaxies, and so on. All wholes are made of parts, all parts are made of wholes. Koestler concludes, “No man is an island—he is a holon. A Janus-faced entity who, looking inward, sees himself as a self-contained unique whole, looking outward as a dependent part.”²⁰

In a similar vein, Lynn Margulis argues that our standard concept of the “individual” as independent is—in her words—“totally warped.”²¹ She

urges us to recognize that we are shaped by dependencies *both internal and external* to our bodies. Internally, we are “walking communities,” wholes composed of other wholes: communities of atoms, molecules, cells and organs. Externally, we in turn make up parts of more complex wholes such as families, societies and ecosystems. Deep ecologists Joanna Macy and John Seed express this sentiment in “Gaia Meditations.”

Beholding you, I behold as well all the different creatures that compose you—the mitochondria in the cells, the intestinal bacteria, the life teeming on the surface of the skin. The great symbiosis that is you. The incredible coordination and cooperation of countless beings. You are that, too, just as your body is part of a much larger symbiosis, living in wider reciprocities....²²

I conclude that since wholes cannot exist without parts and parts inevitably constitute wholes, a relational “part/whole” ontology, what Koestler terms *holarchy*, is a better metaphysical alternative than either holism or atomism. As Wilber puts it, there are no individuals—only “dividuals.” As above, so below: it’s holons all the way up, holons all the way down.

In Francisco Varela’s terminology, all the holons that a given thing contains within itself are its “juniors.” For example, organisms contain within themselves cells, molecules, atoms, subatomic particles, etc. At the same time, any given level of holon has holons which remain (from its point of view) external to it which are its “seniors,” e.g., organisms are integral parts of ecosystems, biomes, and the ecosphere. This reading of parts, wholes and relations ties back into the notion of selection and fitness when

we recognize that “fitting in” is only realized when a given holon is appropriately related with *both* its juniors and its seniors. From the perspective of systems theory,

a system will be selected if: 1) its parts "fit together", i.e. form an intrinsically stable whole, 2) the whole "fits" its environment, i.e. it can resist external perturbations and profit from external resources to (re)produce.²³

The ontological implication in looking at parts and wholes this way is that the relationship of whole to whole can from a different perspective be construed as the relationship of part to whole or part to part. This in turn means that relationships which are *internal* from the point of view of the whole are *external* from the point of view of the parts constituting this whole. Every context is the content for a higher context.²⁴ As systems theorist Francis Heylighen elaborates,

It must be noted that "internal" and "external" merely refer to complementary views of the same phenomenon. What is internal for a whole system, may be external for its subsystems or components....when we look at a crystal as whole system, we see it as a stable structure that is unlikely to disintegrate, i.e. it is absolutely fit and survives internal selection. However, when we look at the molecules as the parts that make up the crystal, we see that they must have the right connections or bonds, i.e. fit relations, to form a stable whole. The exact configuration of each molecule is externally selected by the other molecules to which it must fit. In this way, every absolute or intrinsic fitness characterizing a whole can be analysed as the result of a network of interlocking relational fitnesses connecting the parts.²⁵

An atomistic perspective holds that the essential nature of a thing inheres solely in its parts and exists independently of its relationship to

anything else. Relationships are therefore conceived to be wholly external to a thing's essence. As we have seen, however, any given holon depends entirely upon its relations to its junior *and* its senior holons. If the relationship of parts is crucial to the operation of a whole and the whole determines the function of the parts, then relationships that are external from the point of view of a part are still essential to its being what it is.

The Doctrine of Internal Relations

If I am what I am because you are what you are, and you are what you are because I am what I am, then I am not I and you are not you.

—Hillel

In his highly influential essay, “The Shallow and the Deep,” deep ecology founder Arne Naess uses a similar approach as the basis for a full-blown relational ontology. By rejecting what he terms the “man-in-environment image” in favor of what he calls “the *relational, total-field image*”²⁶ he makes an ontological claim of the most fundamental kind; it reorients one's understanding not merely of what *is*, but of what it means *to be* in the first place. He proceeds by indicating that organisms are

knots in the biospherical net or field of intrinsic relations. An intrinsic relation between two things A and B is such that the relation belongs to the definitions or basic constitutions of A and B, so that without the relation, A and B are no longer the same thing. The total-field model dissolves not only the man-in-environment concept, but every compact thing-in-milieu concept—except when talking at a superficial or preliminary level of communication.²⁷

In other words, instead of construing identity in terms of the properties which a thing's component parts possess, Naess construes identity solely in terms of a thing's relationships, and understands material things in general as "junctions" in the "relational field." "The relations which define the thing *conceptually* converge at the same junction."²⁸

This wholly relational conception of identity revives what has been termed in metaphysics the *doctrine of internal relations*, a doctrine that I consider implausible in its extreme form but that can with some effort be modified into a more acceptable framework. Callicott explains that even though this doctrine is usually associated with English and German idealism dating from the nineteenth and early twentieth century, it has found renewed vitality thanks to the science of ecology.²⁹ In effect, the doctrine states that "a thing's essence is exhaustively determined by its relationships."³⁰ The terminology involved in "doctrine of internal relations" is somewhat confusing since "internal" here means "internal to a thing's essence"—i.e., "essential." The point of the doctrine is that relationships *external* to a thing's physical boundaries are *internal* to its identity.

Naess contrasts an internal relation with an external relation on the basis of how this relationship affects one's identity. He cites "my body" as an instance of an internal relation and "my telephone number" as an example of an external relation.³¹ A telephone number can be changed without altering one essentially, but one's body cannot be. Naess contends that the

relationships organisms have with their ecological context—which we have been accustomed to thinking of as external—are actually internal. Naess concludes that

- 1) A human being is not a thing in an environment, but a juncture in a relational system without determinate boundaries in time and space.
- 2) The relational system connects humans, as organic systems, with animals, plants, and ecosystems conventionally said to be within or outside the human organism.
- 3) Our statements concerning things and qualities, fractions and wholes cannot be made more precise without a transition to field and relational thinking.³²

This supports Alfred North Whitehead's notion that "becoming forms entities," and that everything receives its identity through its relations with others.³³ Australian ecophilosopher Warwick Fox neatly sums this up as follows:

...there is no firm ontological divide in the field of existence. In other words, the world simply is not divided up into independently existing subjects and objects, nor is there any bifurcation in reality between the human and the nonhuman. Rather all entities are constituted by their relationships.³⁴

British idealist F.H. Bradley conceived the doctrine of internal relations in terms of the relationship between the individual and society. He reasoned that individuals are what they are only because their societal context in which they are born and bred is what it is.³⁵ In other words, the identity of a person is constituted by his or her interpersonal relationships in the context of society as a whole. Bradley concluded that since an individual's social relations are internal to his or her essence, "the 'individual'

apart from the community is an abstraction.”³⁶ This notion reverses the thesis of atomistic reductionism, which treats the community as the abstraction and only the individual as concrete and real.

In discussing the units of selection controversy, I have argued that it is the organism (or species, or population, etc.) *in context* which makes up the unit of selection, or more precisely that it is the *relationship* between units of biological organization and their contexts which is selected for. For the doctrine of internal relations there is no controversy. Since according to it everything is understood in terms of its relationship with everything else, individuals are simply *inconceivable* in isolation. As biologist Durwood Allen put it with respect to predator/prey identity, “Fox + Rabbit = Fox.”

Many problems arise, however, when the doctrine of internal relations is so strongly formulated.³⁷ Although it makes sense to think that if a thing were deprived of certain of its properties it would no longer be the same thing, generally not *all* properties are understood to be essential to it.

However, since everything that exists is interrelated (at least at some spatial and temporal level), if *all* relations are internal this means that no one thing in the universe could be different without affecting the essence of all other things, i.e., there is no such thing as a nonessential (or accidental) relational property. (Thus your body has as much bearing on who I am as does mine!) This conclusion would seem to perform an effective *reductio* of the entire

position by making all relationships equally relevant with respect to a thing's identity.

One might however argue in defense of this doctrine and require that only those relations which are *functional* and “enter into” and “become part of” what Bradley terms “the very essence” of a thing are truly internal.³⁸ In other words, only those relations which directly affect an entity—for example, *specific* societal and biological interactions—would constitute a thing's identity. With respect to holarchy, identity could be construed as inhering relationally at the nexus point between those holons which are one's juniors and those which are one's seniors. Since the holons which a thing simultaneously *composes* and of which it *is composed* are truly essential to its identity, I think that this is the more plausible route.

Relational Identity: An Argument From Thermodynamic Openness

The last chapter was about evolution, and it therefore centered around the identity of species. I argued that species identity is constructed through coevolutionary interaction—relationships with other species. But although relationally constituted identity is not, I think, limited to species of organisms, neither do relationships constitute the identity of all things equally. The doctrine of internal relations is problematic, for not only does it render all relationships qualitatively indistinct, but in addition construes the *subject* of such relationships as irrelevant. It does not matter if we are

concerned with the identity of a man, a flower, a rock, or an atom. If we are treating the doctrine as merely a particular methodology (i.e., as but one possible convention out of many), this might be permissible. If we are looking for a *preferred* construction, however, it seems highly implausible that beings which must out of necessity interact with their environment (as all organisms do) should be understood to be no more relationally constituted than a stone, which can maintain its structure without incorporating, assimilating, or excreting in exchange with the world around it. There is an important ontological discontinuity between these two ways of being—the one necessarily interacting, the other relatively self-contained and non-interacting. In their book *Order Out Of Chaos*, Ilya Prigogine and Isabelle Stengers highlight this important distinction.

Equilibrium structures can be seen as the results of statistical compensation for the activity of microscopic elements (molecules, atoms). By definition they are inert at the global level. For this reason they are also “immortal.” Once they have been formed, they may be isolated and maintained indefinitely without further interaction with their environment.³⁹

They go on to contrast structures at equilibrium with dissipative structures—open systems—which exist far from equilibrium.

When we examine a biological cell or a city, however, the situation is quite different: not only are these systems open, but also they exist only *because* they are open. They feed on the flux of matter and energy coming to them from the outside world. We can isolate a crystal, but cities and cells die when cut off from their environment. They form an integral part of the world from which they draw their sustenance, and they cannot be separated from the fluxes that they incessantly transform.⁴⁰

It is important to note that although all living things are dissipative structures, not all dissipative structures are living things. Chemical reactions and hydrodynamic activity (and *anything* involving flow, for that matter) are also dissipative, constantly exchanging matter and energy with their environment. Clearly this distinction between equilibrium structures and dissipative structures implies problems metaphysically with respect to criteria of individuation. The former kind of structure is static and rigidly delimited—a content-determined, mereological sum—whereas the latter is dynamic and context-dependent, engaging in constant interchange with its medium of interaction. In the former, matter and pattern coextend over time; in the latter, pattern predominates since material constituents are continually—as with Heraclitus’ river—flowing through it. Although such a flow contains discrete material “river-stages,” it can be understood as one and the same river only if it is characterized not by its parts, but by its enduring relationships which the parts at any given time reveal. In dissipative structures the parts—the relata—inevitably change; the pattern persists.⁴¹ Making an ontological distinction between dissipative and equilibrium structures allows us to make far more plausible use of the doctrine of internal relations. It provides a framework for construing an organism’s identity in terms of its participation in the fluctuating world embracing it. It is not as if an organism exists “in” a world in a manner analogous to a stone being “in” a

container. For organisms, *to be* means *to belong*—that is, organisms are *part of* and *embedded in* a surrounding context essential to their identity.

Although an organism's internally possessed properties (e.g., genetic traits) are also essential to it, it is not genes themselves, but the *relationship* between genes and many other factors that make an organism what it is.

Lewontin argues,

It is not true that the development of an individual organism is an unfolding or unrolling of an internal program....an organism does not compute itself from its DNA. The organism is the consequence of an historical process that goes on from the moment of conception until the moment of death in which gene, environment, chance, and the organism as a whole participate at every moment.⁴²

Living things are, in the words of Prigogine and Stenger, “formed by their irreversible interaction with the world.” The participatory relationship between organisms and their world is such that the “nature” of the related things “derives from these relations” and at the same time the relations “derive from the ‘nature’ of the things.”⁴³

Thermodynamic openness epitomizes only one aspect of existing in necessary relationship with a broader context. As Bradley pointed out, the contexts that emerge from the interdependent interactions of human individuals, for instance, in families and societies—namely, in culture—are equally relevant with respect to a thing's identity. As Karen Warren indicates, “Relationships are not something extrinsic to who we are, not an ‘add on’ feature of human nature; they play an essential role in shaping what

it is to be human.”⁴⁴ Such sentiments are perhaps best expressed by humanist E.F. Schumacher in his book *A Guide for the Perplexed*:

The most “real” world we live in is that of our fellow human beings. Without them we should hardly be human ourselves, for we are made or marred by our relations with other people.... A world without fellow human beings would be an eerie and unreal place of banishment....human existence in a totally inanimate environment, if it were possible, would be total emptiness, total despair. It may seem absurd to pursue such a line of thought, but it is surely not so absurd as a view which counts as “real” only inanimate matter and treats as “unreal”...the invisible dimensions of life....⁴⁵

Whereas equilibrium structures are understandable in isolation and in terms of their component parts, organisms divorced from their contexts of interaction function much like words removed from their places in whole sentences or social contexts. Words derive their meaning both from their constituent parts (i.e., spoken syllables or written characters) and from their interactions with other words and circumstances. Similarly, specific properties belonging to particular living structures disclose themselves as relevant only in particular environments. Fur, for instance, tends to be meaningful only in a context where insulation matters. Likewise, fins and gills only become significant when a fish’s medium of interaction, water, is taken into consideration. They “in themselves” specify nothing. The atomistic notion of an organism separated from its environment is therefore nothing more than a fiction, for certain relationships that extend beyond the

self-bounded membrane of an organism must obtain for such a thing to continue to exist.

As neurobiologists Humberto Maturana and Francisco Varela put it with respect to life at the cellular level, “It is the network of interactions in its entirety that constitutes and specifies the characteristics of a particular cell, and not [just] its components.”⁴⁶ They continue by applying this non-reductive, relational criterion to dissipative structures at all levels:

For us to fully understand [any system], we need not only to see it as a unity operating in its internal dynamics, but also to see it in its circumstances, i.e., in the context to which its operation connects it.⁴⁷

Again, without the relationship, A and B are no longer the same thing. Since an organism’s very *identity* therefore hinges upon its “skin-out” relationships and not merely upon those “skin-in,” it makes sense to perceive the organism as part of—if not coextensive with—its ecological context rather than as a unit isolated from this context. The organism is part of its environment; the environment is part of the organism. As systems theorist Ervin Laszlo says, “The organism is continuous with its environment, and its experience refers to a series of transactions constituting the organism-environment continuum.”⁴⁸ Gary Snyder explains how it is for instance only through a series of relationships, interactions between humans and the earth, that we have through evolution become who we are today.

...how could we *be* were it not for this planet that provided our very shape? Two conditions—gravity and a livable temperature

range between freezing and boiling—have given us fluids and flesh. The trees we climb and the ground we walk on have given us five fingers and toes. The “place” (from the root *plat*, broad, spreading, flat) gave us far-seeing eyes, the streams and breezes gave us versatile tongues and whorly ears. The land gave us a stride, and the lake a dive. The amazement gave us our kind of mind. We should be thankful for that, and take nature’s stricter lessons with some grace.⁴⁹

Having said this, however, I do not mean to imply a kind of environmental determinism wherein all the properties of an organism correspond with objective features in its environment. As we shall soon see, the relations which matter for an organism are precisely those interactions that the organism *itself* specifies as relevant. In such a model, “ecological context” should not be conceived as a feature of the world as it is in itself, but as the particular set of vital interactions that “counts” for a specific living thing. This will once again—but from the other side, as it were—imply that the organism and its environment are inseparable; they are each constituted by their relationship with the other.

Relational Identity: An Argument
From Organizational Closure

I am in a world that is in me.
—Paul Valery

As I have shown, equilibrium structures and dissipative structures each exist in an ontologically distinct way. A structure in equilibrium endures and maintains its identity without having to exchange matter and energy with its environment whereas dissipative structures are essentially

characterized by and wholly dependent on such interactions. In what follows I explore the ontological implications of one more important distinction between these two ways of being. I will, however, simplify the discussion by referring to “living” and “nonliving” things instead of to dissipative and equilibrium structures. I conclude that an essential feature of all living things is that they exist solely as structures coupled to a medium,⁵⁰ and that the relationship of structure to medium is therefore essential to an organism’s identity.

Although living things may be no more immune to the laws of physics than are inanimate objects, the domain of possible *responses* to the world “out there” (assuming this is even a coherent notion) is richer for living organisms than for nonliving things. As Gregory Bateson points out,

when I kick a stone, I give energy to the stone, and it moves with that energy; and when I kick a dog, it is true that my kick has a partly Newtonian effect...but that is not the essence of the matter. When I kick a dog, it responds with energy got from metabolism.... The energy is already available in the respondent, in advance of the impact of events.”⁵¹

This is certainly not to advocate dog-kicking, but rather to provide an example of the difference between a causal model and what can be termed a “structure determined” model for explaining behavior and changes in an organism. Such an approach has been vigorously promoted by neurobiologists Humberto Maturana and Francisco Varela, founders of the Santiago school of cognition.

Varela outlines the distinction between causal and structural determinism by contrasting what he terms “current biology” with “new biology.” In “current biology,” organisms are understood to behave as heteronomous (other-governed) units operating by a logic of correspondence. In “new biology,” on the other hand, organisms are conceived as autonomous (self-governing) units operating by a logic of coherence.⁵² The “current” biological model is classically Newtonian and is characterized by a behavioral paradigm of stimulus-response where outside impacts (i.e., environmental factors) yield exhibited behaviors. The determining component is construed to be completely external to the organism and the organism’s behaviors are perceived to “correspond” to external factors (a sort of Pavlovian “bell = saliva” approach). This is a similar paradigm to “survival of the fittest,” where an “objective world” selects for “corresponding adaptations” in populations of organisms.

The “new biology” model performs an ontological inversion of this interpretation and states that, far from interactions specifying how a system will behave, it is the *system itself* (or more accurately, the *structure of the system*) which specifies how it will behave.⁵³ Although organisms are open systems from a thermodynamic perspective, they are closed from the perspective of organization. Organisms necessarily *exchange* matter and energy with their environment, but fundamentally organisms are an enduring pattern of internal relationships embodied in a self-maintaining

structure or organization. Varela and Maturana emphasize that what distinguishes living from nonliving systems is that the former are *autopoietic*, or “self-producing.” Autopoietic systems both maintain their defining organization throughout a history of environmental perturbation and structural change and regenerate their components in the course of their operation.⁵⁴ Being both subject and object of their own processes, living systems as autopoietic networks specify their own boundaries and responses to perturbations in their media. This implies that organisms are organizationally circular—or *closed*—as Fritjof Capra relates.

Since all components of an autopoietic network are produced by other components in the network, the entire system is organizationally closed... This organizational closure implies that a living system is self-organizing in the sense that its order and behavior are not imposed by the environment but are established by the system itself.⁵⁵

One reviewer adds,

A cognizing system engages the “world” only in terms of the perturbations in its nervous system, which is “operationally closed” (i.e., its transformations occur within its bounds). To the extent that the nervous system recursively interconnects its components (as in our brains), the organism is capable of generating, maintaining and re-engaging its own states as if they were literal re-presentations of external phenomena. Such states are “second-order” in the sense that they are derivative from, rather than literal recordings of, experience.⁵⁶

This implies organismic *autonomy*: only certain interactions will for a particular organism count as interactions *for it*. Varela and Maturana therefore interpret events that occur in an organism’s medium as

perturbations that trigger changes in that organism's structure, not as efficient *causes that instruct structural changes*. The causal, "current biology" approach promotes a Newtonian "billiard ball" metaphor which emphasizes the nature of the active *agent* (e.g., the cue ball) while neglecting the nature of the *patient* (e.g., the colored billiard balls). One easily forgets that an eight ball moves the way it does because of the nature of the eight ball itself. Its movement is not determined solely by the impacting force. Were an eight-ball made of Nerf or congealed oatmeal it would behave *quite* differently. Likewise, although organisms are *influenced* by external forces, they are not *determined* by them; responses might be in some manner *selected* by circumstances (like pressing the Sprite button to select a Sprite from the pop machine), but responses are not however *instructed* by outside factors (the machine spits out Sprites not because the Sprite button *directs* it to, but because it has been *structured* to deliver a Sprite in response to that particular button being pressed).⁵⁷

As we have already seen, honeybees and certain flowers have coevolved such that ultraviolet light "gets in the bee's way" in a manner that it does not, phenomenologically speaking, for human beings, and this is crucial to the bee's business. As Capra continues,

...not all disturbances from the environment cause structural changes. Living organisms respond to only a small fraction of the stimuli impinging on them. We all know that we can see or hear phenomena only within a certain range of frequencies; we often do not notice things and events in our environment that do

not concern us, and we also know that what we perceive is conditioned largely by our conceptual framework and our cultural context.⁵⁸

In the following example, Varela provides a thought experiment that may clarify how the manner in which an organism responds to its medium is a function of its structure:

Imagine in your mind's eye and ear a mobile, with thin pieces of glass dangling like leaves off branches, which dangle from other branches, and so on. Any gust of wind will cause the mobile to tinkle, the whole structure changing its position, speed, torsion of the branches, etc. Clearly, how the mobile sounds is not determined or instructed by the wind or the gentle push we may give it. The way it sounds has more to do with...the kinds of structural configurations it has when it receives a perturbation or imbalance. Every mobile will have a typical melody and tone proper to its constitution. In other words, it is obvious in this example that in order to understand the sound patterns we hear, we turn to the nature of the chimes, and not to the wind that hits them.⁵⁹

“Turning to the nature of the chimes” hearkens back to the idea that “the proper study of man is man” and, if right, makes every human science inevitably anthropological.⁶⁰ Varela's conclusion is perhaps too strongly worded, however. If two things are essential for a third thing to occur (in this case medium and structure interacting to bring forth a response in a subject) it makes little sense to say that only one of the two is the determining factor. For although the structural properties of the chimes determine what kinds of sounds the chimes can make, considerations external to the chimes (wind speed and direction, for instance) are necessary for the chimes to sound at all.

The behavior is a function of the *relationship between structure and medium* and does not result from simply one or the other.

This implies that in the same way there exists no context-independent adaptive trait, neither is there such thing as an “objective stimulus.” Living organisms themselves *assign* value to the perturbations they experience by transducing physical signals in particular ways. As Richard Lewontin explains, temperature fluctuations reach the inner organs of mammals not as thermal, but as chemical signals; ants that forage regularly in shade experience sunshine not as heat but as hunger; and when a mammal sees and hears a rattlesnake,

the photon energy and vibrational energy that fall on its eyes and ears are immediately transformed by the neurosecretory system into chemical signals of fear.... It is the biology of each species that determines what physical transformation will occur when physical signals impinge on the living system, or whether these signals are even perceived.⁶¹

Thus the medium—the “world out there,” Kant’s “thing in itself”—is a domain containing only *potential* interactions. It is, according to Varela and Maturana, knowable solely through its manifestations, and these manifestations are determined *not by the medium but rather by a thing’s structure*. It is important to emphasize that in this conception the medium does *not* contain distinctions that an organism “represents” or “selects out.” Rather, an organism interacts with its medium in a structurally determined fashion such that distinctions—or as Varela puts it, “worlds”—are “brought

forth.” The organism therefore plays an active (though nonarbitrary) role in constructing its environment—the environment is not simply pre-given.

Varela sums up this notion metaphorically: “In walking, one lays down a path.” Such a model supports a “survival of the fitters” paradigm by stressing *coherence* over *correspondence*. Namely, such an approach construes an organism’s survival in terms of how it “fits in” or couples with its medium—how it “brings forth a world”—rather than upon its “fitness” or correspondence to the world as it is “in itself.”

Another analogy for the “new” biological notion of structure determinism can be found in exploring the operation of a Turing machine, the idealized model underlying every computational device from pocket calculator to PC. A Turing machine consists of a little cart placed over a tape which continues to infinity in two directions. The tape is divided into infinitely many squares which are either blank or contain a particular symbol. Within such a context, the cart will read the symbol on the square over which it rests and in response perform one of three actions: write a symbol, move to the next square to the left, or move to the next square to the right. Which of these it does is not, however, arbitrary. What governs its behavior is its being in one of a finitely many possible *states* (for the sake of our discussion *state* may be functionally identified with *structure*), each consisting of a set of concrete instructions in the format “If x, then y.” State One for instance might specify “If the square is blank, move right and go to State Three,” or “If

the square contains a '1,' write a '0' and remain in State One," and so on. If the Turing machine encounters a symbol for which its present state specifies no response, it halts. The important lesson here is that a Turing machine does what it does not because of what it encounters "out there," or even because of the state it is presently in. Again, context determines content. The Turing machine behaves as it does solely as a function of the *relationship* between its state (or, for our purposes, its *structure*) and what it encounters on the tape (its *medium*). This interaction is active and highly cybernetic: changes in medium bring about changes in state, changes in state bring about changes in medium, and so on. These phenomena may be understood as the function of a *relation of coherence* between machine and tape which is autonomously governed rather than one following a logic of heteronomous correspondence. In other words, the symbols on the tape do not *instruct* the Turing machine in what to do; they merely *trigger* a response which is governed solely by the machine itself, not the tape. The symbols only become meaningful in context with a Turing machine's specific states.

I need to make one more clarification before the ontological significance of this discussion is (I hope) made plain. "Structure" seems to imply an edifice, something solid and unchanging. For Varela and Maturana, however, the structure of organisms is to some degree *plastic*, as social scientist Paul Dell relates:

...in order to avoid confusing Maturana's concept of structure with other notions of structure which the reader may previously have encountered....it is crucially important to keep in mind that *structure is not a static thing*. Structure alters with every interaction that it undergoes; this is especially true with regard to dynamic living systems which are constantly undergoing changes in their components and the relations among those components.⁶²

Varela and Maturana argue that the fact of structural plasticity provides the very basis for the possibility of evolution, which they conceive in terms of a series of historical structural transformations in both a species and its medium. This is not to say that they conceive evolution along the lines of Lamarck; structural changes that occur amid an overall conservation of organization do not result from the inheritance of acquired characteristics. However, they do argue—in opposition to the “adaptationist” paradigm of neo-Darwinism—that we should not conceive evolution as a process wherein organisms become better and better adapted to their environment. Instead, they put forth two closely related alternative conceptions: *structural coupling* and *natural drift*.

Structural coupling finds its closest analogue in neo-Darwinism in coevolution; it occurs when a history of recurrent interactions between two or more living systems leads to a structural congruence between them.⁶³

According to one reviewer of autopoietic theory,

Structural coupling is the label for ongoing engagement between systems, resulting in structural changes in each. Structural coupling describes ongoing mutual co-adaptation

without allusion to a transfer of some ephemeral force or information across the boundaries of the engaged systems.⁶⁴

In other words, these systems endure by “fitting together.” In evolution construed as natural drift, “organism and environment cannot be separated,” Varela notes, “but are in fact codetermined.”⁶⁵ Evolution is an ongoing process wherein the nature of the related things derives from their relations, while at the same time the relations derive from the nature of the things related.⁶⁶

Structural congruence is best characterized as *constancy in relationship, not as constancy in relata* expressed in terms of individuals or even in terms of species. In other words, species do not (properly speaking) adapt to a changing environment and the environment does not (properly speaking) adapt in response to changes in a species. Rather, structurally coupled, historically continuous structural lineages compensate for changes in one another—moving together like dancers. Since evolutionary pathways are unprescribed, the results of environmental change is inevitable biological diversity. The medium and the species both change, but all this occurs under a constancy of coherent coupling, as Maturana explains:

The medium selects the structural change in the organism, and the organism, through its action, selects the structural change in the medium... The life history of any organism is a history of structural change of the medium in which it exists, as realized through the continual mutual selection of the respective structural changes...Its structure is changing, and the medium is changing, but the coherence with the medium is maintained invariantly. Adaptation is an invariant.⁶⁷

This again embodies a notion of evolution wherein the unit of selection is not properly speaking a “thing,” but a relationship, in this case a relationship of structural congruence. Varela explains how this kind of relationship—the conservation of adaptation—characterizes evolution as a whole in terms of *natural drift*.

...there are many paths of change, all of which are viable if there is an uninterrupted lineage of organisms. It is not a matter of survival of the fittest; it is a matter of survival of the fit. It is not the optimization of adaptation, but the conservation of adaptation that is central: a path of structural changes of a lineage congruent with its environmental changes. This view of evolution, centered on the conservation of adaptation as a minimal condition, we call natural drift.⁶⁸

Again, the relata change; the relationship endures. Varela and Maturana argue that to construe this congruence in terms of “adaptation,” however, re-invokes the misplaced representationist paradigm. Rather, since organisms themselves determine what is relevant in their medium of interaction, there exists no “pre-given” world to adapt to in the first place.

The key point...is that the species brings forth and specifies its own domain of problems to be solved....this domain does not exist “out there” in an environment that acts as a landing pad for organisms that somehow drop or parachute into the world.⁶⁹

Similarly, biologist Richard Lewontin points out that the organism itself actively constructs its phenomenal environment—a world that consists of those elements that “get in its way.”

...the organism and the environment are not actually separately determined. The environment is not a structure that is imposed

on living beings from the outside but is, in fact, a creation of those beings. So, the environment is not an autonomous process, but a reflection of the biology of the species. Just as there is no organism without an environment, so there is no environment without an organism.⁷⁰

Lewontin explains for instance that for woodpeckers the bark of trees is relevant but the stones at the tree's base are not. For a thrush, which uses stones to smash open snail shells, the stones are relevant but the bark is not. Each species generates its own "set of problems to be solved"—it is not as if the breaking of a snail's shell was an obstacle to be overcome until particular organisms confronted it as such. If this is the case, then *ecological niches do not preexist the species that fill them; the species rather "brings forth" its own niche*. An ecological niche is constituted relationally by the interactions of a particular structure and its medium. As Gould indicates, niches are defined *in practice*. Flying, swimming, the use of stones to break open a snail's shell to get to the goodies inside—all these are not adaptations to ready-made problems existing out there in the world, but rather are means for bringing about solutions to problems that organisms themselves impose. Again, natural selection only proscribes ways of being; it never prescribes them.

In "The Organism as the Subject and the Object of Evolution,"

Lewontin further explains how it is incoherent to speak of niches preexisting the species that occupy them.

The conceptual problem is how to define the niche of a potential organism before the organism actually exists. There is an uncountable infinity of ways in which the physical world can be

put together to create the niche of an organism. One can construct an arbitrary number of menus of food items, say plant species, in different frequencies, that would nourish an insect, but that no insect actually eats. No animal creeps on its stomach, lays eggs, and eats grass, although snakes live in the grass...niches are defined in practice by the organisms in the process of their activities.⁷¹

The course of evolution does not come equipped with preconstructed pathways; species themselves lay down a path in walking.

Lewontin continues by elaborating how organisms actively construct their own relevant environments.

Our central nervous systems are not fitted to some absolute laws of nature, but to laws of nature operating within a framework created by our own sensuous activity. Our nervous system does not allow us to see the ultraviolet reflections from flowers, but a bee's central nervous system does. And bats "see" what nighthawks do not. We do not further our understanding of evolution by general appeal to "laws of nature" to which all life must bend. Rather, we must ask how, within the general constraints of the laws of nature, organisms have constructed environments that are the conditions for their further evolution and reconstruction of nature into new environments.⁷²

Conceiving adaptation in terms of structural coupling not only supports Lewontin's "constructive" view of the ecological niche, but also adds plausibility to Lovelock's Gaia hypothesis. Adaptation, Lovelock notes, is a dubious notion because the world to which organisms "adapt" is not a determinate object governed by the forces of physics and chemistry alone, but determined by the activities of other organisms. Changing the environment through active construction is simply "part of the survival game. It would be

absurd to suppose that organisms would refrain from changing their material environment if by so doing they left more progeny.”⁷³

Although the approach of Varela and Maturana (and to a lesser degree, that of Lewontin) stresses the conception of a living being in terms of the processes that realize it rather than in terms of its relationship with the environment,⁷⁴ this is not because the environment is not relevant to it. Rather, since they conceive an organism to be organizationally closed (like one of Leibniz’s “windowless” monads⁷⁵), the processes that realize an organism themselves *contain* the environment, phenomenologically speaking. In structural coupling the structure of the organism “fits” its medium hand-in-glove; *structure and medium together make up the unit of survival and selfhood*. This is the reason why, for example, “preserving” endangered species by storing representative DNA or keeping live specimens in captivity does not truly save the species at all. As John Livingston puts it, this merely preserves a species “facsimile”: “...a lion without lion nurture is not a lion any more. The animals we see in zoos are not lions; they are zoo lions.”⁷⁶ A species and an organism are what they are because of where they are. Species and organisms exist solely in virtue of their relation to a place.

Thus it makes no sense to talk about the relationship between an organism and its environment as an inessential property of the organism. The world as “brought forth” is itself a function of interaction between the two: structure and medium endure by cohering—or “fitting”—together;

neither exist in isolation. Understanding units of biological organization as autonomous and conceiving evolution in terms of natural drift thus reveals organisms and their world to co-emerge. As Varela puts it, this co-emergence “is not the mirroring of a world, but the laying down of a world, with no warfare between self and other.”⁷⁷

The Individual in Ecological Context

"What happens to the hole when the cheese is gone?"
—Bertold Brecht

At this point let me make clear what I am *not* arguing in defending relational identity. I am not trying to make the case for “identity through indistinguishability”—the argument that organisms and their ecological contexts are so tightly bound up with one another there is no real distinction between the two.⁷⁸ There *is* a distinction; inseparability does not imply indistinguishability. It would be pointless to treat a broader context (such as an ecosystem or the biosphere) as the only *real* individual instead of the single organism, for every context finds itself embedded in another, and another, and yet another, *ad infinitum*.⁷⁹ My intention is consequently not to abandon our traditional criteria of individuation, but to revise them.

Although an organism ceaselessly exchanges matter and energy with its environment, it does so with some degree of discreteness; the “organism/environment system” is not an amorphous whole. We give-and-take from within topologically bounded membranes; we can be distinguished one from

another. Even if we as “dividuals” harbor other lives—cells, parasites, colonies of bacteria—we are still circumscribed by our skins in such a way that makes us composite unities of a sort. I am merely arguing that our identities are not *solely* the result of such “skin-in” processes; “skin-out” relations are (in many cases) more than extrinsic and arbitrary—they constitute us essentially. The skin is not a boundary, but an interface. We are not in the world as a stone is in a can; we are in the world as part of the world. As Freya Mathews elaborates in *The Ecological Self*, the interplay of “skin-in” and “skin-out” processes implies an alternative method of individuation, one which is

functional and systemic—certain wave-forms or constellations of motion within the substantival continuum distinguish themselves from their surroundings by actively maintaining their structure in the face of the external ebb and flow which otherwise shapes local configurations in the field. By this intrinsic activity they create a genuine—ontological—self/other distinction, though their individuality in no way implies their separability or discreteness from the substantival matrix. Indeed this individuality connects them to their environment with even stronger ties of dependence than do their mere substantival or topological ties. Qua self-realizing systems they need and actively seek out specific environmental elements, where this renders their relation to the environment one of ecological interconnectedness.⁸⁰

Tying this back to our discussion of evolution, an individual organism therefore emerges not merely in, but as *part of* an ecological context long in the making. Having emerged, this organism (whether it likes it or not) finds itself squarely in a context of selecting and being selected for. Or, as David

Abram might put it, it “joins the conversation.” Although this promotes the welcome idea that the unit of survival is a *unit-in-context* (whether it be gene-in-cell, cell-in-organism, organism-in-environment, etc.⁸¹), it must be remembered that *the way this unit fits into its context* is ultimately what its survival hinges upon. This is an important point, because what one identifies as a (or *the*) unit of selection will often make an enormous difference with respect to how one interacts with the rest of the world. This is tied up with how one defines a “unit” in the first place. As I said before, the “units of selection” controversy in biology is not a biological controversy at all, but an argument on the *metaphysical* level about criteria for identity—and this controversy has ethical implications. An ethics that subscribes to an ontology that construes identity solely in terms of nonrelational properties will contain an entirely different set of ethically relevant entities than one which construes relational properties as essential. In my final chapter I argue that there is a strong correlation between how one conceives the unit of selection and how one distinguishes between essential and accidental properties in an individual organism. This in turn determines the range of properties that may qualify as morally relevant.

Notes

- ¹ Arthur Koestler, cited in Barlow, 95.
- ² Berman 241.
- ³ J. Baird Callicott, "The Metaphysical Implications of Ecology," *In Defense of the Land Ethic* (Albany: State University of New York Press, 1989) 110.
- ⁴ Gregory Bateson and Mary Catherine Bateson 157.
- ⁵ See Berman 248, where he specifically connects this with cybernetic theory.
- ⁶ Immanuel Kant, *Critique of Pure Reason*, trans. Werner S. Pluhar (Indianapolis: Hackett Publishing, Inc., 1996) 99.
- ⁷ Naess, *Ecology, Community and Lifestyle*, 49.
- ⁸ Naess, *Ecology, Community and Lifestyle*, 55.
- ⁹ Thanks to Leslie Francis for this example.
- ¹⁰ See Callicott, "The Metaphysical Implications of Ecology," 111.
- ¹¹ Callicott, "The Metaphysical Implications of Ecology," 102.
- ¹² Callicott, "The Metaphysical Implications of Ecology," 102.
- ¹³ Viktor Frankl's term that he applies to reductionism.
- ¹⁴ Gregory Bateson, *Mind and Nature: A Necessary Unity* (Toronto: Bantam Books, 1980) 77.
- ¹⁵ Stephen Jay Gould, cited in Barlow, 103.
- ¹⁶ Karen Warren and Jim Cheney, "Ecological Feminism and Ecosystem Ecology," *Ecological Feminist Philosophies*, ed. Karen J. Warren (Bloomington: Indiana University Press, 1996) 246.
- ¹⁷ Worster 44-45.
- ¹⁸ Ken Wilber, *Sex, Ecology, Spirituality: The Spirit of Evolution* (Boston & London: Shambhala, 1995) 18, emphasis mine.

¹⁹ Arthur Koestler, cited in Barlow, 91

²⁰ Arthur Koestler, cited in Barlow, 85.

²¹ Lynn Margulis, cited in Barlow, 50.

²² Joanna Macy and John Seed, "Gaia Meditations," *Thinking Like a Mountain: Towards a Council of All Beings*, ed. John Seed, Joanna Macy, Pat Fleming, and Arne Naess (Philadelphia, Pennsylvania: New Society Publishers, 1988) 43.

²³ Francis Heylighen, "Fitness," *Principia Cybernetica Web*, <<http://pespmc1.vub.ac.be/FITNESS.html>>.

²⁴ I owe this insight to James Sage.

²⁵ Heylighen.

²⁶ Arne Naess, "The Shallow and the Deep, Long-Range Ecology Movements: A Summary," *Deep Ecology for the 21st Century: Readings on the Philosophy and Practice of the New Environmentalism*, ed. George Sessions (Boston: Shambhala, 1995) 151.

²⁷ Naess, "The Shallow and the Deep," 151.

²⁸ Naess, *Ecology, Community and Lifestyle*, 55.

²⁹ Naess hastens to point out that he does not *derive* deep ecological insights from ecological science, but that ecology merely "suggests" or "inspires" such ideas.

³⁰ Callicott, "The Metaphysical Implications of Ecology," 110.

³¹ Naess, "Ecosophy and Gestalt Ontology," 241.

³² Naess, *Ecology, Community and Lifestyle*, 79.

³³ Ilya Prigogine and Isabelle Stengers, *Order Out of Chaos: Man's New Dialogue with Nature* (Toronto: Bantam Books, 1984) 95.

³⁴ Warwick Fox, cited in Michael Zimmerman, *Contesting Earth's Future: Radical Ecology and Postmodernity* (Berkeley: University of California Press, 1994) 52.

³⁵ H.B. Acton, "Bradley, Francis Herbert," *The Encyclopedia of Philosophy*, ed. Paul Edwards (New York: Macmillan Publishing Co., 1967) 1:360.

³⁶ F.H. Bradley, cited in D. J. Crossley, "Holism, Individuation, and Internal Relations," *Journal of the History of Philosophy* 25.2 (1977): 186.

³⁷ See Richard M. Rorty, "Relations, Internal and External," *The Encyclopedia of Philosophy*, ed. Paul Edwards (New York: Macmillan Publishing Co., 1967) 7:125-133.

³⁸ F.H. Bradley, cited in Crossley, 189.

³⁹ Prigogine and Stengers 127.

⁴⁰ Prigogine and Stengers 127, emphasis mine.

⁴¹ Thanks to Matt Berlin for discussion.

⁴² Richard C. Lewontin, "The Organism as the Subject and the Object of Evolution," *Scientia* 118 (1983): 68.

⁴³ Prigogine and Stengers 95.

⁴⁴ Karen Warren, cited in Valerie Plumwood, "Nature, Self, and Gender: Feminism, Environmental Philosophy, and the Critique of Rationalism," *The Environmental Ethics and Policy Book*, ed. Donald VanDeVeer and Christine Pierce (Belmont, California: Wadsworth, Inc., 1994) 262.

⁴⁵ E. F. Schumacher, *A Guide for the Perplexed* (New York: Harper & Row, 1977) 24.

⁴⁶ Humberto Maturana and Francisco Varela, *The Tree of Knowledge: The Biological Roots of Human Understanding*, Revised Edition (Boston: Shambhala, 1992) 69.

⁴⁷ Maturana and Varela 58.

⁴⁸ Ervin Laszlo, cited in Joanna Macy, *Mutual Causality in Buddhism and General Systems Theory*, 111.

⁴⁹ Snyder 29.

⁵⁰ See Paul F. Dell, "Understanding Bateson and Maturana: Toward a Biological Foundation for the Social Sciences," *Journal of Marital and Family Therapy* 11.1 (1985): 1.

⁵¹ Gregory Bateson, cited in Dell, 7.

⁵² Varela, "Laying Down a Path in Walking," 50.

⁵³ Dell 6. Dell goes on (see p. 19) to draw an analogy between structure determinism and Leibniz's "windowless" monads, which strictly speaking only act out of their own nature and not from "outside causes." In other words, when one body strikes another, it merely provides an *occasion* for properties possessed by the second to manifest themselves. The impacting body does not "cause" anything; it only "triggers" a response in the impacted body.

⁵⁴ Randall Whitaker, "Overview of Autopoietic Theory," <http://www1.acm.org:81/sigois/ois/auto/ATReview.html>.

⁵⁵ Fritjof, Capra, *The Web of Life*, p. 167.

⁵⁶ Randall Whitaker, "Overview of Autopoietic Theory," <http://www1.acm.org:81/sigois/ois/auto/ATReview.html>.

⁵⁷ This example is Dell's, and is an instance of Maturana's denial of the possibility of causation as "instructive interaction."

⁵⁸ Capra 269.

⁵⁹ Varela, "Laying Down a Path in Walking," 50.

⁶⁰ Which means that, as in Kant, metaphysics is inseparably bound up with epistemology. In Maturana's and Varela's model there is no "world" to speak of apart from the world brought forth by an organism. The "thing in itself" simply cannot be spoken of, for to speak of it implies a knowledge claim, and this claim may result only from the interaction of a perceiver and medium. Therefore, no objective knowledge is empirically or even logically possible.

- ⁶¹ Lewontin, “The Organism as the Subject and the Object of Evolution,” 77.
- ⁶² Dell 7.
- ⁶³ Maturana and Varela 75.
- ⁶⁴ Whitaker.
- ⁶⁵ Varela, Thompson, Rosch, *The Embodied Mind*, 201.
- ⁶⁶ Prigogine and Stengers 95.
- ⁶⁷ Maturana, Humberto, “Everything is Said By an Observer,” *Gaia: A Way of Knowing. Political Implications of the New Biology*, ed. William Irwin Thompson (New York: Lindesfarne Press, 1987) 75-77.
- ⁶⁸ Varela, “Laying Down a Path in Walking,” 57.
- ⁶⁹ Varela, Thompson, and Rosch 198.
- ⁷⁰ Lewontin, “The Organism as the Subject and the Object of Evolution,” 76.
- ⁷¹ Lewontin, “The Organism as the Subject and the Object of Evolution,” 75.
- ⁷² Lewontin, cited in Varela, Thompson, and Rosch 202.
- ⁷³ James E. Lovelock, “Gaia: A Planetary Emergent Phenomenon.” *Gaia 2: Emergence. The New Science of Becoming*, ed. William Irwin Thompson (New York: Lindesfarne Press, 1991) 32.
- ⁷⁴ See the preface to Maturana and Varela, 12.
- ⁷⁵ See Dell 19.
- ⁷⁶ Livingston 3.
- ⁷⁷ Varela, “Laying Down a Path in Walking,” 62.
- ⁷⁸ Thanks to Bryan Carr for pointing this problem out to me.

⁷⁹ A startling example of the context of our survival being bound up in a system that goes not only beyond the biosphere, but beyond the relation between our planet and the sun is found in Ken Croswell, "Why Intelligent Life Needs Giant Planets," *New Scientist* 24 Oct. 1992: 18. Croswell notes, "The two giant planets, Jupiter and Saturn, are 318 and 95 times more massive than the earth, respectively. Being so weighty they strongly perturb the orbits of comets, deflecting many away from the inner solar system, where we reside. Calculations by G. Wetherill, at the Carnegie Institution, reveal that if Jupiter and Saturn were only 15 times the mass of the earth, the earth would have been devastated every 100,000 years by giant comets, instead of about every 100,000,000 years, as indicated by the geological record. Under such intense bombardment, it would probably have been difficult for advanced life forms to develop."

⁸⁰ Freya Mathews, *The Ecological Self* (Savage, Maryland: Barnes & Noble Books, 1991) 143.

⁸¹ Gregory Bateson, "Pathologies of Epistemology," *Steps to an Ecology of Mind* (New York: Chandler Publishing Company, 1972) 483.

CHAPTER 3

RELATIONS, MORAL CONSIDERABILITY, AND ECOPHILOSOPHY_

Why should the universe of moral considerability map neatly onto our medium-sized framework of organisms?

—Kenneth Goodpaster¹

Moral Considerability in a More-Than-Human World

As I have shown, a relational conception of identity—whether it be the identity of a species or an individual—radically inverts many traditional assumptions found in both biology and ontology. This is also the case in ethics. What qualifies as an individual unit of moral concern depends entirely on what we understand to *constitute* an “individual” and “unit.” As philosopher David Keller puts it, ethical theories presuppose an ontology of selfhood.² Many have argued that individualistic ethical frameworks fail when applied to the environment, precisely because they do not take into account collectivities such as populations of organisms, species, and ecosystems. J. Baird Callicott comments,

There would be no need for an environmental ethic if we had no dire environmental concerns. Leading the list is the “biodiversity crisis,” the current episode of abrupt, massive anthropogenic species extinction. Running a close (and of course not unrelated) second is the incremental eradication of ecosystems—tropical rainforests, temperate rainforests, long

grass prairies, the Everglades, and so on. An environmental ethic that cannot provide moral considerability for wholes—for species as well as specimens, for ecosystems as well as their components—is therefore of little practical interest.³

Despite this, many philosophers argue that only individual organisms are capable of possessing intrinsic moral worth. The primary distinction between individualistic and collectivist systems of environmental ethics lies in what they respectively require of an entity for it to qualify for moral standing. Individualist theorists look to nonrelational properties possessed by an individual conceived in isolation (such as sentience or rationality) as criteria for moral considerability. Although collectivist theorists sometimes follow a similar route by attempting to show that ecological wholes such as ecosystems possess “interests,”⁴ some—deep ecologists, for example—reject the notion that an entity’s moral value should be determined solely on the basis of its nonrelational properties.

Although theories of environmental ethics often differ with respect to what beings matter morally and over how to adjudicate conflicts of interest between entities each deemed morally relevant, most theories of environmental ethics nonetheless subscribe to a similar ethical framework. More often than not, a theory of environmental ethics is a species of *moral extensionism*. In what follows, I argue that moral extensionism ultimately fails as an environmental ethic precisely because it neglects to consider relational properties as essential to a thing’s identity. I then examine two

ecophilosophical alternatives which embrace relationally-derived criteria for moral standing: Aldo Leopold's land ethic and deep ecology.

Moral Extensionism

The crucial question for moral extensionists is “what does it take to *matter* morally?” What (as G.J. Warnock puts it) is “the condition of moral *relevance*? What is the condition of having a claim to be *considered*, by rational agents to whom moral principles apply?”⁵ Throughout the history of ethical theory it has been widely assumed (and occasionally argued) that the answer to this question is that to matter morally one must be human; i.e., the criterion of moral standing is membership in the species *Homo sapiens*.⁶ Understood in this way, direct moral obligations are owed to all and only human beings; human welfare is the only end-in-itself that must be “positively weighed in deciding what is permissible to do.”⁷ In this view the question of how human beings should be treated falls squarely under the domain of ethical obligation; treatment of everything else falls under the heading of expediency alone.

Moral extensionism challenges the assumption that moral relevance starts and ends with human beings by introducing a simple dilemma. If one limits the domain of moral considerability to all and only human beings, then either humans matter morally because of (a) species membership, or they matter in virtue of (b) some morally relevant property all and only humans

possess other than species membership. If (a) is the case, then it seems that the basis of moral considerability hinges on a characteristic (“being human”) that appears to be in itself morally irrelevant. Is there anything about belonging to one particular species which itself engenders moral obligation in a way that membership to any other sort of group does not? In short, argues the moral extensionist, on such a model moral considerability might as well stem from “being white” or “being male” or “belonging to the order *Coleoptera*.” The characteristics of being white, male or a kind of beetle are arbitrary from a moral perspective and thus form no basis upon which to determine moral standing. To ground moral relevance in such a manner would be (respectively) racist, sexist, or speciesist.

Having rejected (a), the first horn of the dilemma, the moral extensionist presses on to find a reason why all and only human beings would matter morally in (b), the morally relevant characteristic or property which allegedly all and only human beings possess. It is important to emphasize that (b) itself involves two necessary and sufficient conditions on moral standing: (b1), the possession of a particular property which is morally relevant and (b2), the requirement that this property be possessed by every human and by no nonhuman entities.

The two most often invoked candidates for (b) are linguistic capacity and rationality. The moral extensionist, however, finds both inadequate. As far as capacity for language goes, it is doubtful that it fulfills (b1)—there just

doesn't seem to be anything *morally* relevant about such a capacity. But even if one ignores this and assumes (b1) fulfilled, linguistic capacity still fails with respect to (b2) since brain-damaged humans and infants would not qualify for moral standing with this requirement in place; this draws the circle of moral considerability even more narrowly than at the line of the human species.⁸ The rationality requirement fails for similar reasons.

Although reasoning capacity may very well be a valid requirement on moral *agency*, there does not seem to be any good reason to require that the boundary of moral *considerability* follow precisely the same contours as the boundary of moral *responsibility*, Kant notwithstanding.⁹ Moreover, such a requirement would fall short with respect to (b2) since it would eliminate human infants and severely mentally handicapped human beings from the moral domain.

In his essay "The Liberation of Nature?" John Rodman criticizes such appeals to human characteristics for determining moral relevance as fundamentally wrongheaded. He calls such procedures a "Method of Argument from Human Analogy and Anomaly."¹⁰ The line of argument runs something like this: we all know that every human being matters morally at least to some extent (even if we are not sure why), so the criterion of moral relevance (whatever that might be) must apply to the least common denominator among human beings, for example infants, the brain-damaged or the extremely mentally disabled.¹¹ In other words,

There seems no way to avoid admitting that we regard severely mentally retarded persons [for example] as having certain kinds of rights even though they may not be 'rational' in any operational sense.¹²

Although arguments for moral standing are sometimes made from the fact of *potential* personhood in the case of infants, these would seem to extend only *potential* moral consideration, and wouldn't apply with respect to the irreversibly brain damaged anyway. To maintain the integrity of a moral domain exclusive to human beings, then, does not merely require that the most marginal cases within that species be considered. Rather, such an approach *defines* the domain of moral considerability with respect to such cases. Moreover, in extending consideration to all human beings it finds itself in severe difficulty when it makes the further attempt to limit moral considerability to human beings alone.

Thus it appears that the task of including all and only human beings in the realm of moral consideration is more difficult than it might have appeared at first glance, for *there exists no single morally relevant property which all human beings possess that no nonhuman being possesses*. To draw the line of moral considerability hard and fast at the level of *Homo sapiens* is consequently rationally unjustifiable; fulfillment of the criterion of moral standing (whatever that might be) is not coextensive with being human. It is important to note that while this does not in itself bring the domain of morality into the nonhuman world (it remains possible that moral

consideration could apply to only a *subset* of human beings) it does demonstrate that there is no *prima facie* good reason for limiting moral considerability to human beings alone.

Not surprisingly, the moral extensionist is quick to argue that the most plausible criteria for moral standing do in fact widen the circle of moral relevance to include at least some nonhuman entities. An excellent example of how far moral extensionism might go is found in Kenneth Goodpaster's essay "On Being Morally Considerable," wherein he explores various possibilities with respect to the question of what it takes to matter morally.

However the question gets formulated, the thrust is in the direction of necessary and sufficient conditions on X in

(1) for all A, X deserves moral consideration from A,

where A ranges over rational moral agents and moral 'consideration' is construed broadly to include the most basic forms of practical respect (and so is not restricted to "possession of rights" by X).¹³

Goodpaster stresses the fact that even though the domain of X might range over multiple entities of various kinds, it does not follow that these entities all count equally. Moral considerability merely indicates the possession of *some* degree of moral significance; it does not itself specify how much. So in effect, the moral considerability question may be understood as a mere preliminary to the real work of adjudicating conflicts of interest between X's.

The most widely embraced candidate for a criterion of moral standing among moral extensionists (invoked by G. J. Warnock, Jeremy Bentham,

William Frankena and most famously by Peter Singer) is *sentience*, which involves the capacity for feeling pleasure or pain (or more broadly the capacity for experiencing satisfaction or dissatisfaction). This property fulfills the conditions of (b1) above if the capacity to suffer is deemed morally relevant (which seems plausible), but it will be quickly evident that (b2) will go unfulfilled since the domain of suffering clearly extends beyond the human species. Humans are surely not the only kinds of creatures which experience pleasure and pain, Descartes notwithstanding. In what follows, Goodpaster cites Warnock's attempt to justify sentience as the appropriate criterion upon which to base moral standing.

...just as liability to be judged as a moral agent follows from one's general capability of alleviating, by moral action, the ills of the predicament, and is for that reason confined to rational beings, so the condition of being a proper "beneficiary" of moral action is the capability of *suffering* the ills of the predicament—and for that reason is not confined to rational beings, nor even to potential members of that class¹⁴

Presumably Warnock's "condition of being a proper 'beneficiary' of moral action" is a necessary condition and not merely sufficient. Otherwise Goodpaster's formulation of it (which he does not himself embrace) will not follow:

For all A, X deserves moral consideration from A *if and only if* X is capable of suffering pain (or experiencing enjoyment).¹⁵

To *require* the capacity to suffer in order to be morally considerable (“if and only if”) and not deem it only *sufficient* to moral considerability (“if”) requires a premise such as that provided by Peter Singer:

If a being is not capable of suffering, or of experiencing enjoyment or happiness, there is nothing to be taken into account. This is why the limit of sentience (using the term as a convenient, if not strictly accurate, shorthand for the capacity to suffer or experience enjoyment or happiness) is the only defensible boundary of concern for the interests of others.¹⁶

Singer’s sentience requirement canonizes the “Argument from Human Analogy and Anomaly” discussed earlier, since it takes a property possessed by the least common denominator among human beings as the sole criterion for moral relevance.

John Rodman argues that grounding moral relevance in such “zoocentrist sentientism”¹⁷ makes a dubious foundation for an environmental ethic, for two reasons. First, he finds it denigrating to the nonhuman world. For Rodman, extending considerability (though he uses the stronger notion of “rights”) based on sentience “conveys a double message.”

On the one hand, nonhumans are elevated to the human level by virtue of their sentience and/or consciousness; they now have (some) rights. On the other hand, nonhumans are by the same process degraded to the status of inferior human beings, species-anomalies: imbeciles, the senile, “human vegetables.” ...Is this, then, the new enlightenment—to see nonhuman animals as imbeciles, wilderness as a human vegetable?¹⁸

Although the criterion for moral considerability Singer promotes (along with Warnock, Frankena, Bentham, et al.) is clearly not limited *in extension* to

human beings, *the basis* for the criterion is unabashedly anthropocentric. It understands the hallmark of moral relevance to inhere in human beings (and defective ones at that!). In this manner it regards sentient animals as “deficient humans” that scoot in under the curtain of moral considerability wholly in virtue of their halting resemblance to us. Rodman continues,

As a general characterization of nonhuman nature it seems patronizing and perverse...natural entities are degraded...by our failure to respect them for having their own existence, their own character and potentialities, their own forms of excellence, their own integrity and grandeur—and by our tendency to relate to them either by reducing them to the status of instruments for our own ends or by “giving” them rights by assimilating them to the status of inferior human beings. It is perhaps analogous to regarding women as defective men who lack penises, or humans as defective sea mammals who lack sonar capability and have to be rescued by dolphins.¹⁹

The second reason Rodman disputes the sentience criterion as the basis for an environmental ethic is that it leaves the rest of nature “in a state of thinghood.”²⁰

On reflection, I find it as odd to think that the plants have value only for the happiness of the dusky-footed woodrats as to think that the dusky-footed woodrats have value only for the happiness of humans.²¹

Singer’s subject matter for the most part involves the plight of domesticated animals cramped in factory farms or confined in research laboratories. He focuses on identifiable individual entities who unquestionably suffer—and for questionable ends. Even though this clearly concerns Rodman, he deems the individualistic paradigm of animal rights emerging from such a focus on

domesticated animals to be ill-equipped to deal with ecological realities. Suffering, for instance—often needless in the research setting or in industrial farming—is part and parcel of the energy flow and subsequent trophic structure that binds a biotic community together. As Holmes Rolston reminds us, “suffering is an integral feature of sentient life in ecosystems. Nature is harsh; herbivores starve; carnivores kill.”²² Nature is moreover wholly indifferent to the suffering required for natural selection to operate, namely the production of more offspring than can survive. A moral theory that treats suffering as an intrinsic evil and that judges moral relevance solely on criteria which involve capacities for individual beings to experience pain or pleasure consequently fails for constructing an *environmental* ethic. As Rodman indicates, an *environmental* ethic should address specifically *ecological* concerns, namely, issues involving entire species and whole biological communities.

While Singer does not discuss ecosystems, we can assume that he would extend rights to dusky-footed woodrats but not to sagebrush or cactus. And the woodrats themselves would presumably have rights as individuals but not as a species. The moral atomism that focuses on individual animals and their subjective experiences does not seem well adapted to coping with ecological systems.²³

Furthermore, a individualistic moral theory that seeks to prevent individual suffering whenever possible will not only dismiss the moral standing of natural wholes, but also find itself obliged to disparage (if not outright oppose) essential systemic processes such as natural predation. But,

as Rolston points out, we must (in contrast to the sentience theorists) take into consideration not only pain itself but also the *context* in which pain arises.

It might first be thought that pain is an evil wherever it occurs, in nature or in culture, and so it does not matter whether the injury is to a woman or a wombat. If the evil is that it hurts, then one has as much right to treatment as the other. But pain operates functionally in wombats in their niche; pain in a woman in a medically skilled culture is pointless. Pain in nature is situated, instrumental pain; it is not pointless in the system, even after it becomes no longer in the interests of the pained individual. The profit in the pain has vanished in culturally situated persons but it remains in the wild.²⁴

Although I disagree with Rolston's characterization of pain in culture as "pointless," (since pain can still be instructive in a cultural setting—when we let it be), he is right to emphasize that *the situation* in which pain arises is crucial to determining its moral significance. In the same way Socrates said that life is not important unless it is life well-lived, pain itself is not evil, except when it is meaningless or unnecessary. An individualistic, sentience-based ethic does not make such discriminations.

Neither does Singer's argument persuade Kenneth Goodpaster. For him, the sentience requirement asks too much.

...although I acknowledge and even applaud the conviction expressed by these philosophers that the capacity to suffer (or perhaps better, *sentience*) is *sufficient* for moral considerability, I fail to understand their reasons for thinking such a criterion *necessary*.²⁵

He argues that there is in fact something to take into account even in the absence of a capacity for experiencing pleasure or pain, something “which surely does qualify beings as beneficiaries and capable of harm—namely, *life*.”²⁶

Goodpaster argues that as a biologically adaptive characteristic which aids living organisms in anticipating and avoiding threats to life, sentience should with respect to moral relevance be understood as a “finger pointing at the moon” rather than the moon itself. He cites one scientific observer who writes,

If we view pleasure as rooted in our sensory physiology, it is not difficult to see that our neurophysiological equipment must have evolved via variation and selective retention in such a way as to record a positive signal to adaptationally satisfactory conditions and a negative signal to adaptationally unsatisfactory conditions.... The pleasure signal is only an evolutionarily derived indicator, not the goal itself. It is the applause which signals a job well done, but not the actual completion of the job.²⁷

With this in mind, it follows for Goodpaster that “nothing short of the condition of being alive seems...to be a plausible and nonarbitrary criterion” for moral considerability. Whereas sentience-derived interests might matter with respect to moral *significance*, it is mere conceptual baggage to insist upon the necessity of psychological capacities in order for an entity to be morally *considerable*.²⁸ According to Goodpaster, the tendency to equate the good with certain psychological states has confused the issue. For instance,

take the following naturalistic criteria for goodness taken from E.M. Adams in *Ethical Naturalism and the Modern World-View*:

“x is good” means *I, the speaker, like or desire x* (Hobbes).

“x is morally good” means *The one who is the agreed upon judge or ruler likes or desires x* (Hobbes).

“x is good in itself” means *x is pleasant* (Hume).

“x is morally good” means *A typical, disinterested person, well informed of the facts, would under ordinary circumstances have that feeling or attitude toward x which we call “approving”* (Hume).

“x is good in itself” means *x is desirable for its own sake* (Mill).

“x is morally good” means *x is desirable by society* (Mill).²⁹

In each instance goodness is identified with a particular psychological state: pleasure, approval, desire, etc. Although this is a standard move in naturalistic ethics, whether or not it forms a valid criterion for goodness is a different question. Goodpaster understands this to have important implications.

Let me hazard the hypothesis, then, that there is a non-accidental affinity between a person’s or a society’s conception of value and its conception of moral considerability....if one’s conception of the good is hedonistic in character, one’s conception of a beneficiary will quite naturally be restricted to beings who are capable of pleasure and pain.³⁰

Goodpaster goes on to cite resistance to entropy and the presence of homeostatic feedback loops in living systems as far better tokens of moral relevance than a sentience criterion. For him, such a perspective suggests that “the core of moral concern lies in respect for self-sustaining organization and integration in the face of pressures toward high entropy.”³¹ Since “self-sustaining organization and integration” can occur without there being

accompanying psychological capacities, living systems may be understood to possess interests without necessarily possessing “interests in view.”

The implications of such a widening of the moral circle go far beyond those found in conventional sentience-based theories of moral considerability. Influenced by systems theory and Lovelock’s Gaia hypothesis, Goodpaster envisions the possibility that the entire biosphere be understood as a proper object of moral concern. He asks, “Why should the universe of moral considerability map neatly onto our medium-sized framework of organisms?”³² While this is certainly radical from the standpoint of traditional ethical theory, such an “unthinkable” enfranchisement (as Christopher Stone might put it) may be no more unthinkable than what has already occurred in, for example, the history of “natural rights.” Historian Roderick Nash reminds us that although it is only very recently (at least in the American liberal tradition) that the ethical circle has expanded to embrace all human beings, let alone *any* nonhuman beings, his progressive interpretation of moral extensionism may lead one to wonder where the circle will *stop*.

Geographical distance eventually ceased to be a barrier in human-to-human ethics, and in time people began to shake free from nationalism, racism, and sexism. The abolition of American slavery in 1865 marked an important milestone in this process. Humans could no longer be owned, and ethics evolved beyond the level labeled “race.” Blacks, women, and all human beings gained a place in the sun of ethical theory if not always in practice. But speciesism or human chauvinism persisted and animal rights was the next logical stage in moral

extension... More recently there have been calls for “the liberation of nature,” “the liberation of life,” “the rights of the planet,” and even defenses of the right of the solar system and the universe to be free from human disturbance.³³

Moral Considerability and Relational Properties

Thus it seems that moral extensionism should be an ideal procedure for constructing an extremely expansive environmental ethic. There are good reasons, however, to think that this is actually far from the case. Despite strong efforts to treat it as such, it is doubtful that moral extensionism truly qualifies as an *environmental* ethic at all. In his essay “From Egoism to Environmentalism,” Goodpaster argues that there is something narrowly implausible in a fundamental assumption moral extensionism makes, namely that one should judge moral relevance by generalizing from the starting point of individual self-interest. In terms of our discussion, moral extensionism requires that moral standing be determined solely by the possession of morally relevant—and usually psychological—nonrelational properties. By forming morality from the “rib of egoism,” as Goodpaster puts it, “value is tied to the interests of persons and is moralized by being tied to the interests of all or most persons.”³⁴ Considerability in such a model demands an “interested self,” which is why so many moral extensionists require a sentience criterion for moral standing and are frankly baffled by Goodpaster’s life-criterion.

Although Goodpaster's project can itself be understood as a very broad form of moral extensionism, he wants to do much more than expand the circle of ethical relevance: "I am convinced that the mere enlargement of the class of morally considerable beings is an inadequate substitute for a genuine environmental ethic."³⁵ Goodpaster believes (rightly, I think) that there may be entities worthy of moral consideration entirely unlike human beings (e.g., natural systems) which will never be found morally relevant if we use an extensionist model.

The very resources needed to see that moral considerability is not tied to human individuals at the same time provide the realization that such considerability is not tied to individuals at all...If we approach the question as to the proper object(s) of moral respect solely in terms of extending or augmenting the class of already acknowledged moral persons, we run the risk of constraining our moral sensitivity to the size of our self-wrought paradigms. ³⁶

With this we finally reach the ethical upshot of the relational ontology I have been promoting. For although Goodpaster recognizes that there is something fundamentally problematic in construing moral relevance solely in terms of psychological properties, the problem lies not merely in what *kinds* of properties we value, but in *where we look for properties in the first place*. Doing this presupposes an ontological framework for determining what kinds of properties are essential. If our ontology, for instance, dictates that all the essential properties of an organism terminate at the skin, then everything "skin-out" finds itself demoted to the status of the instrumental and

accidental. In such a context it makes no sense to look for morally relevant *relational* properties; being inessential, relational properties are held to be *de facto* morally irrelevant.

Consequently, although I agree with Goodpaster when he concludes that there is a “non-accidental affinity between a person’s or a society’s conception of value and its conception of moral considerability,” I hold that a deeper *metaphysical* assumption underlies evaluations of what *constitutes* potential objects of moral concern in the first place. There also exists a nonaccidental affinity between one’s conception of *what makes a thing what it is* and *what one construes to qualify as a potential unit of moral relevance*. If an organism is conceived as independently existing, its every essential property will be “skin-in.” If an organism is, in contrast, conceived to be embedded in a network of relations which are essential to its identity, then the *organism-in-environment* will become the object of moral consideration, not just the membrane-circumscribed entity itself. My approach here differs from that of others who seek to promote a holistic environmental ethic by showing that species and ecosystems themselves have interests. I have chosen to argue instead that since “skin-out” processes are as essential to the identity of an organism as those “skin-in,” it is incoherent to assert that the only relevant objects of moral concern are individual organisms isolated from their whole contexts of interaction—the context is itself a part of the organism’s identity and not merely instrumental to it.

Moral extensionism embodies ethically the “organism-in-environment” paradigm, where an organism is held to be “in the world” in the same way a stone is “in” a container. A value system emerges from this wherein only sentient individual organisms—the “lit arcs of the circuit,”³⁷ as it were—are construed to be intrinsically valuable. Skin-out processes are held to be wholly extrinsic and instrumental, existing only “for the sake of” something else. Extending the domain of moral value to individual sentient beings while relegating the rest of nature to a state of “thinghood” (as Rodman puts it) is at best, however, a “Ptolemaic Revolution” in ethics—and requires a similarly absurd number of epicycles to keep its machinery from grinding to a halt. It reinvokes a similarly outmoded Aristotelian value-hierarchy wherein everything exists for the sake of something else, all along a great chain of being. This is simply the wrong metaphor; natural systems are nonlinear. Although Aristotle neatly divides the universe into means and ends by conceiving the leaf as existing for the sake of shading the fruit, which exists for the sake of human beings (which exist for the sake of the activity of contemplation), biotic webs do not work this way. Picking out parts in order to find out which entities are “means” and which are “ends” misconstrues how organisms interact ecologically. Biotic processes work cyclically rather than linearly. For example, autotrophic producers (plants) feed primary consumers (herbivores) which feed secondary and tertiary consumers (carnivores) and beyond. But to understand the top carnivore as the end for

which the flow of energy through the biota occurs (which humans tend to do) is an arbitrary stopping point. One may as well understand trophic structure as occurring for the sake of decomposer organisms which feed on detritus (dead organic matter that includes the remains of tertiary consumers). Since the effects of decomposition in turn nourish plants and begin the cycle anew, however, we see that there is no single point which could be understood as final, much less as singularly morally relevant.

Although it might be *useful* to construe units of moral relevance solely in terms of individual entities (as moral extensionists tends to do), doing so attempts to “cut nature at the joints” where no joints in fact exist. Such an approach forms the ethical analogue to neo-Darwinism, which seeks to isolate units of selection when only entire contexts are in fact selected for. Both theories subscribe to an ontology that imputes independent existence to “individually wrapped” members of an ecosystem. Although both moral extensionism and neo-Darwinism recognize that organisms do in fact interact with a world, both construe the relevant properties of a creature in terms of absolute, nonrelational characteristics: “morally relevant” properties in the one case, “fit” or “adaptive” traits in the other. In neo-Darwinism, phenotypic traits are held to correspond to environmental circumstances; in moral extensionism, properties such as sentience correlate to moral relevance.

In a world where morally relevant properties like sentience and critical ecological roles such as oxygen production ran hand in hand, perhaps moral

extensionism could function as an environmental ethic. This is far from the case in our world, however; ecosystems are sustained for the most part by the nonsentient and the nonliving. E.O. Wilson has for instance argued that if all the (morally relevant) mammals on the earth suddenly disappeared, the ecosphere would abide. But if in contrast all the (morally irrelevant) bacteria disappeared, *all life* on earth would crash within three months. Thus, while things like soil bacteria and coccolithophores hardly qualify as morally relevant when we look at properties they possess in isolation, their ethical status is another question entirely if we understand them in terms of their relational properties and explore *the moral relevance of the roles they play in the biotic circuit*. If you want to know what crucial relationship you have with a distant and obscurely-named marine algae, just take a deep breath. Thus, if we ourselves matter morally and if our relationships with others are essential to our identity, then these others to whom we are internally related are morally relevant as well—whether they be sensitive mammals or insentient algae or bacteria.

Here the moral extensionist will protest that I am confusing intrinsic with extrinsic value, and will insist that we should value such things as coccolithophores and soil bacteria only indirectly, and solely for the instrumental role they play in the biosphere. My response is that to posit an unbreachable gulf between instrumental role and essential identity begs the ontological question of what makes things what they are in the first place. In

biotic communities and in a moral theory that invokes relational properties, instrumental roles are intrinsically valuable.

I therefore conclude that the attempt to determine moral considerability solely on the basis of nonrelational properties fails for environmental ethics. Since every organism is internally related to a more-than-human world populated foremost by the insentient and the nonliving, these entities and the systems to which they belong deserve moral consideration even if they lack morally relevant properties when considered in isolation. I therefore allege that relational properties are (in many cases) morally considerable properties; *whole ecological contexts*—the units of survival and selection in evolution—*are the relevant units of moral concern*.³⁸ While this conclusion belongs to ethics, to make sense it requires an ontological reconstruction of the ethical subject matter. For this reason, to succeed, I think an environmental ethic must root itself not in ethical axiology but in a relational ontology. In what follows, I explore two alternatives to moral extensionism which do precisely this: Aldo Leopold's "land ethic" and deep ecology. I will then address some possible objections to relationally based environmental ethics.

The Land Ethic: Obligation Through Felt Relation

The term "land ethic" comes from *A Sand County Almanac*, a collection of nature and conservation essays written by forester and naturalist Aldo

Leopold. Published in 1949, the volume is considered to be “almost a holy book in conservation circles.”³⁹ Although the work predates the conventional beginnings of the environmental movement by about twenty years, in it one finds Leopold propounding a radical, holistic, ecologically grounded ethic which has resulted in him being revered by his followers as “an American Isaiah.”⁴⁰

To better understand Leopold’s project, here is how he begins “The Land Ethic:”

When god-like Odysseus returned from the wars in Troy, he hanged all on one rope a dozen slave-girls of his household whom he suspected of misbehavior during his absence. This involved no question of propriety. The girls were property. The disposal of property was then, as now, a matter of expedience, not of right and wrong.⁴¹

Leopold’s point is that in exactly this way, land—meaning collectively soils, waters, plants and animals—is viewed by society solely as property. As such it is governed in terms of expediency (which reduces to economic utility) rather than in terms of right and wrong (the domain of ethical obligation). Leopold’s goal was for society to stop perceiving land use as entirely an economic problem.

At first glance, Leopold reads like a moral extensionist. Take for instance his characterization of the land ethic in the following:

All ethics so far evolved rest upon a single premise that the individual is a member of a community of interdependent parts.... The land ethic simply enlarges the boundaries of the

community to include soils, waters, plants, and animals, or collectively: the land.⁴²

This expansion of the moral community sounds very much like the project of moral extensionism widely applied. There are, however, at least four crucial differences between moral extensionism and the land ethic Leopold puts forth.

First, in moral extensionism considerability depends on the possession of a particular property by an individual which is intrinsically held by that individual in a nonrelational way, such as sentience or rationality. Soils, waters, plants and animals are not, however, included in the moral community by Leopold because they possess *within themselves* certain morally relevant properties. Although such an approach is not inconceivable in principle (take animism with respect to soils and waters for instance) this is not what Leopold is getting at. Rather, soils, waters, plants and animals (including human animals) are valued in a land ethic because of the *roles they play* in the biotic community. Moral standing, far from being rooted in the possession of certain psychological capacities, derives from the relations that interdependent parts share; the “property” possessed by waters and soils which makes them matter morally is their function in the biotic circuit.

Although in moral extensionism and traditional ethical theory only *indirect* duties may apply to things of instrumental value (for instance to my neighbor’s car), *in the land ethic the possession of instrumental value is*

understood as an end-in-itself. One need not be the ultimate goal (if such a thing even exists!) to still be an object of direct moral concern. This was my point in arguing that Aristotle’s “great chain of being” simply does not map onto the territory. In Leopold’s view all things belonging to the land community can be construed simultaneously as both means *and* ends.

Leopold conceived of an ethic, philosophically, as “the differentiation of social from anti-social conduct.”⁴³ But the nature of the society to which one belongs will determine which sorts of behaviors are deemed “social” or “anti-social” in the first place. Moral extensionism expands the set of morally considerable entities based on criteria of relevant similarity to human beings and thereby welcomes certain nonhuman beings into the human community. While here the (literal!) black sheep of the family may find him or herself an honorary, if not card-carrying member, such a conception is nonetheless one of an extended *human* family. In inverting this, the land ethic makes a second departure from the path of moral extensionism. Rather than expanding the membership of the human community, Leopold argues that humanity itself—along with waters, plants, and animals—belongs to a greater community yet. To borrow a phrase from Robinson Jeffers, such a view is one of humanity *a part*, “not man apart.” Leopold sums up,

In short, a land ethic changes the role of *Homo sapiens* from conqueror of the land-community to plain member and citizen of it. It implies respect for his fellow-members, and also respect for the community as such.⁴⁴

Although respect for fellow members of the land community fits in well with an individualistic paradigm of moral considerability, the land ethic's "respect for the community as such" represents the third divergence from moral extensionism. The broad conception of community found in the land ethic extends direct duties not only to non-sentient beings, but also to entities conventionally deemed to be nonliving (e.g., soils and waters). Since interrelations are valued more than internally possessed properties, a more encompassing conception of moral relevance goes to work here than one finds even in a biocentric ethic: natural *systems* (organic and inorganic, biotic and abiotic) become proper objects of moral concern, not just individual organisms. The atomistic individualism endemic to extensionism and so lamented by Goodpaster is foreign to the land ethic. Although natural systems cannot easily make claims of standing in moral extensionism for the simple reason that wholes so conceived have no experiences,⁴⁵ the land ethic roots moral relevance *ontologically* rather than *psychologically*. For Leopold the ethical upshot is that biotic wholes such as ecosystems are the final arbiter with respect to what qualifies as moral action. "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise."⁴⁶

It is important to recognize that such a holistic outlook implies far more than moral respect for the *set* of entities belonging to a biological community. For Leopold, land is not fundamentally a collection of parts, but

rather a “fountain of energy flowing through a circuit of soils, plants, and animals.”⁴⁷ With this, Leopold hints that an object-ontology is inappropriate for describing the natural world.⁴⁸ Natural systems (whether individual organisms, ecosystems, or something else) are not objects but patterns of organization undergoing a continual energy-driven exchange of material components. Being “open to energy and closed to organization,”⁴⁹ such systems endure this constant flux as patterns of relationships, not as persisting material parts. This understanding of ecosystems in terms of energy flow is a prominent theme in the work of ecologists such as Eugene Odum. Wildlife ecologist Fred Montague sums up this perspective in his definition of ecosystem as

a unit of biological organization consisting of organisms (and communities of organisms) interacting with the environment in such a way that energy flow (through the system) results in trophic structure and nutrient cycling.⁵⁰

An ecological world-view of this kind consequently understands energy to be more fundamental than material objects or discrete entities, and (as we have seen) holds that relationships are as real as things.⁵¹ Embracing biotic communities as proper objects of moral concern, then, radicalizes the notion of considerability in applying it to patterns of energized relationships rather than to material entities. Since in ecology relationships may be understood to have ontological priority over substances, it should not be surprising that the ecological ethic which Leopold promotes is one that hinges moral

considerability on relationships between and among things rather than on properties things possess within themselves as isolated entities.

Leopold and the Experience of Relatedness

Leopold's contribution to ethics does not, however, derive from abstract ontological musings over interconnectedness. Leopold detested book-learning. Throughout *A Sand County Almanac*, his world-view and ethics are both informed by concrete interactions with particular beings who shared the farmland he occupied in the Wisconsin Sand Counties. As John Rodman explains,

For those unaccustomed to looking, Aldo Leopold's *Sand County Almanac* provides, in effect, a guidebook. Before the reader is introduced to the "land ethic" chapter (which is too often read out of the context of the book as a whole), he or she is invited to accompany Leopold as he follows the tracks of the skunk in the January snow, wondering where the skunk is headed and why; speculating on the different meaning of a winter thaw for the mouse whose snow burrow has collapsed and for the owl who has just made dinner of the mouse; trying to understand the honking of the geese as they circle the pond; and wondering what the world must look like to a muskrat eye-deep in the swamp.... What melts away as we become intrigued with this plurality of perspectives is the assumption that any one of them (for example, ours) is privileged....⁵²

The land ethic emerged through particular participatory experiences Leopold shared with a more-than-human-world. I emphasize "emerged"—by which I mean psychologically derived—for it was not deduced logically. This is the fourth way the land ethic distinguishes itself from the moral extensionist route for determining moral standing—it is rooted in personal experience.

Expanding the moral circle (an abstract procedure) is not fundamentally what Aldo Leopold was out to do. Expanding *consciousness* is. For him, the *experience of relatedness* through felt interactions with other beings was a necessary prerequisite to an ecological ethic. “We can be ethical only in relation to something we can see, feel, understand, love, or otherwise have faith in.”⁵³

Although a relationally and experientially-based ethic is about as far from traditional moral theory as one can get, it does have certain advantages over the methods of generalization that carry over from classical ethical theory into moral extensionism. Namely, the land ethic as a product of human interaction and participation with the land community finds fertile soil in human psychology where rationalized universalization encounters only rocky ground. We have seen that determining moral relevance on the basis of certain internal characteristics possessed by individual entities is problematic in itself, but it seems all the more inappropriate as the basis of an environmental ethic since little evidence exists to show that humans even work this way when making moral judgments. David Hume for instance argued that rather than inhering in entities as an objective property, moral standing is simply projected on those beings for whom we feel sympathy. Moral community is limited only to the degree that the human capacity for sympathy is.⁵⁴ A cogent (albeit gruesome) example of this is found in the fact that we do not (in most cases) eat our dead, even though they presumably

would not suffer if we did.⁵⁵ Dead human beings matter to us precisely because they are (or were) *human* beings, members of the human community. Attribution of moral considerability emerges through engagement; it arises through the experience of particular relationships rather than by a dispassionate assessment of *relata* as abstract property-bearers. In line with this, Leslie Francis and Richard Norman have argued that, when making ethical decisions, “certain relations” and “emotional attachments” are morally relevant factors that must be considered in addition to just the interests of the being in question.⁵⁶ But there is no reason to think that these vital relations and attachments must have human beings as their object.

If Leopold is out to extend anything, it is not so much our ethics but our perceptions, our sense of interconnectedness with the land. He therefore relates his concrete experiences instead of simply arguing his philosophy in abstraction. Rodman expresses this sentiment gracefully:

Leopold does not present logical arguments for the land ethic in general, because such arguments could not persuade anyone who still looked at nature as if it were comprised of objects or mere resources, and such arguments are unnecessary for those who have come to perceive nature as composed of subjects. When perception is sufficiently changed, respectful types of conduct seem “natural,” and one does not have to belabor them in the language of rights and duties. What brings it about is not exhortation, threat, or logic, but a rebirth of the sense of wonder that in ancient times gave rise to philosophers but is now more often found among field naturalists.⁵⁷

Consequently, I hold that a relational ontology must be felt and not just dispassionately cognized in order to be effective.

Let me now briefly recount the four ways in which the land ethic distinguishes itself from moral extensionism. First, since in an ecosystem everything necessarily “hangs together,” Leopold rejects the notion that only those properties possessed by individuals in isolation count morally, arguing instead for a relational model of moral considerability. Second, rather than expanding the human moral community by widening the set of morally relevant entities to include certain nonhuman beings, Leopold argues that humanity is itself “plain member and citizen” of an interconnected more-than-human-world, a community inclusive of but not limited to human beings. Third, for Leopold the domain of moral considerability is not limited to those entities capable of psychological experiences or even to individual organisms. Particular soils, plants and waters matter morally in virtue of their roles in the biotic community: their relational properties are morally relevant properties. Biotic wholes such as ecosystems in turn count morally as fields in which organization and energy flow bring forth a world of interconnected flourishing. The fourth and final distinction lies in how the land ethic is constructed. Leopold moves from concrete experiences of relatedness to a general ecological world-view (as he would urge us to do) rather than going from abstract ethical principles to particular applications. The land ethic embraces a network of loosely and untidily bound facts and values; it makes no attempt at logically deriving ethical “oughts” from

ecological “is-es.” *Experiences* of interconnectedness do not postulate; they merely hint and intimate at how to belong to a more-than-human world.

Thus it seems that the land ethic is less an ethical theory and more a *theory of Being*, by which I mean something stronger than just a theory of what exists. While Leopold’s holistic, process-driven ontology is informed by the science of ecology, it is revealed as meaningful only through the direct sensuous engagement of oneself with a more-than-human world where *to be* means *to belong*.⁵⁸ This is better described as ecological consciousness than as environmental ethics, *per se*. Moral extensionism’s focus on the domain of moral considerability is by definition ethics-bound and doesn’t ask deeper questions about what it means to *be*. It fails, as Rodman puts it, because

the attempt to produce a “new ethics” by the process of “extension” perpetuates the basic presuppositions of the conventional modern paradigm, however much it fiddles with the boundaries.⁵⁹

In what follows I inquire into one more relationally and ontologically-based environmental philosophy: deep ecology. In asking “deeper questions,” deep ecology moves beyond an extensionist model into a broader ecological world-view. It holds common ground with the land ethic in valuing relational properties, but goes even further in promoting a relationally constructed, ecological self.

Deep Ecology: Realization of the Ecological Self

Deep ecology (as a label at least) got its start in Arne Naess' seminal paper, "The Shallow and the Deep, Long Range Ecology Movements: A Summary," in 1973.⁶⁰ In this paper, Naess distilled a number of themes that had gained some prominence in the 1960s thanks to the activism and writings of Rachel Carson, Paul Shepard, David Brower and Paul Ehrlich.⁶¹ He also drew inspiration from Spinoza, Gandhi and Aldo Leopold. In his paper, Naess depicted the "shallow ecology" movement as concerned primarily with the effects of pollution and resource depletion on those living in developed countries who are seeking to maintain a high standard of living. Philosophically it is purely "business as usual." In contrast, he characterized the "deep ecology" movement as asking deeper questions about the values underpinning status quo assumptions about the relationship between humans and nature. According to Naess, one goal of the deep ecology movement was "to clarify the fundamental presuppositions underlying our economic approach in terms of value priorities, philosophy, religion. In the shallow movement, argument comes to halt long before this."⁶² Naess in another discussion indicates that a vital aspect of such inquiry "is concerned with the *deepness of premises* used in debates over efforts to overcome the ecological crisis."⁶³ In other words, shallow ecology does not examine the *roots* of our environmental predicament; deep ecology does.

Even so, deep ecology's project of "deeper questioning" (what Warwick Fox calls the *formal sense* of deep ecology) taken by itself remains devoid of content and as such provides nothing in the way of even tentative answers to questions asked. For most people, however, the term "deep ecology" is associated (rightly) with certain substantive normative and descriptive claims. Some of these views are expressed in "The Shallow and the Deep," but many were not fully articulated until the mid-1980s. Much confusion has arisen over exactly what "deep ecology" means because there are (at least) two other senses in which the term is applied in addition to "deepness of questioning." The first sense is somewhat general, the second highly specific.

"The Shallow and the Deep" included a number of points that (according to Naess in a more recent work) "smacked too much of the special metaphysics of a younger Naess."⁶⁴ He came to recognize that while the need for a unified platform in an active deep ecology *movement* was vital, it did not require agreement at the level of ultimate premises. Cultural, religious and philosophical differences inevitably mean different starting points, but do not necessarily rule out the possibility for agreement at a level of greater generality.

Why should we even wish to have conformity at the ultimate philosophical or religious level? We are on the way from we *know* not where to we *know* not where...Those around the world who feel that there must be deep changes in human life styles and policies can be members of the deep ecology movement without having to accept ecosophical positions which they find

confusing, don't understand, don't feel at home with, or simply dislike.⁶⁵

Therefore in 1984 while camping in Death Valley, California, he and George Sessions set upon eight tentative points as “basic to deep ecology” which could be embraced from radically different directions, whether one was a Spinozist, Christian, Buddhist, agnostic, etc. Naess characterized this “deep ecology platform” (henceforth referred to as the DEP) as containing “fairly general and abstract statements that seem to be accepted by nearly all supporters of the Deep Ecology movement.”⁶⁶ As such the DEP constitutes what Warwick Fox calls the *popular sense* of deep ecology. It is given as follows:

1. The well-being and flourishing of human and non-human life on Earth have value in themselves (synonyms: intrinsic value, inherent worth). These values are independent of the usefulness of the non-human world for human purposes.
2. Richness and diversity of life forms contribute to the realization of these values and are also values in themselves.
3. Humans have no right to reduce this richness and diversity except to satisfy vital needs.
4. The flourishing of human life and cultures is compatible with a substantially smaller human population. The flourishing of non-human life *requires* a smaller human population.
5. Present human interference with the non-human world is excessive, and the situation is rapidly worsening.
6. Policies must therefore be changed. These policies affect basic economic, technological, and ideological structures. The resulting state of affairs will be deeply different from the present.
7. The ideological change will be mainly that of appreciating life quality (dwelling in situations of inherent value) rather than adhering to an increasingly higher standard of living. There will be a profound awareness of the difference between bigness and greatness.

8. Those who subscribe to the foregoing points have an obligation directly or indirectly to try to implement the necessary changes.⁶⁷

Although the DEP is frequently characterized as *biocentric* (meaning “life-centered” as opposed to *anthropocentric*, or “human-centered”), in the above formulations “life” is meant to be taken in a very broad sense—for Naess it makes perfect sense to say “Let the river live!” This conception embraces as “living” such things as landscapes, species, ecosystems, and perhaps even the planet itself.⁶⁸ Deep ecology’s particular form of non-anthropocentrism is therefore better characterized as “ecocentric” rather than “biocentric,” since *bio-* refers to “life” in the conventional sense and *eco-* derives from the Greek *oikos* meaning more broadly “household” or “habitation,” this being construed by deep ecologists as meaning the entire ecosphere. The goal, as deep ecologists see it, is to treat living things as valuable in themselves and to regard nothing solely instrumentally. Ecological processes should thus be allowed to continue unhindered and intact.⁶⁹ In this manner deep ecology breaks ground in the direction Goodpaster was heading with respect to moral extensionism and treads familiar soil with Leopold’s holistic land ethic.

Deep Ecology’s Psychological and Ontological Orientation

Deep ecology probably has less in common with traditional moral theory (or for that matter, with moral extensionism) than does even Aldo

Leopold's land ethic. Although in the DEP one encounters terms familiar in standard ethical theory such as "intrinsic value," these are meant in a popular rather than in a technical sense. Strictly speaking, deep ecology is not a theory of environmental *ethics* at all, but rather an all-encompassing environmental *philosophy*, in Naess' terms a "total-view" or ecosophy. It is, according to one writer, "not an attempt to discover 'intrinsic value' or to develop universal moral rules, but a re-shaping and redirection of human consciousness."⁷⁰ While some advocates and critics alike have alleged that deep ecology rejects moral theory altogether, it would be more accurate to say that deep ecology simply finds moral theory *ineffectual* in solving the world's ecological ills. In short, argues Naess, people are not persuaded by moralizing. In the words of Warwick Fox, deep ecology "refers to a psychologically based approach to the question of our relationship with the rest of nature as opposed to an axiologically based (i.e., a value-theory based) approach."⁷¹ Fox goes on to quote from a lecture Naess presented in Australia in 1984.

I'm not much interested in ethics or morals. I'm interested in *how we experience the world....* Ethics follows from how we experience the world. If you experience the world so and so then you don't kill. If you articulate your experience then it can be a philosophy or religion.⁷²

Deep ecology is concerned with what actually motivates people, and recognizes that while no *logical* link may exist between "is" (or one's *perception* of "is") and "ought," there does exist (as I have already pointed out)

a *psychological* link. “Ethics follows from how we experience the world” is a statement descriptive of how humans (purportedly) work, not a prescription for rationally deriving “ought” from “is.” Naess’ hope is that if one experiences the internally-related way things “are” in the world, one “will” spontaneously act in an ecologically responsible way.

...what I suggest is the supremacy of environmental ontology and realism over environmental ethics as a means of invigorating the environmental movement in the years to come. If reality is like it is experienced by the ecological self, our behavior *naturally* and beautifully follows norms of strict environmental ethics. ⁷³

We have already encountered something very much like this in John Rodman’s assessment of the land ethic as a world-view rather than as a moral theory: “When *perception* is sufficiently changed, respectful types of conduct seem ‘natural,’ and one does not have to belabor them in the language of rights and duties.”⁷⁴ An important goal of deep ecology, then, is the psychological bridging of “are” and “will” through ontology rather than the issuing of a bunch of moral “oughts” by way of ethical axiology.

This reveals a more restrictive, and for us more significant, sense in which the term “deep ecology” is used. By “deep ecology movement” Naess means the ecocentric, grassroots social and political entity which is more-or-less exemplified by the DEP. In contrast, he generally reserves the term “deep ecology” (without the *movement*) to indicate a *particular* set of ultimate premises, although he prefers to use “Ecosophy T” to do this. (The “T” comes

from Tvergastein, his mountain hut in Norway). This *aspect* of deep ecology—what Warwick Fox terms its *philosophical sense* and which I will henceforth refer to simply as “deep ecology”—is characterized by “Self-realization” (note the capital “S”) which is brought about through wider identification with one’s ecological context.⁷⁵

“Self-realization,” “Identification,” and the Ecological Self

The goal of deep ecology (in this specific sense) is for people to realize and experience the ecological self.⁷⁶ According to Naess, our ecological self is that with which we “identify” or closely relate. We “underestimate ourselves” when we equate ourselves with our skin-encapsulated egos.⁷⁷ He consequently urges us to widen our identifications and to thus expand our concept of self to include the more-than-human world—that is, to embrace beings that are *different* from us but not *radically other*: non-human organisms, watersheds, bioregions, the ecosphere.⁷⁸

Traditionally the *maturity of the self* develops through three stages—from ego to social self, and from social self to metaphysical self. In this conception of the process nature—our home, our immediate environment, where we belong as children, and our identification with living human beings—is largely ignored. I therefore tentatively introduce the concept of an *ecological self*. We may be said to be in, of and for nature from our very beginning. Society and human relations are important, but our self is richer in its constitutive relations. These relations are not only relations we have with humans and the human community, but with the larger community of all living beings.⁷⁹

Naess' paradigm case of "identification" is the feeling of intense empathy with another being—seeing oneself in the other. This process of identification is akin to extending one's nerve endings so as to incorporate in oneself the joys and sorrows of other human and nonhuman beings.⁸⁰ This can be a powerful force, since one cannot help but feel pain *of one's own* when encountering, for instance, a loved one in pain. Reactions to the suffering of others become involuntary when one's nerves extend beyond the skin. For Naess, Self-realization through identification brings about both integration and maturity in oneself. As philosopher Michael Zimmerman puts it, such integration "means discovering how one is related to and constituted by the larger ecosystemic context."⁸¹

Naess' relational approach attempts to break down the boundary of self and other, the *ego* and the *alter*, and to thereby enable one to spontaneously respond to the interests of others as if they were one's own. If one succeeds in widely identifying, then Self-realization is hindered when the flourishing of others with whom we identify is hindered, and is promoted when their flourishing is promoted. Such "dependency of A's Self-realisation upon B's"⁸² means that the interests of that to which one is internally related—a rainforest, for instance—become one's own.⁸³ In this way the theses "Self-realization!" and "May all beings flourish!" (both norms for Naess) express the same value.

Naess' Self-realization approach rejects the Kantian notion of duty-based ethics in favor of working on people's inclinations. Altruism, in Naess' estimation, misses the mark for it implies a zero-sum game: the *ego* is diminished when it benefits the *alter*.

We need an environmental ethics, but when people feel they unselfishly give up, even sacrifice, their interest in order to show love for Nature, this is probably a treacherous basis for conservation. Through identification they may come to see their own interest served by conservation, through genuine self-love, love of a deepened and widened self.⁸⁴

But Naess intends this to be far more than just a psychological thesis about what motivates people; he is not merely seeking to be effective by promoting a kind of "enlightened Self-interest." For Naess, "wider identification" is the inward expression and felt recognition of an outward reality. As David Keller notes, deep ecology's nonanthropocentrism stems from a principle "that the biosphere does not consist of metaphysically discrete individuals, but ontologically-interconnected individuals comprising one unbroken whole."⁸⁵ The process of identification reveals the individual self to be inextricably bound up in a network of internal relations, not an isolatable thing-in-itself. The "I" is recognized *in relation to* rather than *independent from* the other.⁸⁶

Joanna Macy contends that when we postulate a separate "I," we commit what Bateson called "the epistemological fallacy of Occidental

civilization”—for the larger system of which we are a part is not definitively localizable. The individual self, then, is a “false reification.”

Although we consist of and are sustained by the currents of information, matter, energy that flow through us, we are accustomed to identifying ourselves with only that small arc of the flow-through that is lit, like the narrow beam of a flashlight, by our individual perceptions. But we don't have to so limit our self-perception.... It is as plausible to align our identity with that larger pattern and conceive of ourselves as interexistent with all beings, as to break off one segment of the process and build our borders there.⁸⁷

Deep ecologists argue that to identify with the ego-self introduces a illusory subject/object split between the human and the more-than-human world. With Bateson, many deep ecologists hold the conscious mind, or “self” (little “s”), to be but an arc in a larger circuit,⁸⁸ and believe that to focus our attention exclusively on this arc rather than on the wider circuitry has devastating ecological consequences. In conceiving nature as “radically other” and separate, we instrumentalize it and consign it to “thinghood.” Nature is relegated to the status of raw material, what Heidegger called *bestand*, or “standing reserve”—which subordinates nature's total Being to its use. The Self-realization approach, in contrast, holds that “the highest level of self-realization cannot be reached by anybody without all others [to whom one is internally related] also reaching that level.”⁸⁹ Thus wider identification provides the psychological bridge from ontology to ethics. By recognizing the ontological priority of relationships and strongly identifying with those to whom one is internally related, one perceives his or her own

Self-realization to be bound up with both the human and the more-than-human world and inclines one to adhere to what would otherwise be strict norms imposed by environmental ethics. Since no part belonging to a wider ecological context is valued independently of its relationship to the whole, whole ecological contexts become objects of moral concern in their own right.⁹⁰

With Naess, I reject the notion of the independent self and hold it to be incoherent for the same reasons I reject independent units of selection and isolatable units of moral considerability. As we have seen, thermodynamic considerations dictate that organisms exist in relation to their surroundings; we necessarily absorb and excrete in an incessant give-and-take. As Dorion Sagan and Lynn Margulis explain in “The Uncut Self,”

The minimal autopoietic, or living, system is the membrane-bounded cell.... But the membrane is no concrete, literal, self-possessed wall; it is a self-maintained and constantly changing semipermeable barrier.⁹¹

Our membrane—or skin—is highly osmotic; it acts as a medium for exchange and interpenetration rather than as a rigid boundary. In exhaling, perspiring, excreting and secreting we turn parts of our subjective self into objects; in inhaling and ingesting we incorporate the other. By putting ourselves in relation with members of our own species, with other species, and even with whole landscapes and ecosystems, we both assimilate the

other and allow it to assimilate us. Through wider identification, we recognize our “self-in-Self,” as Freya Mathews relates.

Holistic nesting of a self in a wider self-system means a relative identification with that system. Because the self stands in relations of ecological interdependence (direct or indirect) with the elements of that wider self, those elements (or its relations to them) are logically involved in its identity. Individuality in this framework is thus, again, a relative matter—it is a function of involvement in a wider system, the identity of which is implicated in the identities of each of its participant subsystems. The individual is thus in a very real sense a microcosm of the wider self in which it occurs.⁹²

The organizational closure of organisms as related by Varela and Maturana further implies no self/other dualism. The “other” is continually incorporated in the self through the structural changes that perturbations in one’s medium bring about. In other words, experiences cause structural changes in beings that make the other effectively part of oneself. The subsequent world brought forth is entirely a function of an organism’s relationship with its medium of interaction. Similarly, historian William Irwin Thompson takes the work of Lynn Margulis in cell biology to reveal a new paradigm for understanding the individual overall as a structure “awash in a sea of relationships...the membrane is not the wall containing an identity, but, like the skin of a resounding drum, an instrument of communication.”⁹³

So far, this talk about “relationships” is all very abstract. But, as Leopold demonstrated, we need not so much to *cognize* interrelatedness as to *experience* it. Valerie Plumwood explains,

Special relationship with, care for, or empathy with particular aspects of nature *as experiences* rather than with nature *as abstraction* are essential to provide a depth and type of concern that is not otherwise possible. Care and responsibility for *particular* animals, trees, and rivers that are known well, loved, and appropriately connected to the self are an important basis for acquiring a wider, more generalized concern.⁹⁴

Although Plumwood goes on to criticize deep ecology for its abstraction, deep ecologists are not usually in practice so abstract. Many, including Gary Snyder and Bill Devall, stress the *experience* of the ecological self through *reinhabitation* and *bioregionalism*. This implies directly participating in one’s ecosystemic context, interacting with particular mountains, ridgelines and watersheds, drawing sustenance from the place one belongs to. Indeed, such interactions might set concrete parameters on one’s *experience* of the ecological self. It means returning to what Raymond Dasmann calls “ecosystem culture.” Devall explains that the “Ecological self seems most accessible to us not by focusing on human-built places or on the organic whole or Gaia initially, but on our own bioregion.” Naess, too, recognizes that *felt* relation must be the source of identification, not just theory.

Simple holism—the insistence that wholes be taken seriously—is not enough.... *The argumentation must refer to experience, and spontaneous experience in particular.* And it must

acknowledge hierarchies of wholes and their non-external...internal relations.⁹⁵

A reconstructed ontology, if not felt, will do nothing for ecological consciousness. As Leopold says, we only grieve for what we know.

For deep ecologists, identification with the more-than-human world enables us to experience our Self as it truly is. Identifying with our egos is, as Joanna Macy puts it, a “case of mistaken identity.” The ethical impact of this is best summed up by Michael Zimmerman: “Ontology precedes ethics...before knowing what we *ought* to do, we must understand who we really *are*.”⁹⁶

The “Substitution” and “Dilution” Problems

The relational ontology and subsequent ethical holism that I have been defending are by no means problem-free. Leopold’s land ethic and deep ecology have similar difficulties which have been criticized by defenders of anthropocentric ethics, animal rights philosophers, and ecofeminists alike. Most detractors argue that ethical holism is morally unacceptable because it instrumentalizes the individual and subordinates his or her interests to that of the collective whole. Although most of these criticisms involve problems with respect to moral *significance*, difficulties remain for ethical holism and moral *considerability* (to which I have limited this discussion). For instance, in “Organism, Community, and the ‘Substitution Problem,’” Eric Katz indicates that

advocates of an environmental ethic must adopt a holistic or “total field” view of natural systems, in which individual natural entities and humans are “conceived as nodes in a biotic web of intrinsically related parts.” In an environmental ethic the ecological system or the natural environment becomes morally considerable....interdependency is what counts. The system as a whole—and not merely the individuals in the system—is of primary moral significance....⁹⁷

This is precisely what I have argued, and is a fair characterization of deep ecology and the land ethic as well. Katz, however, concludes that in this framework individual value is inevitably identified with individual *function*, and that this is ethically unwarranted: “if an entity is valued for its instrumental function and not its intrinsic value, then it can be replaced by a substitute entity as long as the function it performs remains undisturbed.”⁹⁸ He calls this “the substitution problem.”

Those who argue that ecosystems have interests and that such wholes are the primary seat of moral value do in fact have to address this challenge; in such views individuals may indeed be construed as “nothing-but” means to systemic ends. This has not been my approach, however. I have contended that relational properties are in many instances morally relevant properties; entities internally related to a morally relevant individual *form part of its identity*—and thus are themselves direct objects of moral concern and not merely instrumental. Ecosystems therefore matter morally as relational matrices wherein individual members codetermine one another; the ecosystem does not have to be reified and assigned “interests” in order to

make it morally considerable. *Individuals* matter morally, in terms of both “skin-in” *and* “skin-out” properties.

Katz fails to recognize that ethical holism (at least as embodied by my view, the land ethic, and deep ecology) draws its premises not from object ontology, but an ontology of relation. He insists that

An entity has intrinsic value if the entity has value in itself, without regard to other entities, without regard to its effects on other entities. The intrinsic value of an entity is based on its own independent properties. To have intrinsic value it need not have any relationship with another entity; its value, after all, is intrinsic to it.⁹⁹

In an object ontology, Katz would be completely right. However, in a relational ontology entities are understood to be *constituted* by their relationships—the intrinsic value of an entity is bound up in its essential properties, and these are themselves bound up in interdependent relationships. Whereas Katz assumes that instrumentality and intrinsic value mutually exclude one another, in a relational ontology these (in many instances) mutually *imply* one another. In attempting to dismiss holistic ethics by invoking an individualist ontology, Katz performs an ontological category mistake.

There is a second and more serious objection, which I call the “dilution problem.” In the same way that the doctrine of internal relations goes too far by insisting that all relations are internal, a moral theory that directly values whatever is internally related to a morally relevant entity might itself be

criticized as too general to be useful. Moreover, if there is transitivity in moral considerability, then whatever is internally related to whatever is internally related to any given entity (and so on) is also morally considerable, in a moral analog to the highly implausible “thou canst not stir a flower without troubling a star.”¹⁰⁰ This leads to the dismayingly useless conclusion that more-or-less *everything* (as far as we can tell) becomes morally considerable. While this is certainly logically possible, it is not a very useful foundation for a moral theory because it “dilutes” considerability beyond recognition. Although a generalized respect for all that exists may be in fact appropriate, moral considerability is supposed to *distinguish* particular objects from one another; if it applies to everything, it may as well apply to nothing.

The “dilution problem” is complicated by factors associated with Katz’s “substitution problem.” Namely, many things internally related to an entity are *fungible*—i.e., they may be substituted one for another without making any essential difference to the parties involved. A good example of fungibility is found in a court of law when someone is owed a cash settlement. The debt is understood solely as a sum to be paid; which *particular* dollar bills are used for repayment is never specified because dollar bills are completely substitutable one for another. In the same way, oxygen and water (for instance) are fungible items from the perspective of those organisms requiring them. It does not matter which *particular* oxygen and water

molecules are assimilated; it only matters that *some* water and oxygen is in fact taken in and expelled in given quantities and at specific rates. This means that organisms—living in the concrete world they do—are internally related only to particulars, not to classes.

A problem quickly emerges from this, for none of us knows the origin of the molecules in our next breath of air. Although our interactions are always eminently concrete, we treat them as abstract. We want *a* glass of water, not *that* water, we breathe air, not *that* air. This would seem to make the task of ascribing moral standing to our fungible internal relations all but impossible. Rather than take fungibility as an obstacle to determining moral considerability, however, I take it to reveal an important fact about our interactions with a broader ecological context. Since those things to which we are continually internally related cannot be isolated from the flows from which they emerge, we must value morally not just these things themselves, but the systemic processes that make these internal relations possible in the first place. Since we need particular water molecules in our bodies to survive, but must derive these from a source of water in general, both abstraction and concreteness apply to our relations. Thus it is vital to keep ecological *patterns of interaction*—energy flow, trophic structure, and nutrient cycling—intact within *particular* habitats, watersheds and ecosystems.¹⁰¹ Recognizing land to be, in Leopold's words, a "fountain of

energy” puts our priorities not on things, but on maintaining the integrity and stability of such *processes*.

This might, moreover, provide a way out of the “dilution problem” by changing our focus from objects of moral consideration themselves to the processes that realize them. A muskrat may be internally related to only particular water molecules as it swims across the stream it feeds from, but its overall relationship with the flowing stream is what ensures that these particular internal relations endure. In the same way, the muskrat is internally related to the molecules in its own body. These are, however, merely transient placeholders; it is one’s organizational pattern that endures, not one’s material components. Logical levels once more enter our discussion, for the *types* of things that organisms are composed of (carbon, hydrogen, nitrogen, oxygen, etc.) are not fungible, but the *tokens* of these types are.

The fact of fungibility in our internal relations reveals the “dilution problem” to be an inadvertent carry-over from object ontology. Although our internal relations are always to concrete things, these things themselves are but *relata* embedded in and dependent on greater patterns of interaction. One values his or her skin, for instance, as something internally related to oneself. However, one is not overly attached to the parts that constitute this skin, for these are being scraped off and replaced constantly. Skin is valued for the organization it embodies, not for the *relata* that constitute it.

Therefore, the overall pattern that organizes relata must itself be morally considerable, not just the things composed of these relata.

Modern “biosphere people” (as Raymond Dasmann puts it), have become divorced from the particularity involved in our internal relations. The *sources* of what we depend upon have themselves become fungible. Few of us know where our clothes and food come from anymore, for these have in most cases become completely substitutable items off the shelf of a wholly substitutable chain store outlet. Again, as Homer Simpson said, “It’s lamb, Lisa—not a lamb!” For “ecosystem people,” there exists in contrast *this* ridge, *that* stream, *those* mountains, *that* elk population—a concrete *there* there—not generalized “nature.” Recognizing one’s dependence upon a specific place fosters a felt sense of relation with one’s landscape. Experiencing such stark particularity is probably a necessary prerequisite to *feeling* constituted by one’s relations. The less fungible the sources of one’s internal relations are, the more one will seek to preserve them. I take this to be the thrust of bioregionalism as it is lived by people like Gary Snyder. The ecological self is tied to particular places that embody more general ecosystemic processes.

Relations in a World of Circuitry

In the early 1950s, the Dayak people of Borneo suffered from malaria. The World Health Organization had a solution: they sprayed large amounts of DDT to kill the mosquitoes that carried the malaria. The mosquitoes died; the malaria declined; so far, so good. But there were side-effects. Among the first was that the roofs of people's houses began to fall down on their

heads. It seemed that the DDT was also killing a parasitic wasp that had previously controlled thach-eating caterpillars. Worse, the DDT-poisoned insects were eaten by geckos, which were eaten by cats. The cats started to die, the rats flourished, and the people were threatened by potential outbreaks of typhus and plague. To cope with these problems, which it had itself created, the World Health Organization was obliged to parachute 14,000 live cats into Borneo.¹⁰²

Joanna Macy contends that “the false reification of the self is basic to the ecological crisis in which we now find ourselves.”¹⁰³ By dissociating self from other, we lose sense of our interrelation with our environment, forget how we are embedded in wider circuitry, and destroy that upon which we most depend. Such an outmoded ontology leads to bad environmental policy and an impoverished ethical outlook. The thrust of this thesis has been an attempt to remediate this by arguing for “better ethics through ontology”—chiefly through the process of internalizing externals. In the case of evolution, I have argued that an organism’s relationship with its external situation—its ecological context—is what determines its “fitness.” Ontologically, I have made the case that (at least with respect to living things) external relations are frequently internal to a thing’s identity. With respect to ethics I have maintained that, based upon the above biological and ontological considerations, relational properties must be considered when making determinations of moral relevance; whole ecological contexts are the proper object of moral concern.

I conclude that the unit of selection, the unit of selfhood, and the unit of moral relevance are coextensive.¹⁰⁴ We derive each of these notions from a more fundamental ontological framework which dictates what individual things *are*, and what it ultimately means *to be*. As I hope to have demonstrated, this is not just an abstract philosophical concern. Since one's ontology shapes perceptions and these perceptions infect interactions, it is vital that our maps fit the territory.¹⁰⁵ In a world where only fitters survive, mapping out fitness, identity, and moral relevance in terms of an object ontology is a misfit notion, and is consequently dangerous. Without revision, our maps will only serve to get us more and more lost. As Bateson indicates,

I suggest that the last hundred years have demonstrated empirically that if an organism or aggregate of organisms sets to work with a focus on its own survival and thinks that that is the way to select its adaptive moves, its “progress” ends up with a destroyed environment. If the organism ends up destroying its environment, it has in fact destroyed itself.¹⁰⁶

The attempt to isolate and benefit singular parts of the biotic circuit is ultimately doomed to failure, because things never exist in isolation. By changing one variable in the circuit, one affects everything else in it; if ecology has taught us anything, it is that human survival is bound up in the survival of the rest of the biosphere. According to Bateson, the result of falsely reifying the “I” and trying to isolate one unit as *the* unit of survival—divorcing each from its context—is that

you end up with the species versus the other species around it or versus the environment in which it operates. Man against

nature.... When you narrow down your epistemology and act on the premise “What interests me is me, or my organization, or my species,” you chop off consideration of other loops of the loop structure.¹⁰⁷

One example of the hazards present in ignoring the “loop structure” of which Bateson speaks is in the widespread use of DDT earlier in this century. Insecticides were construed as necessary in order to increase agricultural output for a rapidly increasing population as well as to save troops from malaria overseas. Once DDT became widely used by the 1950s, however, four things were happening: 1) there was a vast economic commitment to DDT manufacture, 2) insects at which DDT was directed were becoming resistant, 3) animals which ate these insects started to die off, and 4) the world population aided by DDT was permitted to increase.¹⁰⁸ The result was an addiction to a product deemed necessary to support both an industry and a burgeoning population but which had begun to cycle back around the food chain and kill those forms of life humans depended on for survival. By isolating one part of the circuit, humans put themselves in a double-bind from which escape seemed impossible, and found themselves no longer removed from the consequences of their actions, even at the level of vast biospheric circuitry.

Another instance, perhaps closer to home, can be found in predator management. Since predators such as coyotes and mountain lions pose a threat to livestock grazing on public lands, a widespread federally funded

program was implemented to help: Animal Damage Control. “Control” in this case meant poisoning, trapping and aerial gunning with the purpose of such measures being to kill predators and thereby protect private industry. Engaging in such a band-aid attempt at fixing the problem, however, once again ignored the intricate feedback loops involved. By killing coyotes, for instance, prey populations irrupt more frequently and farmers in some cases get overrun with rodents and rabbits, which they call the ADC in to poison. This in turn results in the poisoning of birds of prey which feed upon these animals; moreover, with their prey-base poisoned, the coyote has that much more incentive to attack livestock as an alternative food source. In addition, nontarget animals such as raccoons, deer, and domestic dogs often get caught in the traps intended for coyotes, since traps do not discriminate. Similarly, the poisoned meat ADC intends for predators kills not only those animals that eat it (frequently nontarget animals), but those who eat the poisoned animal as well. All this time, due to what biologists call “inversivity,” the subsequently thinner coyote population allows female coyotes to make use of more abundant resources and to thereby produce more pups per litter, which helps compensate for the loss due to the ADC in the first place.

Since the coyotes never go away, this of course justifies calling in the ADC once again to control them and the cycle starts over. All this fails to mention that coyotes have been able to vastly extend their range only thanks to human elimination of the wolf and evidence that hiring the ADC to

perform such “controls” costs more than it would to just pay ranchers for their losses. This in turn, however, fails to ask the crucial *contextual* question: “With so many negative impacts—compaction of soil, enhanced runoff, widespread desertification, riparian zone depletion, predator elimination—what are livestock doing grazing on public lands in the first place?” One cannot manage for livestock (or for anything, for that matter) in isolation. Aldo Leopold expresses this notion in his typically beautiful way:

Harmony with the land is like harmony with a friend; you cannot cherish his right hand and chop off his left. That is to say, you cannot love game and hate predators; you cannot conserve the waters and waste the ranges; you cannot build the forest and mine the farm.¹⁰⁹

Enduring biological systems seek to “fit in” and to thereby survive by optimizing conditions, not maximizing them. This is the key to sustainability. There exists a certain *range of tolerance* (i.e., a specific kind of relationship) wherein any variable (temperature, salinity, light intensity, etc.) promotes the survival of life,¹¹⁰ whether this be the life of a cell, organism or an entire system composed of organisms. Outside of this range, the variable will begin to cause harm and eventually prove toxic; for any organism too much calcium, for example, is as deadly as not enough. Industrialized human behavior, drawing resources from all over the biosphere (and expelling its wastes just as widely), ignores optimization in favor of *maximizing* (a) growth (whether this be in terms of money, populations, or simply power), (b) production (often of things wholly

unnecessary if not downright harmful), and (c) consumption (see production). This, uncorrected, will too will prove fatal. “Growth for the sake of growth,” a mentality eagerly promoted by industrialized nations, does not “fit” the global context. It is rather what Ed Abbey has called “the ideology of the cancer cell,” and makes for a poor long term survival strategy, to say the least. It results from seeing ourselves as subjects and the world as object rather than perceiving both self and other as relationally codetermined. Bateson emphasizes that what our society needs to survive is an “ethics of optima”—not an ethics of maxima.¹¹¹ As David Orr says, “It makes far better sense to reshape ourselves to fit a finite planet than to attempt to reshape the planet to fit our infinite wants.”¹¹² I take this to follow directly from a relationally derived holism that values entire ecological contexts instead of just parts in isolation.

Embracing a relational ontology is not only a necessary precondition for an effective environmental ethic, but is also essential if we are to “fit” into our broader ecological context. The difficult task is implementing such radical ideas in both everyday world views and ultimately in policy. As John Livingston says,

no one knows how a new paradigm or a new metaphysic, no matter how cogently drafted, is to be gotten into the human bloodstream. You don't legislate things of this kind. You evolve into them, and out of them. That takes time.¹¹³

This is all the more difficult when a new metaphysic such as relational ontology has to combat a robust cultural immune system. Perhaps we can gradually “evolve into” a relational paradigm, but this may require more time than we really have.

I hinted earlier that when species select for each other, they also select for themselves. By catching those prey most easily found, for instance, a predator leaves behind more cryptic prey¹¹⁴—a behavior which in turn selects for a more acutely perceptive predator. Units of selection are selected for because they fit in with their contexts; as we have seen, however, contexts evolve. For over three billion years, life has selected for itself and in so doing generated a context where “being fit” meant “fitting in” —life with life. In just a few centuries, however, humanity has (in large part) selected for a different kind of relationship with the planet, a relationship which cannot ultimately survive—one that sees the world as standing reserve, an object to which we are related externally. This in turn selects for human beings who are dulled to the vast interpenetration that makes up life itself, who are content to dwell in virtual, prosthetic worlds of their own making, people who Emerson characterized as “unworthy of the equinox.” Dissenters who see things differently—a mutant minority by all accounts—find surviving (or at least flourishing) in such a world difficult, because doing so means fitting into a human-engineered context which is itself at war with the living. Such people, according to Leopold, live “alone in a world of wounds.”

The environmental crisis is indeed a *crisis of perception*—a failure of human beings to perceive themselves as bound up in a context upon which they are entirely dependent, but which extends far beyond human control. This brings those who recognize this fact to despair, for *within* the context that humanity has selected for itself—a context of “man apart”—*there is no way out*. As Bateson says,

life depends on interlocking circuits of contingency, while consciousness can see only such short arcs of such circuits as human purpose may direct... That is the sort of world we live in—a world of circuit structures—and love can survive only if wisdom (i.e. a sense of recognition of the fact of circuitry) has an effective voice.¹¹⁵

We can only alter this context of interaction and come to recognize our role as a *partner* in coevolution if we regain sight of the *relational real*. Re-visioning ourselves as relationally constituted—one arc in the flowering circuit, one voice in the living conversation—“fitting in” will prove to be the mechanism of our survival, and the world’s.

Man did not weave the web of life;
he is merely a strand in it.
Whatever he does to the web,
he does to himself.¹¹⁶

Notes

- ¹ Kenneth Goodpaster, "On Being Morally Considerable," *The Journal of Philosophy* 75.6 (1978): 323.
- ² David Keller, "Gleaning Lessons from Deep Ecology," *Ethics and the Environment* 2.2 (1997): 145.
- ³ Callicott, "Can a Theory of Moral Sentiments Support a Genuinely Normative Environmental Ethic?" *Inquiry* 35.2 (1992): 183.
- ⁴ The most extensive account I have encountered of the supposed interests of holistic entities is that of Lawrence E. Johnson, *A Morally Deep World: An Essay on Moral Significance and Environmental Ethics* (Cambridge: Cambridge University Press, 1991).
- ⁵ G. J. Warnock, cited in Goodpaster, "On Being Morally Considerable," 308.
- ⁶ VanDeVeer and Pierce 57
- ⁷ VanDeVeer and Pierce 56.
- ⁸ This is not to mention the fact that if for instance dolphins, chimpanzees, or gorillas possess language capacity, this would draw the circle *more widely* than just around humans. In this instance (b2) would fail as well.
- ⁹ Goodpaster, "On Being Morally Considerable," 314.
- ¹⁰ John Rodman, "The Liberation of Nature?" *Inquiry* 20 (1977): 87.
- ¹¹ It might be more accurate to say that such cases make up possible "least common denominators" *among human beings who unquestionably possess some capacity for conscious experience*. Although it could be argued that the comatose or those in persistent vegetative states make better candidates for "least common denominators" among human beings in general, for the sake of brevity and simplicity I will ignore such a possibility. It is taken as read by most moral extensionists (this being justified or not) that psychological capacities are a necessary condition for moral standing. Whether or not comatose or persistent vegetative states truly qualify as nonconative is of course another question entirely.
- ¹² Rodman, "The Liberation of Nature?" 89.

- ¹³ Goodpaster, "On Being Morally Considerable," 309.
- ¹⁴ Goodpaster, "On Being Morally Considerable," 314.
- ¹⁵ Goodpaster, "On Being Morally Considerable," 314-315, emphasis mine.
- ¹⁶ Goodpaster, "On Being Morally Considerable," 316.
- ¹⁷ Rodman, "The Liberation of Nature?" 91.
- ¹⁸ Rodman, "The Liberation of Nature?" 94.
- ¹⁹ Rodman, "The Liberation of Nature?" 94.
- ²⁰ Rodman, "The Liberation of Nature?" 91.
- ²¹ Rodman, "The Liberation of Nature?" 84.
- ²² Holmes Rolston III, *Environmental Ethics: Duties to and Values in the Natural World* (Philadelphia: Temple University Press, 1988) 56.
- ²³ Rodman, "The Liberation of Nature?" 89.
- ²⁴ Rolston 60.
- ²⁵ Goodpaster, "On Being Morally Considerable," 316, emphasis mine.
- ²⁶ Goodpaster, "On Being Morally Considerable," 316.
- ²⁷ Mark W. Lipsey, cited in Goodpaster, "On Being Morally Considerable," 317.
- ²⁸ Goodpaster, "On Being Morally Considerable," 320.
- ²⁹ E. M. Adams, *Ethical Naturalism and the Modern World-View* (Chapel Hill: University of North Carolina Press, 1960) 37.
- ³⁰ Goodpaster, "On Being Morally Considerable," 321.
- ³¹ Goodpaster, "On Being Morally Considerable," 323.
- ³² Goodpaster, "On Being Morally Considerable," 323.

³³ Roderick Nash, *The Rights of Nature* (Madison: The University of Wisconsin Press, 1989) 5-6.

³⁴ Kenneth Goodpaster, "From Egoism to Environmentalism," *Ethics and Problems of the 21st Century*, ed. K. E. Goodpaster and K. M. Sayre (Notre Dame: University of Notre Dame Press, 1979) 25.

³⁵ Goodpaster, "From Egoism to Environmentalism," 29.

³⁶ Goodpaster, "From Egoism to Environmentalism," 29-32.

³⁷ Joanna Macy's term for the conscious parts of a natural system.

³⁸ Holmes Rolston led me to this conclusion by saying something very much like this in "Why Species Matter," VanDeVeer and Pierce 486. "The appropriate survival unit is the appropriate level of moral concern." He was in that instance referring to species.

³⁹ Wallace Stegner, cited in Callicott, "The Conceptual Foundations of the Land Ethic," *In Defense of the Land Ethic* (Albany: State University of New York Press, 1989) 75.

⁴⁰ Stegner, cited in Callicott, "The Conceptual Foundations of the Land Ethic," 75.

⁴¹ Aldo Leopold, *A Sand County Almanac* (New York: Oxford University Press, 1966) 237.

⁴² Leopold 239.

⁴³ Leopold 238.

⁴⁴ Leopold 240.

⁴⁵ See Callicott, "The Conceptual Foundations of the Land Ethic." It is worth noting that while Leopold's criterion of goodness is naturalistic (one can presume it to be biotic health), it is unconventional in not being identified with a psychological state of any kind.

⁴⁶ Leopold 262.

⁴⁷ Leopold 253.

⁴⁸ Callicott, "The Metaphysical Implications of Ecology," 108.

⁴⁹ See Capra 167.

⁵⁰ Montague 40.

⁵¹ Callicott, "The Metaphysical Implications of Ecology," 109.

⁵² Rodman, "Four Forms of Ecological Consciousness Reconsidered," 127.

⁵³ Leopold 251.

⁵⁴ I (unlike Callicott) think that the Humean account of sympathy would likely do better as a form of individualist extensionism than as any kind of holistic theory of environmental ethics. In general, we sympathize only with those beings we attribute with a capacity for feelings. Although we might simply be wrong about the facts in this respect (e.g. a child's sympathy for a teddy bear) it seems that sympathy would exclude biotic wholes from moral considerability unless one treats them as sensing superorganisms, a route I will not take. I mention Hume because of his stress on how sentiments rather than reason inform our judgments about who or what is morally relevant.

⁵⁵ See Cora Diamond, "Eating Meat and Eating People," *Philosophy* 53 (1978), 465-479.

⁵⁶ Leslie Pickering Francis, and Richard Norman, "Some Animals are More Equal than Others," *Philosophy* 53 (1978), 507-527. Their primary argument for why "some animals" (namely, humans) "are more equal than others" lies in the substance of particular human-to-human relationships as opposed to that found in human-animal interactions, namely complex communication and economic, political and familial relationships.

⁵⁷ Rodman, "Four Forms of Ecological Consciousness Reconsidered," 127.

⁵⁸ The significance of sensuous engagement with a more-than-human world is a theme that pervades the work of David Abram. See *The Spell of the Sensuous*.

⁵⁹ Rodman, "The Liberation of Nature?" 95.

⁶⁰ Sessions xii. This paper summarized a lecture Naess gave on the subject at a Third World Futures conference in Bucharest the year before. Henceforth I will refer to this essay as “The Shallow and the Deep.”

⁶¹ See Sessions ix-x.

⁶² VanDeVeer and Pierce 211.

⁶³ Naess, “Deepness of Questions and the Deep Ecology Movement,” Sessions 204.

⁶⁴ Naess, “The Deep Ecology ‘Eight Points’ Revisited,” Sessions 221.

⁶⁵ Naess, “Man Apart’ and Deep Ecology: A Reply to Reed.” *Environmental Ethics* 12 (1990): 187.

⁶⁶ Naess, “The Deep Ecology ‘Eight Points’ Revisited,” 214.

⁶⁷ Naess, “The Deep Ecological Movement: Some Philosophical Aspects,” Sessions 68.

⁶⁸ Warwick Fox, *Toward A Transpersonal Ecology* (Boston: Shambhala Publications, Inc., 1990) 116.

⁶⁹ Zimmerman, *Contesting Earth’s Future*, 25.

⁷⁰ Eric Katz, cited in VanDeVeer and Pierce, 212.

⁷¹ Fox 197.

⁷² Naess, cited in Fox, 219, emphasis mine.

⁷³ Arne Naess, “Self-Realization: An Ecological Approach to Being in the World,” *The Deep Ecology Movement*, ed. Alan Drengson and Yuichi Inoue (Berkeley: North Atlantic Books, 1995) 26. By “beautifully” Naess means that this action is rooted in inclination rather than in a sense of duty. Kant called such behavior “beautiful” but was quick to indicate that only “dutiful” actions can be considered truly moral.

⁷⁴ Rodman, “Four Forms of Ecological Consciousness Reconsidered,” 127.

⁷⁵ Drengson and Inoue xxi.

⁷⁶ Thanks to Vaughn Lovejoy for stressing the “experience” side of this.

⁷⁷ I believe this is Alan Watts’ term.

⁷⁸ See Zimmerman, *Contesting Earth’s Future*, 36.

⁷⁹ Naess, “Self-Realization: An Ecological Approach to Being in the World,” 14.

⁸⁰ I get this idea from Stephen R. Donaldson’s *Chronicles of Thomas Covenant* series. In the story, an alternate world exists where people experience the health of the land as part of their own direct well-being. Thomas Covenant enters this world as a leper, whose nerve endings do not even extend to his own skin. His leprosy is like the western conception of the self—atomic, disconnected and subdivided. Dwellers in the land, on the other hand, interact with the land as they would with another individual to whom they owe personal obligations; they reverentially internalize aliantha berries and scatter the seeds as a sacramental partaking in the big game of “give and take.” Their nerves, their selves extend to include a vast network of interconnections.

⁸¹ Zimmerman, *Contesting Earth’s Future*, 38. The process of identifying empathetically with presumably non-sentient entities such as rivers and ecosystems is, of course, problematic. It reinvokes the problem of trying to use Humean sentiments as the basis for a holistic ethic (see Callicott). One simply cannot (meaningfully) have sympathy for something that doesn’t have experiences. Empathy is only one kind of identification, however; one can still identify with the flourishing of something (like a rainforest) even if this entity doesn’t *experience* its own flourishing.

⁸² Naess, *Ecology, Community and Lifestyle*, 172.

⁸³ Naess, “Self-Realization: An Ecological Approach to Being in the World,” 14.

⁸⁴ Naess, “Self-Realization: An Ecological Approach to Being in the World,” 17.

⁸⁵ Keller 140.

⁸⁶ See Bill Devall, "The Ecological Self," Drenegson and Inoue 102.

⁸⁷ Joanna Macy, "Awakening to the Ecological Self," *Healing the Wounds: The Promise of Ecofeminism*, ed. Judith Plant. (Philadelphia: New Society Publishers, 1989) 206.

⁸⁸ See Berman 243.

⁸⁹ Naess, "Self-Realization in Mixed Communities of Humans, Bears, Sheep, and Wolves," *Inquiry* 22 (1979): 236.

⁹⁰ See Zimmerman, *Contesting Earth's Future*, xxx.

⁹¹ Dorion Sagan and Lynn Margulis, "The Uncut Self," *Slanted Truths: Essays on Gaia, Symbiosis, and Evolution*, ed. Lynn Margulis and Dorion Sagan (New York: Springer-Verlag, 1997) 64.

⁹² Mathews 144.

⁹³ Thompson, *Gaia 2: Emergence*, 26.

⁹⁴ Plumwood, 253, emphasis mine.

⁹⁵ Naess, "Ecosophy and Gestalt Ontology," 244-245, emphasis mine.

⁹⁶ Zimmerman, cited in Fox 228.

⁹⁷ Eric Katz, "Organism, Community, and the 'Substitution Problem'," VanDeVeer and Pierce 161-162.

⁹⁸ Katz 166.

⁹⁹ Katz 164.

¹⁰⁰ Francis Thompson, cited in Don E. Marietta, "Environmental Holism and Individuals," *Environmental Ethics* 10 (1988): 254.

¹⁰¹ Thanks to Fred Montague for emphasizing to me the importance of *processes* such as energy flow, trophic structure and nutrient cycling in ecosystem dynamics.

¹⁰² “A Special Niche,” *Rocky Mountain Institute Home Page*,
<http://www.rmi.org/a_report/niche.html>.

¹⁰³ Macy, “Awakening to the Ecological Self,” 205.

¹⁰⁴ Bateson puts this similarly by equating the unit of selection with the unit of “mind.”

¹⁰⁵ I owe this insight to Tom Malloy.

¹⁰⁶ Bateson, “Form, Substance, and Difference,” *Steps to an Ecology of Mind*, 451.

¹⁰⁷ Bateson, “Pathologies in Epistemology,” 484.

¹⁰⁸ Bateson, “The Roots of Ecological Crisis,” *Steps to an Ecology of Mind*, p. 489.

¹⁰⁹ Leopold 189-190.

¹¹⁰ Montague 64.

¹¹¹ See Berman 255.

¹¹² Orr 9.

¹¹³ Livingston vii.

¹¹⁴ Ricklefs 385.

¹¹⁵ Gregory Bateson, “Style, Grace, and Information in Primitive Art,” *Steps to an Ecology of Mind*, 146.

¹¹⁶ Ted Perry, inspired by Chief Seattle, cited in Capra xii.

WORKS CITED

Journal Articles and Web Pages

- Abram, David. "The Mechanical and the Organic: On the Impact of Metaphor in Science." *Wild Earth* Summer 1992: 70-75.
- Acton, H. B. "Bradley, Francis Herbert." Ed. Paul Edwards. *The Encyclopedia of Philosophy*. 8 vols. New York: Macmillan Publishing Co., 1967. 1: 359-363.
- Bateson, Gregory. "Pathologies of Epistemology." *Steps to an Ecology of Mind*. New York: Chandler Publishing Company, 1972. 478-487.
- . "Form, Substance, and Difference." *Steps to an Ecology of Mind*. New York: Chandler Publishing Company, 1972. 448-468.
- . "The Roots of Ecological Crisis." *Steps to an Ecology of Mind*. New York: Chandler Publishing Company, 1972.
- . "Style, Grace, and Information in Primitive Art." *Steps to an Ecology of Mind*. New York: Chandler Publishing Company, 1972. 488-493.
- Beatty, John. "Fitness: Theoretical Contexts." Ed. Evelyn Fox Keller and Elisabeth A. Lloyd. *Keywords in Evolutionary Biology*. Cambridge, Massachusetts: Harvard University Press, 1992. 115-119.
- Callahan, Daniel. "Can Nature Serve as Moral Guide?" *Hastings Center Report* Nov.-Dec. 1996: 21-22.
- Callicott, J. Baird. "Can a Theory of Moral Sentiments Support a Genuinely Normative Environmental Ethic?" *Inquiry* 35.2 (1992): 183-198.
- . "The Conceptual Foundations of the Land Ethic." *In Defense of the Land Ethic*. Albany: State University of New York Press, 1989. 75-100.
- . "The Metaphysical Implications of Ecology." *In Defense of the Land Ethic*. Albany: State University of New York Press, 1989. 101-114.
- Crossley, D. J. "Holism, Individuation, and Internal Relations." *Journal of*

- the History of Philosophy* 25.2 (1977): 183-194.
- Croswell, Ken. "Why Intelligent Life Needs Giant Planets." *New Scientist* 24 Oct. 1992: 18.
- Dell, Paul F. "Understanding Bateson and Maturana: Toward a Biological Foundation for the Social Sciences." *Journal of Marital and Family Therapy* 11.1 (1985): 1-20.
- Devall, Bill. "The Ecological Self." Ed. Alan Drengson and Yuichi Inoue. *The Deep Ecology Movement*. Berkeley: North Atlantic Books, 1995. 101-123.
- Diamond, Cora. "Eating Meat and Eating People." *Philosophy* 53 (1978). 465-479.
- Francis, Leslie Pickering, and Richard Norman. "Some Animals are More Equal than Others." *Philosophy* 53 (1978). 507-527.
- Goodpaster, Kenneth. "On Being Morally Considerable." *The Journal of Philosophy* 75.6 (1978): 308-325.
- . "From Egoism to Environmentalism." Ed. K. E. Goodpaster and K. M. Sayre. *Ethics and Problems of the 21st Century*. Notre Dame: University of Notre Dame Press, 1979. 21-35.
- Gould, Stephen Jay. "Room of One's Own." *Natural History* Nov. 1997: 22+.
- Heylighen, Francis. "Fitness." *Principia Cybernetica Web*.
<<http://pespmc1.vub.ac.be/FITNESS.html>>
- Katz, Eric. "Organism, Community, and the 'Substitution Problem.'" Ed. Donald VanDeVeer and Christine Pierce. *The Environmental Ethics and Policy Book*. Belmont, CA: Wadsworth, Inc., 1994. 161-171.
- Keller, David. "Gleaning Lessons from Deep Ecology." *Ethics and the Environment* 2.2 (1997): 139-148.
- Lewontin, Richard C. "The Organism as the Subject and the Object of Evolution." *Scientia* 118 (1983): 65-82.
- . "The Units of Selection." *Annual Review of Ecology and Systematics* 1 (1970): 1-18.

- Lloyd, Elisabeth A. "Unit of Selection." Ed. Evelyn Fox Keller and Elisabeth A. Lloyd. *Keywords in Evolutionary Biology*. Cambridge, Massachusetts: Harvard University Press, 1992. 334-340.
- Lovelock, James E., "Gaia: A Planetary Emergent Phenomenon." *Gaia 2: Emergence. The New Science of Becoming*. New York: Lindesfarne Press, 1991. 30-49.
- Macy, Joanna. "Awakening to the Ecological Self." Ed. Judith Plant. *Healing the Wounds: The Promise of Ecofeminism*. Philadelphia: New Society Publishers, 1989. 201-211.
- Macy, Joanna, and John Seed. "Gaia Meditations." Ed. John Seed, Joanna Macy, Pat Fleming, and Arne Naess. *Thinking Like a Mountain: Towards a Council of All Beings*. Philadelphia, PA: New Society Publishers, 1988. 41-43.
- Marietta, Don E. "Environmental Holism and Individuals." *Environmental Ethics* 10 (1988): 251-258.
- Maturana, Humberto. "Everything is Said By an Observer." Ed. William Irwin Thompson. *Gaia: A Way of Knowing. Political Implications of the New Biology*. New York: Lindesfarne Press, 1987. 65-82.
- Naess, Arne. "The Deep Ecological Movement: Some Philosophical Aspects." Ed. George Sessions. *Deep Ecology for the 21st Century: Readings on the Philosophy and Practice of the New Environmentalism*. Boston: Shambhala, 1995. 64-84.
- . "The Deep Ecology 'Eight Points' Revisited." Ed. George Sessions. *Deep Ecology for the 21st Century: Readings on the Philosophy and Practice of the New Environmentalism*. Boston: Shambhala, 1995. 213-221.
- . "Deepness of Questions and the Deep Ecology Movement." Ed. George Sessions. *Deep Ecology for the 21st Century: Readings on the Philosophy and Practice of the New Environmentalism*. Boston: Shambhala, 1995. 204-212.
- . "Ecosophy and Gestalt Ontology." Ed. George Sessions. *Deep Ecology for the 21st Century: Readings on the Philosophy and Practice of the New Environmentalism*. Boston: Shambhala, 1995. 240-245.
- . "'Man Apart' and Deep Ecology: A Reply to Reed." *Environmental Ethics* 12 (1990): 185-192.

- . "Self-Realization: An Ecological Approach to Being in the World." Ed. Alan Drengson and Yuichi Inoue. *The Deep Ecology Movement*. Berkeley: North Atlantic Books, 1995. 13-30.
- . "Self-Realization in Mixed Communities of Humans, Bears, Sheep, and Wolves." *Inquiry* 22 (1979): 231-241.
- . "The Shallow and the Deep, Long-Range Ecology Movements: A Summary." Ed. George Sessions. *Deep Ecology for the 21st Century: Readings on the Philosophy and Practice of the New Environmentalism*. Boston: Shambhala, 1995. 151-155.
- Plumwood, Valerie. "Nature, Self, and Gender: Feminism, Environmental Philosophy, and the Critique of Rationalism." Ed. Donald VanDeVeer and Christine Pierce. *The Environmental Ethics and Policy Book*. Belmont, CA: Wadsworth, Inc., 1994. 251-266
- Rocky Mountain Institute Home Page*. "A Special Niche."
<http://www.rmi.org/a_report/niche.html>
- Rodman, John. "The Liberation of Nature?" *Inquiry* 20 (1977): 83-145.
- . "Four Forms of Ecological Consciousness Reconsidered." Ed. George Sessions. *Deep Ecology for the 21st Century: Readings on the Philosophy and Practice of the New Environmentalism*. Boston: Shambhala, 1995. 121-130.
- Rolston, Holmes, III. "Why Species Matter." Ed. Donald VanDeVeer and Christine Pierce. *The Environmental Ethics and Policy Book*. Belmont, CA: Wadsworth, Inc., 1994. 485-492.
- Rorty, Richard M. "Relations, Internal and External." Ed. Paul Edwards. *The Encyclopedia of Philosophy*. 8 vols. New York: Macmillan Publishing Co., 1967. 7:125-133.
- Sagan, Dorion, and Lynn Margulis. "The Uncut Self." Ed. Lynn Margulis and Dorion Sagan. *Slanted Truths: Essays on Gaia, Symbiosis, and Evolution*. New York: Springer-Verlag, 1997. 59-74.
- Sober, Elliot. "Holism, Individualism, and the Units of Selection." Ed. Elliot Sober. *Conceptual Issues in Evolutionary Biology*. Cambridge, Massachusetts: The MIT Press, 1984. xxx

Varela, Francisco. "Laying Down a Path in Walking." Ed. William Irwin Thompson. *Gaia: A Way of Knowing. Political Implications of the New Biology*. New York: Lindesfarne Press, 1987. 48-64.

Warren, Karen and Jim Cheney. "Ecological Feminism and Ecosystem Ecology." Ed. Karen J. Warren. *Ecological Feminist Philosophies*. Bloomington: Indiana University Press, 1996. 244-262.

Whitaker, Randall. "Overview of Autopoietic Theory."
<<http://www1.acm.org:81/sigois/ois/auto/ATReview.html>>

Worster, Donald. "The Ecology of Order and Chaos." Ed. Susan Armstrong and Richard G. Botzler. *Environmental Ethics: Divergence and Convergence*. New York: McGraw-Hill, Inc., 1993. 39-49.

Books

Abram, David. *The Spell of the Sensuous: Perception and Language in a More-Than-Human World*. New York: Pantheon Books, 1996.

Adams, E. M. *Ethical Naturalism and the Modern World-View*. Chapel Hill: University of North Carolina Press, 1960.

Armstrong, Susan J., and Richard G. Botzler, eds. *Environmental Ethics: Divergence and Convergence*. New York: McGraw-Hill, Inc., 1993.

Barlow, Connie, ed. *From Gaia to Selfish Genes: Selected Writings in the Life Sciences*. Cambridge: The MIT Press, 1991.

Bateson, Gregory. *Steps to an Ecology of Mind*. New York: Chandler Publishing Company, 1972.

---. *Mind and Nature: A Necessary Unity*. Toronto: Bantam Books, 1980.

Bateson, Gregory, and Mary Catherine Bateson. *Angels Fear: Towards an Epistemology of the Sacred*. New York: Macmillan Publishing Company, 1987.

Berman, Morris. *The Reenchantment of the World*. Toronto: Bantam, 1984.

Callicott, J. Baird. *In Defense of the Land Ethic*. Albany: State University of New York Press, 1989.

- Capra, Fritjof. *The Web of Life: A New Scientific Understanding of Living Systems*. New York: Anchor Books, 1996.
- Colinvaux, Paul. *Why Big Fierce Animals Are Rare*. Princeton, New Jersey: Princeton University Press, 1978.
- Curtis, Helena. *Biology*. New York: Worth Publishers, 1983.
- Darwin, Charles. *The Origin of Species by Means of Natural Selection*. New York: D. Appleton and Company, 1896.
- Dawkins, Richard. *The Blind Watchmaker*. New York: W. W. Norton & Company, 1987.
- Dennett, Daniel C. *Darwin's Dangerous Idea: Evolution and the Meanings of Life*. New York: Simon & Schuster, 1995.
- Devall, Bill, and George Sessions. *Deep Ecology: Living as if Nature Mattered*. Salt Lake City: Gibbs M. Smith, Inc., 1985.
- Drengson, Alan, and Yuichi Inoue, eds. *The Deep Ecology Movement*. Berkeley: North Atlantic Books, 1995.
- Edwards, Paul, ed. *The Encyclopedia of Philosophy*. New York: Macmillan Publishing Co., 1967.
- Eiseley, Loren. *Darwin's Century*. New York: Anchor Books, 1961.
- Fox, Warwick. *Toward a Transpersonal Ecology*. Boston: Shambhala Publications, Inc., 1990.
- Goldsmith, Edward. *The Way: An Ecological World-View*. Boston: Shambhala, 1992.
- Goodpaster, K. E., and K. M. Sayre, eds. *Ethics and Problems of the 21st Century*. Notre Dame: University of Notre Dame Press, 1979.
- Hanson, Barbara Gail. *General Systems Theory Beginning With Wholes*. Washington, DC: Taylor & Francis, 1995.
- Johnson, Lawrence E. *A Morally Deep World: An Essay on Moral Significance and Environmental Ethics*. Cambridge: Cambridge University Press, 1991.

- Kant, Immanuel. *Critique of Pure Reason*. Trans. Werner S. Pluhar. Indianapolis: Hackett Publishing, Inc., 1996.
- Keller, Evelyn Fox, and Elisabeth A. Lloyd, eds. *Keywords in Evolutionary Biology*. Cambridge, Massachusetts: Harvard University Press, 1992.
- Leopold, Aldo. *A Sand County Almanac*. New York: Oxford University Press, 1966.
- Livingston, John A. *Rogue Primate: An Exploration of Human Domestication*. Toronto: Roberts Rinehart, 1994.
- Lovelock, J. E. *Gaia*. Oxford: Oxford University Press, 1987.
- Macy, Joanna. *World as Lover, World as Self*. Berkeley: Parallax Press, 1991.
- . *Mutual Causality in Buddhism and General Systems Theory*. Albany: State University of New York Press, 1991.
- Malloy, Thomas. *Curtain of Dawn*. [Salt Lake City]: n.p., 1987, 1997. N. pag.
- Margulis, Lynn, and Dorion Sagan. *Slanted Truths: Essays on Gaia, Symbiosis, and Evolution*. New York: Springer-Verlag, 1997.
- Mathews, Freya. *The Ecological Self*. Savage, Maryland: Barnes & Noble Books, 1991.
- Maturana, Humberto, and Francisco Varela. *The Tree of Knowledge: The Biological Roots of Human Understanding*. Revised Edition. Boston: Shambhala, 1992.
- McKinney, Michael L. *Evolution of Life*. Englewood Cliffs, New Jersey: Prentice Hall, 1993.
- Montague, Fred. *Wa-Maka-Skan*. N.p: n.p., 1997.
- Naess, Arne. *Ecology, Community and Lifestyle: Outline of an Ecosophy*. Trans. David Rothenberg. Cambridge: Cambridge University Press, 1989.
- Nash, Roderick. *The Rights of Nature*. Madison: The University of Wisconsin Press, 1989.

- Odum, Eugene P. *Fundamentals of Ecology*. 3rd Edition. Philadelphia: W. B. Saunders Company, 1971.
- Orr, David. *Earth in Mind*. Washington, DC: Island Press, 1994.
- Plant, Judith, ed. *Healing the Wounds: The Promise of Ecofeminism*. Philadelphia: New Society Publishers, 1989.
- Prigogine, Ilya, and Isabelle Stengers. *Order Out of Chaos: Man's New Dialogue with Nature*. Toronto: Bantam Books, 1984.
- Ricklefs, Robert E. *The Economy of Nature*. 3rd Edition. New York: W. H. Freeman and Company, 1993.
- Rolston, Holmes, III. *Environmental Ethics: Duties to and Values in the Natural World*. Philadelphia: Temple University Press, 1988.
- . *Philosophy Gone Wild: Essays in Environmental Ethics*. Buffalo, NY: Prometheus Books, 1986.
- Schumacher, E. F. *A Guide for the Perplexed*. New York: Harper & Row, 1977.
- Seed, John, Joanna Macy, Pat Fleming, Arne Naess. *Thinking Like a Mountain: Towards a Council of All Beings*. Philadelphia, PA: New Society Publishers, 1988.
- Sessions, George, ed. *Deep Ecology for the 21st Century: Readings on the Philosophy and Practice of the New Environmentalism*. Boston: Shambhala, 1995.
- Snyder, Gary. *The Practice of the Wild*. San Francisco: North Point Press, 1990.
- Sober, Elliot, ed. *Conceptual Issues in Environmental Biology*. Cambridge, Massachusetts: The MIT Press, 1984.
- . *The Nature of Selection*. Cambridge, Massachusetts: The MIT Press, 1984.
- Thompson, William Irwin. *Gaia: A Way of Knowing. Political Implications of the New Biology*. New York: Lindesfarne Press, 1987.
- . *Gaia 2: Emergence. The New Science of Becoming*. New York:

- Lindesfarne Press, 1991.
- VanDeVeer, Donald, and Christine Pierce. *The Environmental Ethics and Policy Book*. Belmont, CA: Wadsworth, Inc., 1994.
- Varela, Francisco J., Evan Thompson, Eleanor Rosch. *The Embodied Mind*. Cambridge, Massachusetts: The MIT Press, 1991.
- Vonnegut, Kurt. *Galapagos*. New York: Dell Publishing Co., 1985.
- Warren, Karen J., ed. *Ecological Feminist Philosophies*. Bloomington: Indiana University Press, 1996.
- Wesson, Robert. *Beyond Natural Selection*. Cambridge, Massachusetts: The MIT Press, 1991.
- Wilber, Ken. *Sex, Ecology, Spirituality: The Spirit of Evolution*. Boston & London: Shambhala, 1995.
- Zimmerman, Michael. *Contesting Earth's Future: Radical Ecology and Postmodernity*. Berkeley: University of California Press, 1994.
- Zimmerman, Michael, J. Baird Callicott, George Sessions, Karen J. Warren, John Clark, eds. *Environmental Philosophy: From Animal Rights to Radical Ecology*. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1993.