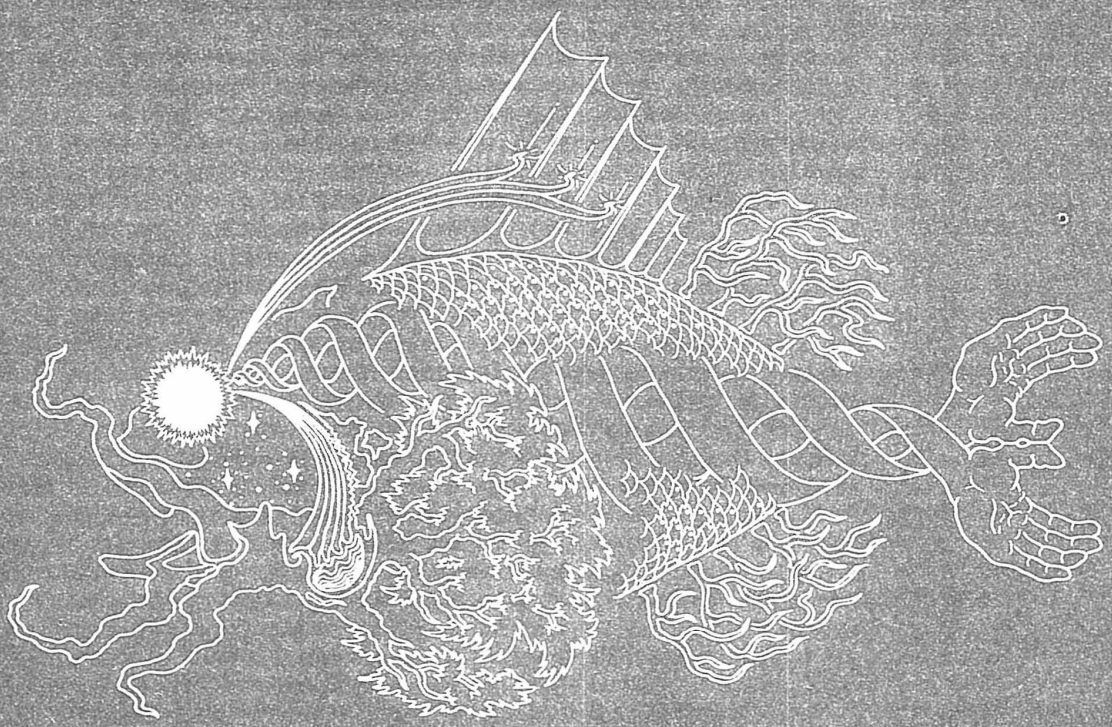

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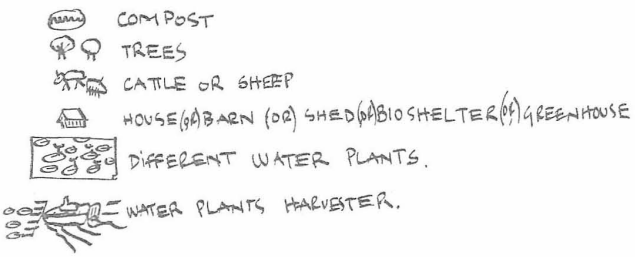


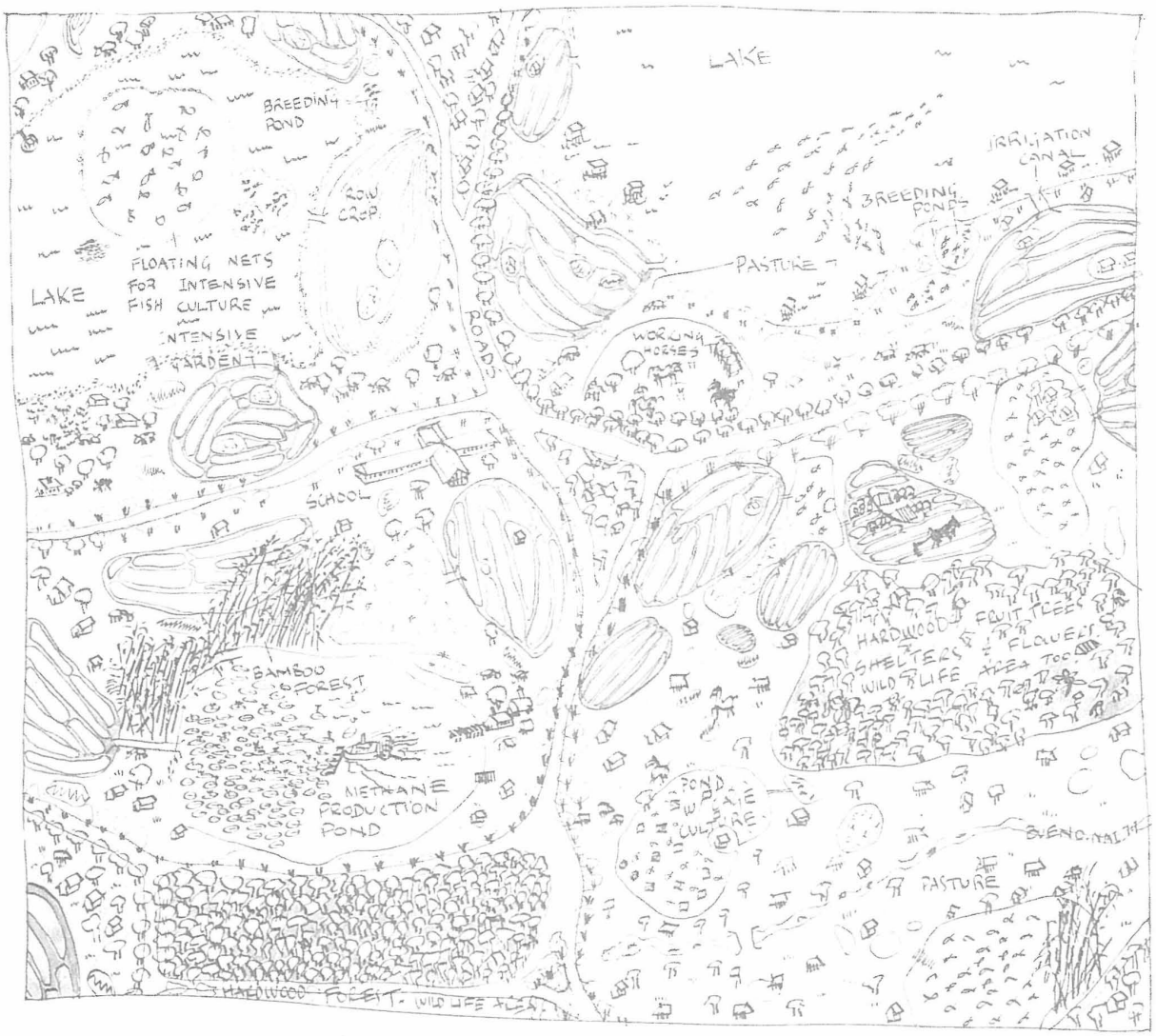
This section of the Journal *traditionally has been a mixed bag, a space in which New Alchemists and their friends could pursue their personal quests in areas that did not necessarily fall definitively into any of our other categories. This time, with "Sensitive Societies," Ron Zweig extends the thinking that he developed in an earlier article, entitled "Bioshelters as Organisms," to social applications of a biological analogy for the present mechanistic social structure. Like Lewis Thomas, he is a firm believer in those "spectacular symbionts —the chloroplasts and mitochondria tapping the sun and making use of it in aid of all the rest of us."*

In "Near Horizon Economics," Joe Seale indicates the disparities in thought between proponents of continued economic growth and those of us who come to weigh our actions in the judgment of coming generations, contrasting the traditional economic and the ecological ethic.

With Jeff Parkin's interview of Sava Morgan, the puzzling over learning which underlies so much of what we do is tackled straight on. Sava has been struggling for many years to find means by which one can learn what Gregory Bateson has called "ecology of mind." The medium that she has found most satisfactory for doing so is art, specifically drawing and painting. Most of the people who have worked with her maintain that she is the best art teacher they have had. Jeff, who has studied with her, shares this view and through his interview with her some of the reasons for it become apparent.

The last article is the transcript of a talk that was given by Francisco Varela at the Lindisfarne Fellows Conference in New York in June 1978 and was subsequently reprinted in the Lindisfarne Letter (8). I was profoundly impressed by the talk on first hearing it at Lindisfarne, equally so on rereading it. Bill Thompson has always warned that no matter how well intentioned one's acts, they contain the seeds of their opposite or shadow side. As the politics of ecology become more heated with the debate over nuclear energy and fuel shortages, the lesson of Francisco's experience of the political polarization that developed during the Allende years in Chile seems to me particularly apt. Weathering what is bound to be a fairly stormy transitional period in the next few years may depend less on vigorous partisanship than on learning to think, in as much as we can, about the entirety of the situation, upon what Varela and Bateson call our epistemology.

NJT



Sensitive Societies: A Biological Perspective

Ron Zweig

"How can your philosophy of decentralization and ecology be concretized into a useful framework for society?" This question was posed by a visitor one Saturday at a workshop at New Alchemy led by Murray Bookchin. I found the question of interest for two reasons: the first being the man's selection of words, and the second, the theme implicit in his question.

It is important to consider the way in which a question is asked to be able to give an answer with the proper perspective. In the case of our visitor the rigidness of his terminology called for an extensive reply. In pursuing the idea of an ecological perspective for social design, the word "concretize" creates some difficulty because the very general nature of the question implies a universal solution, applicable to diverse social climates which, even in North America, are the case. Such a concept without flexibility for the particularities of region would, in itself, be unecological. The integrating of decentralization with ecological principles is critical in seeking a viable approach to design for human communities.

This becomes evident in considering the various

bioregions of the continents throughout the world. The "biogeographical provinces" which Dasmond and Udvardy's work illustrates indicate the necessity for specific evaluation of a particular region as to its resources and climate, assets and limitations.[1] With these criteria in mind, the paradigm for an ecologically based human society, one that adapts with minimal impact into the larger ecosystem, can be formed. The design principles inherent in biological systems offer an excellent early foundation for an enduring social structure. Many of these are found consistently in all living organisms, and considerable data from research on individual cells to that of ecosystems has been documented in scientific literature.

Cells are the modular units, or simplest forms, of life. Essentially, cellular processes are miniature analogs of the mechanisms of larger life forms. A remarkable number of the better designs for human community have been engineered to parallel cellular functions. The sections following will describe some of the potential for the adaptation of the principles of cellular processes, but before doing so I should like to restate the question that prompted this inquiry into one that is more workable. "How can we use the principles of decentralization and ecology to restructure a guide for human society?"

THE PARADIGM OF THE CELL

The analogy of a cell to larger systems has been used before to increase our comprehension of living systems. In *The Lives of the Cell*, Lewis Thomas portrays the earth as reflecting the image of the living cell.[2] Lynn Margulis and James Lovelock, in their *Gaia* hypothesis,[3] look at the earth as a single ecosystem—the biosphere—and postulate that a deleterious impact on any portion of it would threaten the health of the entire planet. Such a perspective, conceptualizing the earth as a single, interconnected, living organism opens our minds to planetary consciousness. Such a supposition makes it impossible to ignore any longer that human enterprise must be considered within such a framework. Human activity must be integrated to have minimal impact on indigenous ecosystems yet be woven intimately into specific environments. The perceivable intricacies found within the microcosm of the cell teach us how living systems function. Their mechanisms have been developed through billions of years of evolution. An understanding of the processes of the cellular microcosm can be extrapolated to the study of the dynamics of the macrocosm of the biosphere and for this reason, the use of the cell as a model is appropriate.

> We shall not cease from exploration
> And the end of all our exploring
> Will be to arrive where we started
> And know the place for the first time.[4]

BIOENGINEERING & THE ORGANELLES

The mechanisms in cell biology applicable to the design of a human society are (1) the means of energy production, (2) transformation of energy to a widely applicable form, (3) the use of resources in productivity, and (4) the way in which productivity is managed and controlled. These are associated with different structures in the protoplasm of the cell.

The process by which the living cell incorporates these processes into means of internal productivity involves a complexity of networks in close biochemical communication. Within the cell, energy production and utilization, and protein production are in delicate balance and there is a direct relationship between chloroplasts, which are the organelles involved in photosynthesis, the mitochondria or subcellular components producing biochemical energy, and the ribosomes, which are the sites of protein production.

Essentially the chloroplasts are solar-driven factories within the plant cells. Through photosynthesis, the organelles produce sugars which are a primary energy source for other cell processes. The main compounds are water and carbon dioxide. Oxygen, as well as sugar, is a by-product of the reactions. Some of the oxygen is used by the cell in respiration. Excess quantities are released into the atmosphere. The excessive quantities of oxygen, in a sense, are waste products resulting from intensive productivity. Such efficiency and incorporation of all residual products, would be well worth emulating in industrial enterprises. The energy in the sugar produced by the chloroplasts is in a form that can be stored and used readily by the mitochondria.

The mitochondria function as generators of energy for biochemical reactions. They utilize the chemically bonded energy stored in the sugar molecules to produce ATP (adenosine triphosphate) from ADP (adenosine diphosphate), a compound that is a lower form of energy. This process is cyclic. ATP is readily accepted by almost all cell processes and provides the energy necessary for their operation. It is the task of the mitochondria to transform the energy in sugar into a mode useful for other biochemical processes within the cell. This activity of the organelle could be likened to that of an electricity generator. The chloroplast would be analogous to a windmill. Without its storage

[1] R. Dasmond, 1976, "Biogeographical Provinces," *The CoEvolution Quarterly*, 11: 32–35.

[2] L. Thomas, 1974, *The Lives of the Cell* (New York: Viking Press).

[3] L. Margulis, and J. Lovelock, 1975, "The Atmosphere as Circulatory System of the Biosphere: The *Gaia* Hypothesis," *The CoEvolution Quarterly*, 6: 30–40.

[4] T. S. Eliot, *Four Quartets*, 1

capacity, the sugar could be compared to the mechanical energy of a machine that can be used to drive a generator to produce electricity and to charge batteries, and is like the mitochondria in relation to the ADP to ATP reaction. The weakness in this analogy lies in the stages of energy storage, but the basic premise remains valid.

The respective sizes of the mitochondria and chloroplasts are nearly uniform. They are not contained in a single structure. Rather, the requirements that are answered by their processes are spread throughout the cytoplasm of the cells. Each cell contains different numbers of organelles, depending upon need. The entire cell is not dependent upon a single, large energy producing station. Both organelles contain their own genetic material and are capable of independent replication, dispersing the control of some processes throughout the cell, and leaving the responsibility for other activities to those entities directly involved in the particular process. Current ideas for decentralizing energy production are somewhat analogous to those of the cell and its micro-ecosystem.

This design permits a specific cellular reaction to take place at the site where it is required, reducing the need for extensive internal transport systems. Protein synthesis, for example, takes place throughout the cytoplasm, wherever there are ribosomes. Proteins are necessary for all structural and enzymatic activities. ATP is required for energy for their synthesis. The mitochondria found near a ribosome facilitates the supply of the energy compound. This is also the case for chloroplasts and mitochondria.

Proteins are made from a series of linked amino acids that can be used over and over again. Rather than repeat the energy-intensive process of synthesizing at every level in the food chain, biochemical means have evolved capable of breaking down proteins into individual amino-acid building blocks. For example, when one eats a carrot, the proteins in the carrot tissue cannot be used directly but, through the digestive process, are broken down into separate amino acids and then reassembled into useful proteins. Although extensive recycling of materials is a relatively novel concept in our society, it is an efficient process, well-tested in cell systems that are not involved in primary productivity.

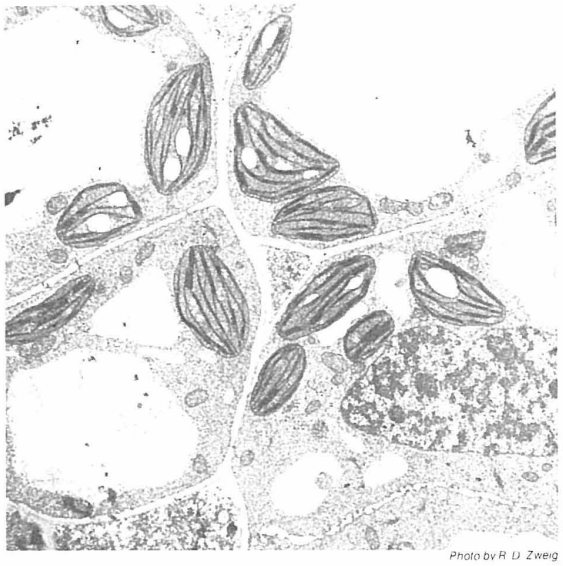


Photo by R. D. Zweig

MANAGEMENT AND BIOLOGICAL FEEDBACK

A last mechanism of the cell should be discussed before beginning an attempt to extrapolate to human settlements. There is, within cells, a tight management scheme for internal functions which are extensively governed through feedback pathways. It is known, for example, that the codes for protein synthesis are found in the cell nucleus. The nucleus secretes messages used by the ribosomex to produce a particular protein. It has been found that this sequence of events is controlled by the amount of protein available. A particular protein, in sufficient concentration, is capable of self-regulating the processes of its own synthesis. The effectiveness of this mechanism in any production scheme is obvious—the more direct the communication, the better the chances for healthy equilibrium or a viable economy.

APPLICATION OF CELL PRINCIPLES TO A HUMAN COMMUNITY

One way to approach ecological design is to look at existing engineered technologies. The chloroplast could be seen as offering an analogy that could be used to create more efficient sewage treatment plants that could convert wastes to usable products. At the present, there are facilities that have been designed and are in operation containing several of the stages of operation necessary to achieve such a goal. In such systems raw sewage is put first into primary treatment ponds where the solid material is converted to sludge through bacterial activity. Methane gas is generated through this anaerobic process in quantities sufficient for the mechanical operation of the sewage plant. Possibly excess heat from the process could be channeled into a district heating scheme, but this would depend upon the quantities available. The heat made available through this and other manufacturing processes could be utilized as a back-up for auxiliary passive solar architecture designs. As with cells, such an interconnected network is essential for the most efficient use of available resources.

The sludge can be converted to organic fertilizer for agriculture. The conversion process could be done using earthworms, and these in turn could be used in fish culture.[5] Perhaps the amount of sludge could be considered as an indicator of the amount of food necessary to sustain a community. If all food residues and human wastes were run through such systems, it should be possible to calculate the amount of food needed, providing a mechanism for direct feedback. Agriculture of a scale suitable to provide sufficient food could be designed to surround the settlement. Sludge fertilizer would be combined with compost from local plants and from inedible parts of harvested food plants.

Designs are being developed in the secondary stages of sewage purification that use algae in treating residual gray water. The algal cells can be removed through filtration and the water returned purified to the environment. The stability of such a system is obviously dependent on the quality of the sewage entering the plant and would have to be restricted to organic wastes free of heavy metals and toxic hydrocarbons. This remains a problem in most cities where municipal wastes enter a common sewer system. As is true with size of cells and organelles, the scale of a community remains an important consideration.

* * * * * * * * * * *

Clearly, the above example is a simplified version of what will be necessary. What it does is offer a partial format for community designs that would be analogous to biological systems. It would be naive to assume that the model of a cell is a complete answer. The greatest strength of any biological system comes from the diversity of its components. Just as with the mixing of genes, inbreeding within a species gives rise to an increased potential for matching weak genes that could threaten the vitality of an individual and should, therefore, be avoided. It is best at this crossroads in design for human communities to combine the strongest components from a wide range of paradigms to create the most broadly applicable understanding. What has been true in the evolution of life itself should be true in evolving fundamental principles for community development. Synthesis with relevant ecological concepts provides the greatest chance for long-term stability in a society. Hopefully, the outcome will be a sensitive symbiosis.

[5] J. Parkin, 1978, "Other Friends of the Earth," *The Journal of The New Alchemists*, 5: 69–72. P.O. Box 47, Woods Hole, MA 02543.

Photo by Hilde Maingay

Near Horizon Economics and Renewable Resource Based Technologies

Joseph Seale

Modern industrialized countries virtually do not engage in any planning that extends beyond a decade ahead. In capitalist countries government planning is viewed with suspicion and fear of regulation and bureaucratization. It is discount rates, which represent competitive interest plus inflation and dictate the present value of anticipated future returns on invested capital, that substantially determine the time horizons of corporate planning. This sets those horizons very near in inflationary times.[1] Economic planning by individuals and families shapes the future only at the family level. The purchase of a house, for example, affects where and how one lives, or saving to send children to college affects their education and vocational future. But the way in which invested family money is used outside the family is seldom a family concern. Monetary abstractions of security, earnings, and growth rate obscure the particular impacts of investments on the direction of technological evolution. Capital return becomes the sole measure of investment value despite the multidimensional consequences of investments.

Before the industrial revolution, and to a lesser extent even up to the beginning of this century, there was considerable planning inherent in cultural tradi-

[1] For example, by geometric discounting (only one method), at a 25% annual rate (not uncommon for internal industry investments), next year's $1.00 earnings has a "present value" of $.80 (divide by 1.25), or $.64 two years hence (divide again by 1.25), then $.51, $.41 and $.33 for the $1.00 earned five years hence. Far-future anticipated returns, negative or positive, carry little weight in investment computations.

tions as the long-range consequences of certain activities were known by cultural experience. Planning did not depend on anticipating a future unlike any time in the past. But if cultural experience once bore some weight in decision making, modern forecasting seems useful, in practice, mainly to buttress self-righteous I-told-you-so's after a gloomy forecast comes true. It seems that now, as throughout history, people learn lessons the hard way as they are confronted by tangible consequences.

Increasingly tangible evidence is bringing many people to believe, however, that the future debts incurred by present types of industrial activity are rapidly overtaking us, and that, if our civilization is not to be swamped, our planning must begin to make allowance for debts bestowed on the future. The simple pollution-control measures of a few years ago are beginning to acquire dimensions of ecosystem management and future planning. Advocates are arguing for renewable resource based technologies to curb the depletion of and dependence on finite resources. They argue for an economy that future generations can carry forward.

Others contend that the strongest buffer against pollution and economic collapse is a strong industrial economy equipped with energy producing technologies that are equal to the tremendous energy costs of recycling materials and fighting pollution. Most of those of this persuasion consider that nuclear technologies alone can be implemented on a scale necessary for long-term needs, with pollution costs and hazards we can accept. Although many disagree with their assessment of nuclear pollution and hazards, few contest the warnings of nuclear proponents about the environmental costs of massive-scale coal-electric generation. Many people look to space for future resources. High-technology advocates argue that historically we have always been able to discover new resources, unimagined by our predecessors, as the need has arisen. They contend that the future can best take care of itself if we build a strong present, by which they mean not breaking the stride of a successful growth economy.

Both sides argue for national-scale priorities, although many renewable technology proponents favor that the priorities be accomplished not monolithically, but in ways that are appropriate regionally and by relatively small groups. This essay proposes that it is only as individuals and groups, in our economic and vocational activities, that we can effectively take responsibility for directing technology development according to long-range, whole-system value criteria. Such direction will not be accomplished by governmental edict that bureaucracies be funded to study large systems of the future, nor by legislation that industries follow the recommendations of experts or lobbies. We have a system in which individuals, and consequently the corporations they form, are encouraged to act entirely according to self-interest while the government is asked to determine what activities work to our collective detriment and to regulate economic activity accordingly. Yet regulation of one sector of the economy affects other sectors and other activities in ways that are as yet only poorly understood, and the impact of regulation is to generate confusion and waste.[2] The problem inherent in the free enterprise alternative, when self-interest degenerates into greed in the context of a corporate economy, is that anticompetitive activities can destroy the freedom of enterprise.

I have little confidence in either government regulation or in regulation entirely by "the market." If individuals are to intervene to the benefit of the whole system, which I believe is the only viable path, that intervention must arise from a basis broader than narrow self-interest. Intellectual tools, like an understanding of the downstream consequences of present choices, will only help. More critical is a sense of cultural continuity, an awareness of relationships to generations past as well as future, and an awareness of and reverence toward the interdependencies of all life in an ecosystem. While various traditional moral codes incorporate particular dimensions of ecosystem awareness, we, for a broadly ecological ethic, must look to a few long-lived primitive societies. Where we find such an ethic, it is not imposed by higher authority so much as it is integral to the prevailing concept of the self in relation to nature.[3] I should like to look at such cultural themes in relation to the theme of economic time horizons, and consider a few historical examples of changing time spans for investment planning.

In 1900, a young father might have invested his family capital and subsequently his labor, in land that he hoped to improve for the benefit of his new family and his grandchildren. His great-grandchildren would have lived beyond the time frame of his lifetime and his imagination.

In the Middle Ages, artisans labored to build cathedrals started before their birth and completed long after their death. Cathedrals were an investment to the glory of God on the part of the whole society to come full term with the Second Coming of Christ.

Before they made contact with Europeans, the Plains Indians of North America tried to live as to leave no trace of their life's passage on the land. Lasting value lay not in monuments, but in the uninterrupted cycles of nature. One's final investment toward maintaining natural cycles was one's body, whose decomposition

[2] See Gregory Bateson, "Conscious Purpose Versus Nature" and "Effects of Conscious Purpose on Human Adaptation," essays appearing in Part V of his *Steps to an Ecology of Mind* (Chandler Publishing Company). These essays apply not only to regulation of economic activity, but to human regulation of natural ecosystems, a topic of the remainder of this paper.

[3] See Wendell Berry's essay, "A Secular Pilgrimage," from his collection, *A Continuous Harmony* (a Harvest book, Harcourt Brace Jovanovich).

would return the last of borrowed sustenance to the soil that gave life, although the word "investment" hardly fits here, for its modern usage implies the channeling of human effort or the currency of human effort, capital, to improve on the natural state of things. Currently investments are not based on the eternal cycles of nature.

Modern industrial equipment is amortized fully in about five years. Beyond that horizon, today's equipment is scrap. An example can be seen in the IRS schedules whereby companies depreciate capital equipment to salvage value in about five years. Computers give way to faster, more powerful computers. Typewriters give way to word processors. Fixed typewriter fonts yield to interchangeable fonts. Mechanical linotype fonts give way to evolving phototypesetting methods. Next come cathode ray tube (CRT) scanned optical fonts, then digital fonts that control CRT letter formation, and now digital fonts that steer laser beams to make offset plates in one step.

For a more detailed example of economic pressures leading to rapid technological advancement and equally rapid obsolescence, we should consider oil-well drilling technologies. Mud drilling, based on pipe rotation to turn rolling conical studded bits, mud flow to carry away cuttings, and drill stem weight for cutting force, is being challenged in dry continental formations by faster air drilling, which uses a flat studded bit face, compressed air to carry cuttings up the hole, and pressure differential between air and high internal pressure rock to eliminate the need for great mechanical cutting force.[4] Drilling with bits may be made obsolete in the future by fast erosion drilling, which uses very high pressure (up to 15,000 psi) drilling mud jets to cut through rock.[5]

Equipment becomes more specialized, complex, expensive, and far more productive—of necessity. To continue with the example of fast drilling technologies, large shallow continental fields run dry, forcing drillers to go deeper, or out to sea, for smaller returns in oil. Production demands drive companies from $4,000 per day shallow drilling in east Texas to $10,000 per day drilling in deeper, harder formations in the Rocky Mountains to $25,000 per day for shallow Gulf of Mexico drilling as high paying onshore reserves dwindle. From there, costs climb to $40,000 per day for U.S. East Coast offshore drilling, $40,000 to $60,000 per day for North Sea drilling, as waves, weather, and remoteness add their costs, and to $100,000 per day to drill through Arctic ice in northern Canada in search of even more difficult reserves. Completion times increase exponentially with depth, from a day or two in east Texas to four to six days for 8,000 ft. wells in southern Louisiana, to more than a year for 25,000 ft. mid-continent wells. Pressures for increased productivity, drilling speed in this case, come from the need to go to great depths, from high daily operating costs (crews, fuel, management), from interest on tied-up capital (drilling rigs, ships, offshore platforms and leases), from inflation, taxes, and ultimately from competing equipment manufacturers. These pressures force rapid technological evolution and correspondingly rapid obsolescence of equipment. Inflation is really having to spend more to get the same thing; however, some people claim that inflation can be cured by redirected government economic policy and ignore patterns like this. Do they think we can legislate easy-to-recover petroleum back into the ground?

On a deeper level, short horizon economics are a symptom of a race to stay in one place, to maintain our economy and our lifestyles even while nonrenewable resources vanish and must be replaced by resources that are harder to obtain, like offshore petroleum; or are currently more challenging to use, like solar energy (as contrasted with fuel oil), or depleted soils (as contrasted with the rich soils our ancestors used). The costs of environmental pollution and ecosystem damage have begun to acquire important economic proportions. We are racing to invent our way out of the consequences of past actions.

How do markets move from long to short range economics? Take agricultural land as an example. Land was once a very long-term investment, especially in Europe, where a tradition of conservative land management had evolved around centuries of use of a finite resource, which is an example of "planning" integrated with cultural tradition. Much of the investment was not so much in the land as acreage, as it was in the soils. Management included rotations of nitrogen-fixing legumes, soil-holding cover crops, and nonmarket "green manure" crops to be turned under for soil fertility. Animal husbandry and market farming were complementary, as manure was a necessary part of agriculture. The land produced "fuel" for draft animals, and the animals returned fertilizer.

With the settling of America, people discovered that they could use land more easily as a nonrenewable resource and neglected conservation practices. Depleted soils could be abandoned for land further west which led eventually to the geographic separation of farms and markets, a pattern that now locks us into costly long-range transport of food. Later with chemical fertilizers, farmers found a technological fix for the accumulating consequences of their nonconserving practices. The tremendous success of fertilizers led farmers to ignore tradition altogether. Increasing mechanization encouraged larger field size. Mechanization, economic pressure, and loss of a cultural

[4] Mile-deep rock is under extreme pressure of rock weighing down from above. In air drilling, this internal pressure causes rock to break loose easily into the much lower pressure air environment. The drill bit does comparatively little work.

[5] Roy Long, Jr., Tenneco Oil Co., provided most of the specifics for the above paragraph.

memory that trees are useful in agriculture led to the cutting of windbreaks. Consequently, wind-caused crop damage and erosion increased. Birds would not venture out across large fields, far from protective cover, to feed on agricultural pests. And the simplified soil ecosystems bred of chemical fertilization and pest management did not support the biological balances that once held many pests in check. Selective evolutionary pressures from pesticides caused fast-evolving insects to develop resistance while bird populations that evolve more slowly dwindled, enforcing the escalation of the pesticide war. Further destruction of soil microbial ecosystems reduced the pathways by which soil minerals were converted to compounds available for uptake by roots, while breeding for optimal productivity with fertilization led to dwarfed root systems equipped to feed only on soluble fertilizers.

In modern practice, "soil" is used in the singular, for its use is largely undifferentiated. Soil is space for plants to grow in sunlight. Soil is a floor to bear the passage of plant-tending machinery. Soil is a mechanical structure stable enough to hold plants upright by their miniaturized root systems. Soil is capillary structure to hold the nutrient chemical solutions on which roots feed and the vermiculite of the most economical form of mass hydroponic food production. Soil fertility has moved from an investment lasting for generations to a one-season investment: chemicals on, crops off. Land under this type of management acquires a time horizon for agricultural use of decades, not centuries.

Current economies rely largely on resources that are either nonrenewable and in short supply or else in imminent danger of depletion faster than can be resupplied by nature. It seems relevant to ask which forms of resource depletion are most likely to affect the race to invent our way out of past consequences.

Fossil fuels, particularly petroleum, are becoming harder to recover as prime reserves vanish. Long before supplies are gone, several rising costs will combine to outweigh the value of these resources as fuel. These include the rising recovery and extraction costs mentioned earlier, as in offshore petroleum, oil shales, tar sands, land reclamation costs in relation to strip-mined coal and oil shales, and the costs of pollution control for substances like high-sulfur coal and petroleum. The uses of fossil resources in chemicals and materials are likely to outlast fuel uses, but at a price.

Metals are becoming harder to recover. In cases like aluminum, ores are abundant, but the tremendous energy requirements for electrolytic refining binds the costs of aluminum to energy costs. In other cases, supplies of good ores will be more limiting, and metal recovery from poorer ores costs much more in labor, equipment, and energy. These rising costs pose a threat to the construction of many of the devices supposed to form the basis of renewable resource technologies.

Soils are being depleted in two ways. Erosion has already claimed about one-third of American topsoils, and loss is accelerating despite $15 billion spent since the 1930's to fight erosion. The destruction of soil structure, organic matter, and microbial ecosystems is reversible in principle, but only over decades, and at considerable expense. This soil destruction enforces the continuation of the agricultural methods that brought it on, while the quality of soil, even as a hydroponic medium, deteriorates with the on-going loss of organic matter. Microbial ecosystems are essential both for the conversion of soil minerals to compounds useful to plants and in the return of potentially recyclable components removed with the harvested crop.

Water resources are coming to be used to capacity. In agriculture, destruction of soil structure reduces water retention, increasing both the demand for irrigation and rainwater runoff, accelerating erosion, and creating expensive flood-control problems. It is easy to forget that the kind of damaging floods we commonly experience or read about were rare in North America 200 years ago. Industrial uses of water, such as pumping water-suspensions of crushed coal from mines to generating plants, threaten to lower water table and disrupt ecosystems, ultimately destroying soils and species.

Mineral phosphate reserves are declining rapidly. This is tied again to unsustainable soil management, which fails to recycle phosphrus-bearing manures, sewage, and garbage, and allows the leaching of phosphorus from poor soil structure.

The genetic stocks of the biosphere are being destroyed, as the last areas of arable land are brought under tillage. Modern agriculture has relied on the infusion of diversity from wild genetic plant-stocks to develop new domesticated breeds that combine good productivity under specific growth environments with pest and disease resistance. But the green revolution led to the development of plants optimized for petro-chemical-based agriculture. The decline of fossil fuel resources will generate needs for very different crops and these cannot be developed without genetic raw materials.

It is currently common to call the depletion of such resources an "energy crisis." While energy is indeed very important to an industrialized economy and to industrialized agriculture, the term "energy crisis" seems frighteningly narrow, as the issues raised above should suggest. And the measures that are proposed to fight the "energy crisis, with vast energy-producing technologies, are still more frightening for the capital and the intelligent thinking that such projects would divert from whole-system problems and

from the underlying roots of the symptomatic energy shortages. Increasing numbers of people are advocating efforts toward breeder fission and hydrogen fusion technologies that would require commitment of a large fraction of the national GNP. While the costs of dealing with the side effects of nuclear power cannot be argued concretely, as they are unknown, and the necessary technologies do not exist, the fact that the costs of dismantling the first spent reactors had exceeded their huge construction costs warns of future economic debts on an unprecedented scale. Unfortunately, some proposals for renewable-resource-based technologies, particularly those focused single-mindedly on the production of energy outside contexts of use, sound equally inadequate, if a little more benign. Two examples will illustrate.

Many engineers propose planting monocrop stands of fast-growing fuel trees, clear cutting and replanting every two to four years. Whole trees would be removed and burned in electric generating plants. Could such practice result in net profit and sustainable yields, or would it use forest soils as nonrenewable resources? Agricultural experience by now should indicate the high energy costs of maintaining stable immature monocrop ecosystems against a biosphere that attempts to reimpose diversity. Pests are certain to require constant control. Regular irrigation, fertilization and herbicide control are anticipated as though there would be plenty of water for this new and massive need, and as though the energetics of fertilizer and herbicide manufacture without petrochemicals would permit such practices.

What would be taken from soil? Nitrogen. Phosphorus. Potassium. Carbon, which is organic matter from decay. Minerals. Short-horizon agriculture recognizes the first three elements primarily. The nitrogen compounds in wood would generate volatile, polluting stack effluents. Would such compounds be scrubbed from stack gases and processed to a form more suitable for fertilization? Or would it be cheaper to dispose of scrubbed effluents and synthesize fertilizer from atmospheric nitrogen? Power-plant ash would contain phosphorus, potassium, and trace minerals that hopefully could easily be returned to soils. What of carbon? Fuel woods would be hardwoods, whose leaves are better soil builders than needles. Is that sufficient? Or will the soil structure deteriorate?

Natural forests, and some managed European forests as well, contain decaying trees that provide food for bacteria, fungi, insects, and ultimately birds and small mammals. Varieties of seeds from different tree species feed birds and animals, thereby creating niches for larger predators. The droppings and decaying bodies of the insect, animal and bird life sheltered by a forest provide soil-building inputs beyond the mere chemical elements necessary. Enduring soil ecosystems which maintain structure and microbe-driven nutrient cycles have evolved with these inputs. Pests are a result of predator-prey imbalances that seldom occur in forests with mature trees, species diversity and the accompanying diversity of animals, birds, and insects.

Forest managers try to maintain early succession ecosystems that are more productive than climax forests. In nature, less mature forests are more diverse than slow-moving climax forests. To push for both extreme immaturity and uniformity implies difficult, energy-intensive management. It seems doubtful that many current biofuel forest plans would fundamentally have a more renewable basis—in fact, coal would probably be a much longer-lasting resource than unwisely exploited forests.[7]

Can windmills become part of a sustainable economy? Once, wind machines were used to accomplish mechanical tasks directly, primarily those of grain milling and water pumping. The products of these tasks, flours and pumped water, could be stored for the duration of calm spells. Now that energy production and task performance have evolved into separate specialties, windmills are being designed almost exclusively to produce one of the prime commodities of energy exchange, electricity. For that single purpose, windmills are being made more efficiently year by year in the manner of industrial products in general. But, unlike grain milling or water pumping, the task of electricity generation alone is incomplete and requires an array of other devices to serve human needs. Electrical systems cost enormous amounts of capital, energy, and materials to build.[8] For wind-generated electricity systems of the near future, fossil fuels are likely to provide much of the back-up power for periods of inadequate wind. But once the chemical energy stored in fossil fuels is depleted, as when the energy costs of recovery exceed the energy value of the fuels, then the high costs of other forms of electrical energy storage and back-up power will further diminish the net absolute worth of wind-powered electricity generators.

This is not an argument against the relative merits of the wind-generation of electricity, which look quite

[7] For a more hopeful view of what can be accomplished through sound agricultural and forestry management, see Earle Barnhart, "On the Feasibility of a Permanent Agricultural Landscape" in *The Journal of The New Alchemists # 5*. While Barnhart's paper indicates constructive approaches for dealing with many of the specters raised here, the paper makes it clear that implementation of these approaches can happen only in a context of long-range economic planning.

[8] See Amory Lovins, *Soft Energy Paths: Toward A Durable Peace* (Friends of the Earth and Ballinger Publishing Co.) for broad-ranging research into these costs and their implications. For a briefer view of some of the solar technology implications of electrical system costs, plus concepts on systems integration, see Joe Seale, "Sun, Wind, and the Power Company," *CoEvolution Quarterly*, Winter 1978 79 issue. For an end-use oriented, integrated wind system description, see Joe Seale, "An Integrated Wind-Powered System to Pump, Store, and Deliver Heat and Cold" in this issue of *The Journal of The New Alchemists*.

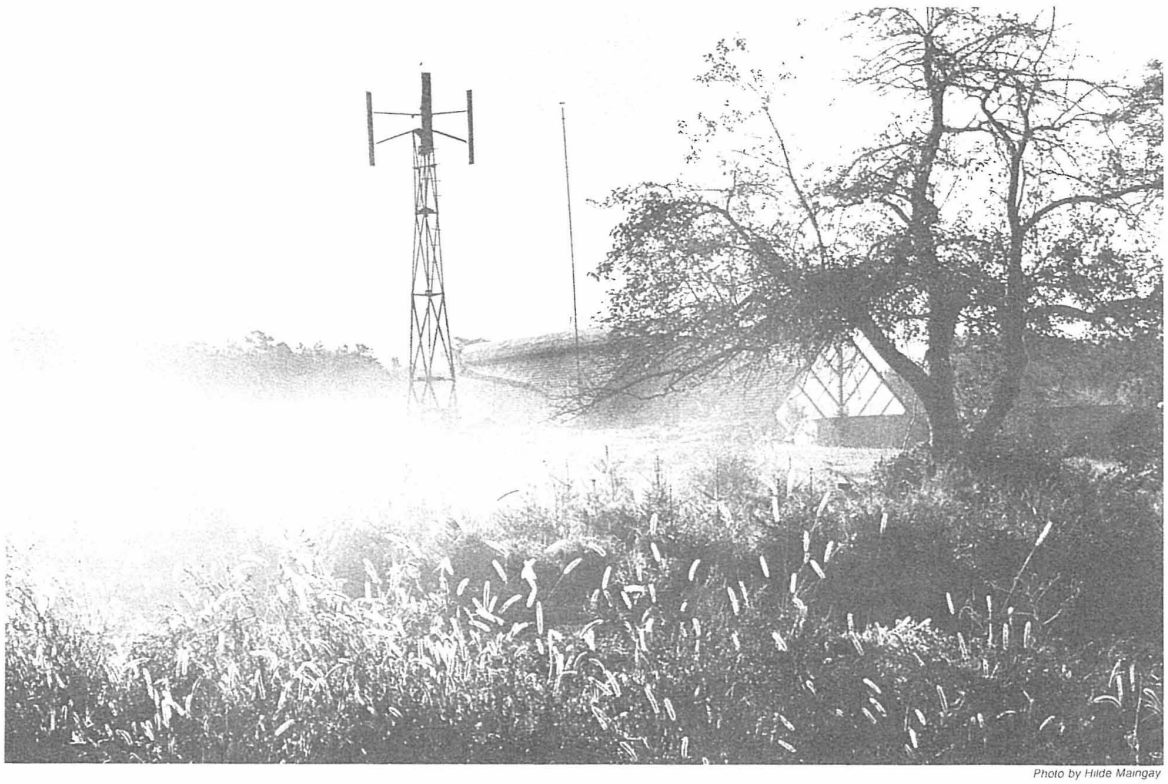


Photo by Hilde Maingay

favorable. For certain premium uses where continuous energy in electrical form is indispensable, or where power can be intermittent with the wind, wind-generated electricity is likely to rank with the best energy resources. The question of net absolute worth is as follows: Will the costs of future total wind energy systems for continuous power approach or exceed the value of their lifetime energy production? If the costs are too high, then such systems would require a net subsidy, even though they might be constructed for their special utility in limited applications. This caveat applies to other renewable resource technologies. Only the best-conceived renewable-resource-based economy, as a well-integrated assembly of component technologies, is likely to be self-sustaining. The "out" of continuing much longer to discover new nonrenewable resources to exploit seems less promising. Only clear systematic thinking and planning will sustain us.

As I said earlier, the problems we face are much too broad to be termed an "energy crisis." Gregory Bateson reminds us that what is called "human energy," and especially "psychic energy," seldom means the kind of energy defined by Newtonian and Einsteinian physics, and would better be termed information, control, or intelligence.[9] That a light bulb and a computer consume equal wattages says nothing of their comparative "computing power." The "energy" crisis might more properly be called an information crisis, a failure of intelligent control of our technology. The examples from agriculture and forest management should indicate the ways in which ignorance of how ecosystems can help us achieve human ends has led to prodigious expenditures of real energy, the kind measured in Btu's or horsepower hours or kilowatt hours. Eugene P. Odum made a statement about plant "energy" and human "energy," meaning energy plus information or organization: "A lot of energy (human or otherwise) other than fuel is required to keep machines running, repaired, and replaced; it is not fair to compare engines and biological systems unless this is considered, because the latter are self-repairing and self-perpetuating."[10] The folk adage is, "Things break down." Whereas broken-down machines are scrap requiring energy for disposal or recycling, dead plants and animals in a healthy ecosystem provide both nutrients and food energy to the microbes that carry their material back into the cycles of plant and animal life.

American Indians were the last residents of this land to participate fully in such cycles. Can our society find ways to build sustainable technologies with intelligence, especially biological intelligence, where brute energy has failed us? Beginnings of positive answers

[9] Gregory Bateson, "Form, Substance and Difference," op. cit. After reading this and the two essays mentioned previously, the reader may well be inspired to tackle the whole book of essays, which is wonderfully wise and coherent.

[10] Eugene P. Odum, *Fundamentals of Ecology*, W. B. Saunders Co., p. 77

lie all around us. Solar greenhouses that avoid the costs of heating fuel and produce vegetables in the area where they are consumed cut into the cost and resource depletion of long-range food shipment. Bioshelters combining greenhouse agriculture with aquaculture make double use of water for thermal storage and fish raising, use algae and bacteria to purify the water and help feed the fish, use fish wastes to fertilize plants, and use compost heat and CO_2 to enhance plant productivity before the finished compost builds soil fertility and vitality.[11] A waste-water treatment facility that was half as expensive to build as its chemical-based counterparts uses sunlight, rather than fossil or nuclear-derived energy, and plants for energy conversion to purify water.[12] Some of the plants promise to become useful as cattle feed. A large mixed farm in Iowa operated according to biological principles has slightly lower productivity per acre than neighboring farms using chemicals but it operates in the black, because of reduced operating costs, whereas neighboring farms are owned by the banks.[13]

Another issue of trade-off between energy and intelligence involves the conflict between corporate structure and the efficient integration of systems. Industry is geared toward the manufacture of modules and will, for reasons of profit, promote the sale of complete modular systems over the sale of materials that require finishing outside industry. On the marketing side, advertising is effective at selling modules, not concepts. The best practical example of this is solar space-heating systems. Industries have developed and promoted modular component systems consisting of solar collectors, heat-storage reservoirs, heat exchangers, blowers and/or pumps, and controls. These modules taken together are a direct physical and conceptual replacement for a furnace heating system. The concept being sold is simple: "The fuel for this furnace is free." This sort of marketing molds popular opinion, even though high costs prevent large sales. How many places do we see slogans like "Plug into the Sun and Wind!" or "Switch to Solar Energy!" as if simple substitution of one form of energy for another, all in the same unintegrated framework, would cure our ills? Now that solar space-heating has been identified in the popular consciousness with active solar-collector systems, intelligently edited magazines and journals carry the post-mortems: " . . . uneconomical . . ."; " . . . unfulfilled promise . . . "; " . . . complex and unreliable . . . "; " . . . too costly for the homeowner. . . ."

Meanwhile, a new tradition of integrated solar architecture based on the initiative of many individuals and not supported by mass marketing is gaining a foothold. Glass walls with insulating shades are more expensive than insulated walls, but far less expensive than insulated walls plus solar collectors plus thermal transport mechanisms. Designed-in masonry or water containers exposed directly to sunlight are more cost-effective storage media than rock storage piles with blowers and ducts, or than water tanks with pumps and blowers and heat exchangers and ducts. Granted, the more passive integrated solar approaches offer less tight temperature control, but that is a trade-off that increasing numbers of homeowners are willing to accept for reasons of economy and security. Homeowners are also reluctant to become dependent on repair specialists to keep complex plumbing, motors, pumps, and controls operating. The "energy crisis" lies in hundreds of thousands of badly constructed, leaky, large (oversize by my prejudices) houses going up each year, where well-constructed, integrated solar houses would not create such large new energy demands.

To call consumers the victims of industry in situations like this is to point to the counterproductive but mutually reinforcing habits of industries and consumers. It takes two parties to make a mental illness. The two parties here are the warring factions of the body politic, our divided selves.[14] As consumers, we are victims. But as consumers making purchases, we control part of the capital flow of the economy. If we invest, our investment choices reinforce or discourage corporate patterns. If we are blind to all but maximum investment returns, we reinforce the short economic horizons that are a formidable barrier to long-range renewable technology investments. To be employees of a system we may wish to change, or to be in a vocation that does not help shape a future we would choose, is perhaps unavoidable in the short run. But eventually there is always other work to move into by our own choice, if we make it. Economic inducements usually discourage vocational innovation. High-school and college career-placement counselors too often play the role of market analysts, using computer-based job market forecasts to suggest where we (or our children) might best cast our abilities, how we might most profitably sell ourselves in the market place. At colleges, the Future wears a business suit and visits campuses near the time of graduation, illustrating how Still the Future can choose us with the apparent inevitability of Progress.

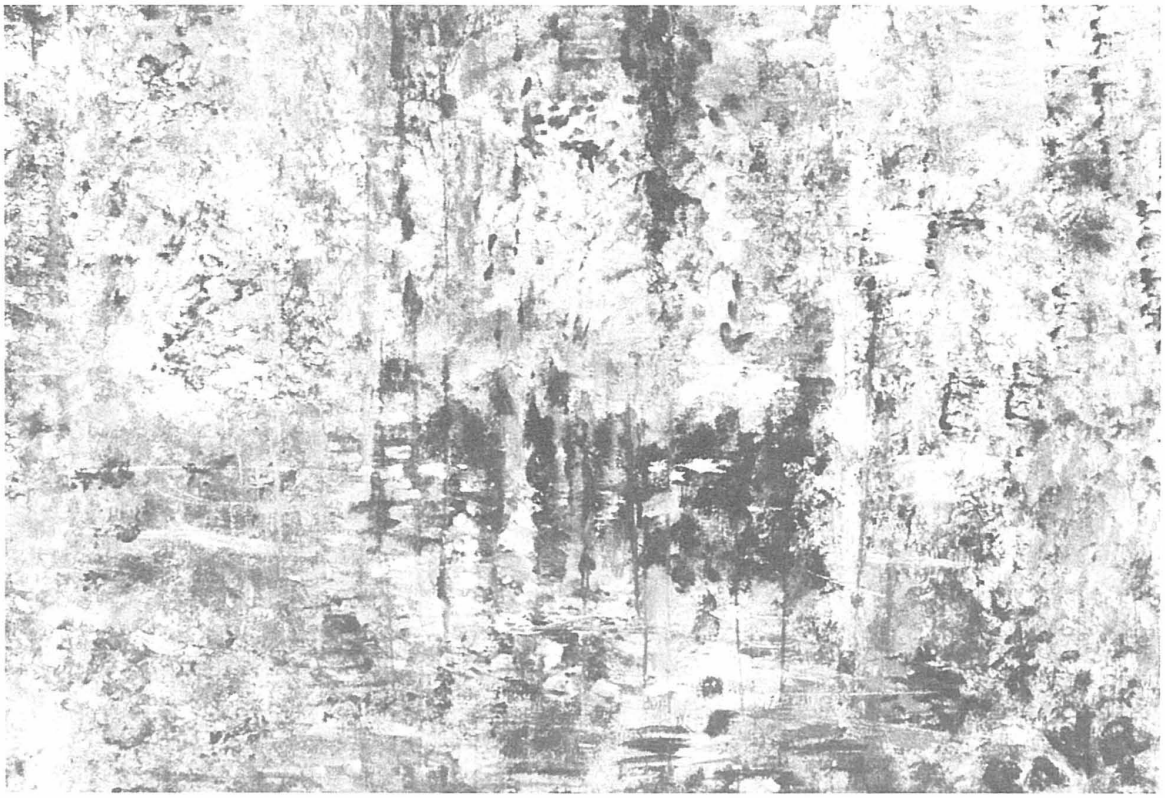
Or we can choose the future.

[11] "From Our Experience." Part 5, see p. 146.

[12] Frank Balyn, "Solar Sewage Treatment," *Popular Science* May, 1979, pp. 106-7.

[13] Richard and Sharon Thompson operate 420 acres; they specialize in corn and cattle raising. For an account, send for: Proceedings of the First Conference on Biological Agriculture, Spring 1978, Charlottetown, P.E.I., Canada. Send $7.00 to Martha Musgrove, Institute of Man and Resources, 50 Water St., Charlottetown, Prince Edward Island, Canada.

[14] Wendell Berry offers a fine exposition of this concept in *The Unsettling of America: Culture and Agriculture* (Sierra Club Books; published by Avon Books), especially in chapter 2. He contrasts the integrating effects of traditional agriculture as nurturing stewardship with the fragmenting effects of exploitive industry and industrialized agriculture. Though Mr. Berry's emphases are cultural and agricultural, his thought has been a cornerstone for these arguments focused on economics and technology development.



From a painting by Sava Morgan

Learning and Unlearning: Some Patterns and Connections

Jeffrey Parkin and Sava Morgan

The interview that follows arose from a strong feeling, one that I share with many other people, that Sava Morgan's approach to painting and to teaching, which amounts essentially to learning from one's self and from others, should be shared. I first met Sava when I became a participant in her painting workshops. The beauty of her classes is that they are meant for everyone not just for artists per se. Through our painting, she prompted each of us to take a hard look at ourselves. In many instances, this was quite a revelation.

In my case, much of my pre-college life was devoted to formal training in art, then my college days were spent predominantly in science. For many years, I thought of my art and my science as complementing one another, the subjective and the objective, the yin and the yang. Throughout my first twelve years of school, I was taught in art to render my reality objectively. While this is perhaps a logical, initial step for aspiring artists, most of us, particularly when we are very young, are not aspiring artists. Yet largely without exception, elementary-school children are encouraged to compose the inevitable witches on broomsticks at Halloween, predictable turkeys and Pilgrims at Thanksgiving, assembly-line Santa Clauses and evergreens at Christmas, and so on as the years and children go on. Our perception of reality thus, as objective, through various forms of art, is not fundamentally different from science. With my background, I found it difficult in Sava's classes to displace my objectivity for long enough to find a greater balance within myself. It is the rare teacher outside the discipline of Zen Buddhism who asks questions without answers, offering art as a vehicle for self-expression and self-awareness, as a true complement to science.

Sava is such a teacher. Although she defies translation onto paper, I have not been able to resist the impulse to try.

Jeff: What do you think are the most important aspects of your teaching of painting?

Sava: Many modern artists, like Dubuffet, Klee, and Picasso, studied young children's art in the hope of capturing some of its spontaneity. I wondered if it was possible to trigger comparably spontaneous activity in adults. In my adult art classes, I attempt to have participants relate individually to experiences still within them, from their pre-school stage (from about two to six years of age). The period is often referred to as the mytho-poetic or what Piaget termed the preoperational stage of childhood. It is a time in people's lives when they can directly express their perceptions of reality through movement, feelings, color, music and through metaphor, without intellectualizing or being bothered about the final product or outcome. In our workshops, we play. We experiment with materials like large brushes, primary poster paints and inexpensive paper, as children do. You express yourself with individual spontaneity, through color and forms. As part of the process, you feel the extent to which you want the colors to flow, to combine to new hues, to fill spaces, and so on.

Working like this you might move into a new phase. When presented with the exploration of materials exclusively, you focus on constructing configurations in relation to the paper and to your perceptions. These configurations may be developed into a world of your own—figurative, associative, or abstract. The application of paint may be lacy, heavy or patterned. When painting a plant, I may suggest that you imagine how it would feel if it were made out of bricks or feathers. By doing so, you could communicate many of the qualities inherent in nature—the hardness of a trunk, the softness of a leaf. Often, you may not understand what you are doing, but connections evolve out of enjoying the work rather than aiming at results. You reach toward your own understanding and expression rather than making something that is going to be pleasing to others. You become childlike in that you are searching. A joy like that in dancing, jumping, or playing is experienced in your painting.

An important element in realizing this lies in discarding tools usually employed for achieveing perfection. The pencil, pen or fine brush in the child or adult hand is directed toward achieving results acceptable to other people. You must be able to write legibly and draw clear, straight lines, or a smooth circle. Throughout all these years, you are conditioned to direct your hands toward planned, nonspontaneous activity. Attempting to achieve this, you have inhibited other parts of your self-expression, fragmenting yourself. If you did not enjoy your work, you relinquished pleasure for approval.

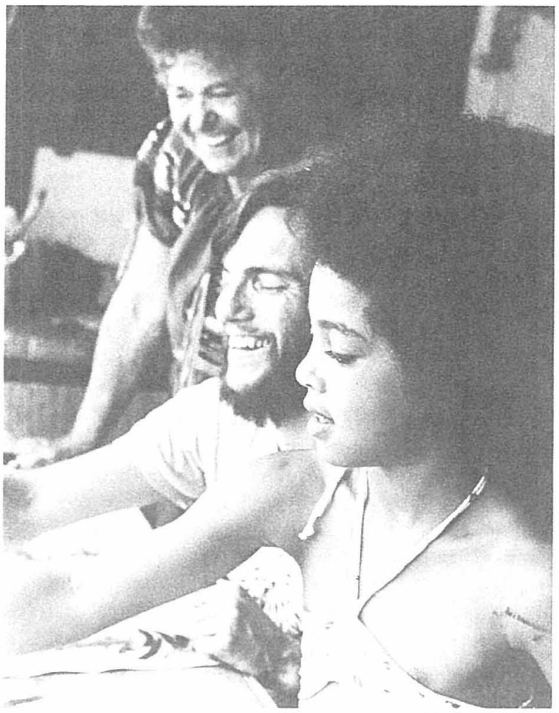


Photo by Hilde Maingay

Using large brushes and primary colors, you are reintroduced to attributes of nature like color, space and movement, as detached from a particular object. This is characteristic of tribal art, which is an integrated communication of total experience in symbolic form, through construction rather than imitation. The quality of essential communication about a state of mind connects the art of tribal people with that of children. In tribal art, utility and spiritual values were one. A drinking vessel can have both ceremonial and symbolic meaning. The work of the artist has spiritual significance, rooted in the collective life of the tribe. In my classes, you approach attributes of nature from your own subconscious and preconscious experience in an analogous way. You begin to perceive and treat these interconnected attributes as flowing through you. You are not by-passing your subconscious to fabricate a product that might be admired. I try to help you take away the striving for perfection, so that you can begin to confront your basic, creative imperfection. This may lead you toward new concepts and discoveries.

This is why I emphasize change when we work. Each time you do something to your satisfaction, I encourage you to do something entirely different in which you will have to use other capacities. This will lead to balancing achievement in one direction with other aspects of exploration. My hope is that you begin to enjoy every aspect of yourself, which will gradually result in an improvement of skills through

the process of self-evaluation in terms of your own complexity. The hope is for a person with an awareness of self rather than one who has been programmed to achieve a standardized performance.

If you ask me, "is my painting good?," I turn it back to you and ask, in the manner of Carl Rogers, "Does it please you? Is the feeling good? Did you discover something?" You achieve control of your own activities in terms of your demands on yourself.

In broader terms, the type of education I envision has many of its roots in the procedure of Fritz Perls. I try deliberately to disturb you by confronting you with your stereotype. Through your paintings, or whatever form of expression you have used, I show you that often you do not speak for your real self: you have been stuck for many years in a certain manner of working because that is what you were taught. Like one of Perls' clients, you may use a greeting to avoid rather than make contact with people. Then when you realize this aspect of yourself, you wonder what to do. I may encourage you to try working with color, to use it in a new way, to perceive it as overlapping spaces, to stop making outlines, to confront that painting as you would a new person. And that new person is yourself. Because you are unfamiliar with this, you may implode and then explode your negative feelings about this confrontation. Yet, as you begin to conceive of a new aspect of yourself, I try to help you to view it and express it. But I do this only when you have developed criteria that are valid for you, not only for me. This is why, when I teach painting, I encourage people to discover things important in their own lives that become valid artistically, and then make a statement of strong conviction. Originally, the intent is not to make statements to others. It is to explore the process of your own growth, your own capacities, and your own satisfaction.

Jeff: Why do you think painting is uniquely suited for the self-exploration and expression you speak of?

Sava: When you dance or play music, it escapes from you minute by minute. Photography and film tend to be technical expressions of selection and association suspended in time. Construction into single frames mediated by an instrument can remain a process of fragmentation. The moment you read back writing, it becomes linear; words and sentences ordinarily follow one another according to grammatical sequence and are viewed analytically. Even sculpture can be viewed from a linear point of view, as you walk around it. You may see it one part after another. In painting, the image is flat and confronts you as a whole.

While you are painting, you may, within your painting, have a mirror of yourself, moment to moment. You can see what you felt because unlike music the temporal dimension is hidden. Through painting you can sense your own control over the space as it occurs in time. This is important. According to Cassirer, the spatial concept came before the temporal. In the templum, which was space, one could contemplate, and thus tempus, time, arose. So you go from space, to considering space in time, to the origin of the concept of time. Painting illustrates this process.

Jeff: Having taught in elementary school and colleges, how do you view the current educational process?

Sava: Much of education today is based on the cumulative theories of the behaviorists, particularly those of Skinner. By eliminating the dimensions and complexities that are part of children's personalities, they can be treated as "black boxes," repositories for facts and programs. Then it is justifiable to reinforce those qualities important for optimal operation as a cog in the wheel of our progressive social machine. Education is analogous to feeding. The child may consume what is offered by way of education, and may even find it palatable. Because of the great pliability of the young child, this is overtly successful in the short term.

New curricula are devised to increase the level of performance rather than competence. The flaw in this lies in the fact, as Chomsky states, "that production is a small fraction of competence" at every stage of growth and development. Not only is the fraction an inconsistent, inaccurate tool for evaluation, but encouraging performance (production) has an effect that at best is indirect in revealing competence. Actually, stressing performance in education has led to an increased level of incompetence in many students because of rebellion inherent in many living organisms against being cast into molds not their own. It is useless to attempt to change an eagle into a duck.

The product orientation of education is comparable to our approach to agriculture. Crop yields are increased through the application of synthetic fertilizers A direct relation between the input of fertilizer and the output, or performance, of crops can be measured, and serves as the basis for evaluation. The natural balance or needs of the environment are not considered. As we judge a crop by one standard, that of yield, we assess children by two: How much of the input of programmed information is processed and at what rate? Real understanding is disregarded. If either, and certainly if both, of the two outputs fall below a certain standard of achievement, the children are pronounced failures by their educators and then by themselves. Such so-called failures arise because the children do not accept the inputs they are given as relating to themselves. The particularities of their growth and expression are not nurtured. In fact, our de-emphasis and, in many cases, ignorance of the processes leading to fruition, whether in an individual or a crop, has resulted in the long-term despoiling of two of our most precious resources.

Jeff: Returning momentarily to the "education" you give in your art class, I was fascinated by your observa-

tions on early childhood. What do you feel are the important aspects of the mytho-poetic stage of childhood and what might we learn from it as adults?

Sava: The ability to view each experience in a unified sense is one of the most important aspects of the mytho-poetic stage of childhood. It is in this stage that children still perceive a story as a story, a holistic image, not as a series of paragraphs, sentences, dictionary words or letters. Reading stories in order to learn words and grammar and to spell removes the children from the content and meaning of the story. In promoting forms of linear thinking, such as spelling or counting, among children of this age, we destroy their potential for unifying each experience through their own connections. It is hardly surprising that many children reject their teacher's attempts at injections of skills that are devoid of connections with themselves. In our haste to groom children for adulthood, we deprive them of a rich inner life at a time when it is ripe for development. We promote stereotypes. I don't deny that historically linear thinking has been and is of tremendous importance, but I do think that the skills can be taught too early in children's lives.

In the mytho-poetic stage, the integration of one process with another occurs not through logical analogy but through artistic metaphor. Children may project the emotions they feel at a given moment on an animal or object; they identify their experiences with an external world. Their realities are composed of passing series of experiences and feelings related, connected, to them. This is how they perceive their world as unified. If I understand morality as an interdependence of the entire world, then the mytho-poetic stage forms a basis of feeling for ethics.

I have seen a little girl of four walk up to a fire hydrant, clutch the two arms and say, "How are you, my little teddy bear? It is so nice to meet you." Children see the events of the world as things connected to their own lives; they befriend objects as animals. Each event, each animal, and object has a special significance in terms of a child's needs, not unlike tribal people who create gods that correlate significances in their lives. Tribal hunters and gatherers represented plants, animals and natural phenomenon through language, religion and myth, seeing in them innumerable connections and meanings. In tribal culture as in childhood, a person lives in a world of significance and connections. Though some of their perceptions might not appear objectively valid to us, it is important to keep in mind that they were and are valid to their holistic worlds.

The relating of object and significance is exemplified in children's paintings. In depicting her mother and father seated at a table, one child greatly exaggerated the size of her parents relative to the table, signifying comparative importance. My grandson has portrayed his mother as a lady with two (he has a little brother) small birds on her shoulder, the significance being in the large, nourishing, goddess mother and the two little birds whom she feeds. This is a reccurring metaphor in children's paintings and drawings.

Cassirer said that creating connections between objects is more important to humanity than formulating the classes to which the objects belong. As I mentioned earlier, it is these relations between objects and events as they change from moment to moment that form the basis of tribal psychology. This concept can be found in the immersion in the here-and-now in Chinese philosophy and in nomadic cultures. People constantly on the move, rooted in impermanence, must be aware of the here-and-now. Similarly, when children, absorbed in the moment, are asked what they were doing a little while ago, they don't remember. They are so completely involved in the present task, the here-and-now. Events as experienced by children are structured in the mind as a series of sporadic occurrences, not as a continuum. This may have a physiological basis in the growth of the brain cells.

Jeff: Schumacher considered education "the greatest resource." For the potential of this resource to be realized, it's obvious that the role of the teacher is of utmost importance. In the classroom, what do you consider to be the most important functions of the teacher?

Sava: The period when children have the greatest potential for perceiving wholes as well as essential qualities occurs in the mytho-poetic stage. This is well-documented in the literature of developmental psychology. With traditional education children learn spelling, grammar and other formal aspects of communication rather than content through which they can identify and experience. Children are trained to judge by formal qualities rather than to relate the instruction as applying to themselves. Gradually the ability to distinguish between the essential and the irrelevant in order to function optimally in balance with the environment becomes clouded. Such a shift in perception can eventually result in people who vote for a candidate on the basis of appearance, or buy a chair because of the veneer. More serious is the justification of prejudice and war which can be the consequences of bonding emotional states with theories, as we saw in Nazi racism and social Darwinism.

This is an example of how this might occur. Walking through a zoo with a child, an adult may say, "ick. . . that hippopotamus is disgusting; look at how he wallows in the mud!" Such a judgment is both directed toward the animal and child. How can anything dirty be beautiful? And the hippo is dismissed. With children it is most important that you examine the beauty of a particular structure within its own environment, separating subjective responses from objective qualities. Through my teaching, I attempt to help people of any age to discriminate between what is essential to them and to their work and what is peripheral, between what is true and what is merely pretty.

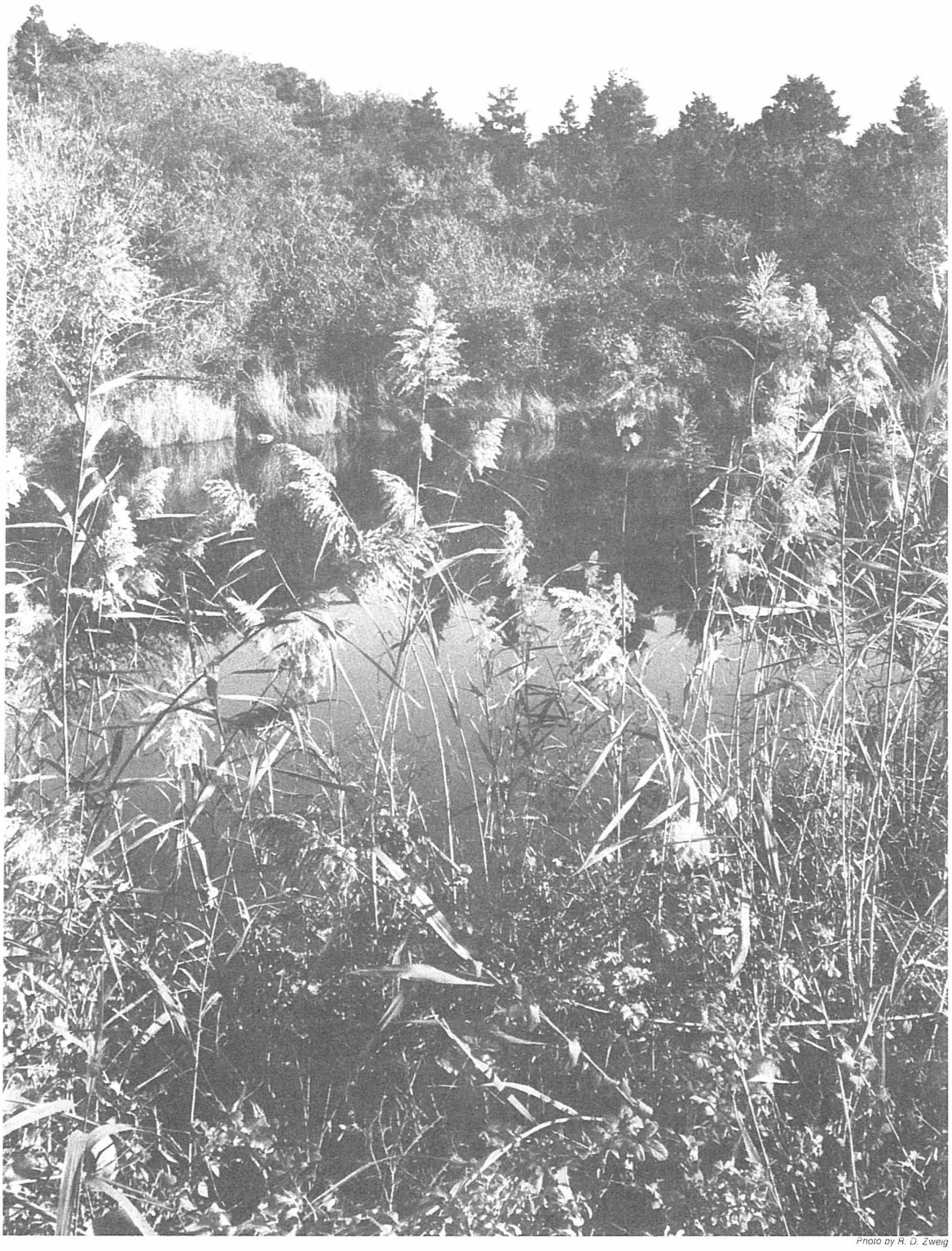


Photo by R. D. Zweig

This process has a wide and much-needed application in education. This might well be adapted to the method often used in teaching numbers. Children frequently are presented with three horses, five chickens, six houses, seven spoons, and the like, from which they are supposed to learn the abstract concept of number. It becomes easy for the child to fuse or confuse horsiness, or whatever, with the quality of numbers. Rather than eliciting the abstract understanding of number, the teacher achieves a fixation on those qualities. This is how people can come to attribute qualities to a concept or an object that have little or nothing to do with it, being unable, many times, to distinguish between what is inherent and essential to it and what is not. Suppose instead the children were exposed to four sets of the same number of objects, all of which were different. Eliminating color, the qualities of the animals and all concrete qualities at which children in this particular developmental stage are so apt, they would arrive through the process of reasoning at the abstract quality of number. The concept thus becomes general rather than qualified by irrelevant data.

Jeff: It seems to me that an important aspect of the teacher-student relation (or maybe any relation for that matter) is the difference between approval and acceptance. What do you think about this?

Sava: Very few instances arise in any classroom in which approval can be given with a long-term positive outcome. In most cases it has the effect of stunting. The only time I tend to show approval is when someone lacks a self-image with which to promote themselves or their work—when they are floundering. I give approval immediately followed by acceptance of that person. In essence I am saying "It is good that you have lost your way. This is evidence of your searching. The world is indeed complicated and it is something we all struggle with at one time or another."

On the other hand, the bestowing of approval upon a child or adult can be viewed as condescension. When people have low self-images, they may feel that you are flattering them rather than respecting them or valuing their intellectual capacities. Also approval can isolate a child from other children by making the others feel rejected. The self-analysis, or self-admiration resulting, distracts the children. When someone is given a grade or a distinction of whatever sort, the process of learning may actually be arrested.

This comes back to the bonding of irrelevant qualities to concepts, events or objects. The children's distinctions between their own processes of learning, or their subjective feelings of growth, and the objective grading of their performances by the teacher become obscured. As educators impose and reinforce these irrelevant connections, students often turn to bask in an artificial sun that gives warmth but no illumination.

Approval stratifies you as good, mediocre and/or bad; acceptance means I am interested in you and what you are doing. Whereas approval serves to assert the authority of the teacher, acceptance denotes an egalitarian situation within the classroom as a whole. Acceptance offers internal support for the person's growth and expression, rather than a crutch. Often in class, something may happen outside the window that diverts the attention of the children, perhaps the flight of an interesting bird. The excitement awakened by this event could be channeled creatively. They could express the ways in which they experienced it into a drawing, a musical composition, a drama, a written story, or in any combination of these. The crux is the acceptance of an event which has come into the children's world, of the children and their excitement into the entirety of the learning situation.

Jeff: What is your approach to integrating withdrawn and disruptive children into the learning situation?

Sava: Withdrawn children are often responding to damage that has been done to them by refusing to face the world. Frequently, they don't want to participate in classroom activities and hesitate to talk. Their activities can be just as disruptive to the class as those of hyperkinetic children. I once had a little girl in one of my classes who was seeking the teacher's attention and affection constantly. She was given a box of bandaids and asked if she would take care of the other children's hurts. Gradually her desperate need to be loved was extended outward to helping others as well. Instead of pestering and clinging to the teacher, she became aware of the other children. Whenever someone cut themselves, she was there in a flash with her box of bandaids. Realizing that her actions were of value to others increased her self-esteem. Her need for a special bond with an "important person" began to disappear and she began to take on activities in which she acted on her own. It was through this special function that she became accepted by her classmates and was able to receive acceptance not only from them, but also from the teacher and ultimately from herself. While withdrawn children need approval even while they can't welcome it, acceptance can be the dynamic, growing approval needed for healthy relations.

Disruptive children tend to respond to the way that they have been hurt by acting it out. The child I have just told you about came from a family of ten in which she had no chance to express herself or to receive any individual recognition. In other cases, the disruptiveness of the action can depend upon what is required to elicit a response. When children are confronted daily with the difficulties of a ghetto, this is complicated and accentuated to an extreme.

When I was a teacher at Public School 113 in Harlem, I was given a small group of fourth-grade students that the other teachers couldn't manage because of their disruptive tendencies. I disapproved of or

punished these children very infrequently, but rather I tried to create for them a special situation that would utilize the intensity of their energy. I might say something like, "Let's try something new; what would you like to do?" Usually they would have no answer; then I might suggest, "Let's get some instruments and play a rainy-day tune. Let's listen to the drops fall and each one of you make the sounds in your own way. Find your own beat. Just put the sounds together so that you enjoy listening to them, and then play with them." They played for awhile, then went off, with my encouragement, to the kindergarten, first and second grade classes to explain to their little brothers and sisters about improvised music.

I tried to do some reading with them. At that point, although they were in the fourth grade, none of them were able to read. They were uninspired to do so, and had a strong aversion to books, particularly ones they felt were for younger children. Here I said, "You want your little brothers and sisters to learn how to read, don't you? The only books they can understand are the ones written for children, not adult books like the ones you use." Well, the ego-bolstering thoughts of being older and partially responsible for others they cared about was enough to interest them. The first book I gave them was about medieval manners. It began something like, "What would you do if you fell through the roof of a Queen's palace?" The children responded with "Excuse me please, Your Highness," holding their pants legs out to the sides. This was a marvelous parody by these "macho" children. They were able to act unselfconsciously and to begin to break down sexual stereotypes, as they indicated by

their curtsies. After practicing reading and acting out numerous episodes, they decided that they were ready to go down and perform for the kindergarten class. One returned shortly, tears rolling down his face, "Teacher, they don't listen to me." I said, "Man, now you know the problems I have. What shall I tell you? Let's think about how we can make them listen, maybe you can make them listen if . . ."

The most disruptive children in the school had become teachers. They had come to realize that they were functional members of this social grouping and individually were accepted for themselves. With some inventiveness, sensitivity and experience in interrelations with children, formerly disruptive activities had been, and again can be, translated into positive, satisfying ones.

Jeff: You've made numerous references to ecological balance. Could you clarify this?

Sava: I use the phrase ecological balance as a way of describing the enrichment and intrinsic integration of those elements that I feel all children need in order to grow, just as one of your bioshelters at New Alchemy can offer a balanced environment for plants. In an enclosed area nutrients can be supplied and utilized with sensitivity. We brought seeds, compost, water, plants, animals, and machines into our classroom. These represent elements human beings have needed always in their passage from childhood to adulthood. The sprouting plant selects what it requires for its development from its environment, balancing growth with ecological restraints. The classroom should offer optimal conditions for the children to attain within themselves, with other individuals, and with the environment. The evolution of particular modes of thinking, imagination and projection on interrelatedness can be built and unfolded in such surroundings.

Within this situation, the teacher is a gardener, a catalyst for growth, a nurturer. The sensitivity and respect the teacher should bring cannot be over emphasized. The education of teachers should span not only the learning of skills, but also an understanding of the ecology of children. This must obviously be based in part on the self-balancing in the teacher.

Jeff: How do you as a teacher bring this about?

Sava: I feel it's important to have animals, of whatever sort, in the classroom and allow children to observe them. So the adaptiveness of the animals can be seen as meaningful, I try to see that their environment is made as natural as possible for them. My class at P.S. 113 had a pair of gerbils in a "cage" that was about four by five feet and three feet deep. It contained earth and other natural materials like twigs, leaves, feathers, grass clippings and the like, collected by the children during our walks through the park. Back in the classroom, we would decide what to introduce into the gerbils' "cage." The children consulted on every aspect pertinent to the life of their "pets," giving rise to ongoing social interactions.

At one point, much to our delight, one of the gerbils appeared to have become pregnant because the other one, the male we thought, selected all the softest materials we put in the "cage," shredded them up, and, with the Mama gerbil's help, used them to line one of their burrows. And there was the nest, well-padded and protected from drafts. The next morning when we came in, we all stared incredulously at a magnificent gerbil city which they had built with the materials that we had given them. They had separated the materials and then either stored them away or used them for a variety of purposes. The gerbils had formed bridge-like structures by matting together some of the twigs and had dug an intricate maze of tunnels through the earth.

The children felt they had discovered how a gerbil might behave in natural surroundings. They began to ask questions about where gerbils live and what their life is like. We searched through numerous books. Through their absorption in the gerbils, the children used their perceptions as metaphors in telling and writing stories, in composing songs and in painting.

One day we made tapes of the children telling stories of what they'd like to be when they were older. One boy wanted to be a fireman, a girl wanted to be a mother or a nurse. Then a boy started his story, "When I grows up, I wants to be a Papa gerbil. Papa gerbil does the most beautiful things in the world. He builds tunnels, bridges and a house. He loves Mama gerbil. Whenever he passes Mama gerbil's room, she sticks out her head and he kisses her and gives her a carrot. I'm sure when the babies come, they're gonna be happy. When I grows up, I wants to be a Papa gerbil."

It was very moving. As tribal people who admire and identify with the bear or the hawk, our children had developed a larger understanding based on their experiential involvement with the gerbil.

Not long afterward, Mama gerbil gave birth to five babies. Watching over the gerbils gave the children, each in her or his own way, an admirable and desirable image of the family—a story grounded in life out of which everyone created a personal moral. Children often reject moralistic books written for them because they feel manipulated. In our case, the children were in touch with the environment, the gerbils and with each other. I didn't have to warn them about drowning the gerbils, for example. The children saw that the gerbils needed a certain amount of moisture to be comfortable. If the ground was too wet, their tunnels collapsed. If it was too dry, they crumbled. The children learned to measure more exactly and appreciated the importance of exactness in applicable instances.

The children had learned something about nature and their coexistence with it. They used materials, math, writing, painting, music, drama, and themselves

to further integrate their understanding. It was completely self-motivated. They became more aware of their own feelings and potentials, of other people, and of course of nature.

Later the principal asked me whether I would want a school like this in which the children would be there twenty-four hours a day—my answer was no. I feel that children belong to the people and to the society in which they have been brought up. They should not become withdrawn from their way of life. That is not the purpose. The purpose rather is for them to carry the excitement and the message of their education back to the people with whom they live. In this way it might not be an isolated experience, but be extended to help to create a way of life.

Reflections on the Chilean Civil War

Francisco Varela

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I can't really talk about the Civil War in Chile without being very personal. And therefore, I am quite uneasy talking here today, because I haven't spoken publicly on this matter since those events, five years ago. I guess in this group of people and given the circumstances, it is somewhat possible to do it now. But I have never done it. I would be much more comfortable talking about differential equations, or the limbic system, or something. So you will have to bear with me, because it is not the kind of thing where I can prepare something very logically structured.

So I guess I am just going to use the broad paintbrush and draw a few images for you. However, I don't think it would do us any good to have just a bunch of anecdotes or experiences without any context. So I would like to propose a context for these ideas or experiences: what these experiences have meant to me, on the basis of what we have heard at this conference yesterday and today. You see, my basic bias, my fundamental narrow-mindedness, is that I don't believe we can talk about a world view, or any

representation of what the world is, without *at the same time* observing and critically examining how these ideas come about. No content should be divorced from where this content has been produced. This goes under the name of epistemology. And so I would like to do a little epistemology.

I take epistemology quite seriously. I think it *does* matter. It is not a game or a fine pastime. Very specifically I want to go back to yesterday. And I want to make a distinction which I was very disappointed we did not make yesterday. Maybe there was no time. I want to retake the question of energy as an example of what I mean by getting us into a frame of mind about our ideas, which would include an epistemological side to it. The energy issue can serve as my example, because it was discussed yesterday and it thus becomes more tangible. And in that sense I want to make a very clear distinction between the kind of picture that Howard Odum was presenting to us and the kind of picture that Amory Lovins was presenting to us. They are fundamentally distinct: What Lovins was saying is something I can relate to and side with in many ways; Professor Odum's point of view I consider, in many respects, nonsensical. I am sorry he is not here, because I would have loved to have him hear what I have to say; in fact, one of the reasons I can say this at all is because we are in a gathering of friends, and he was present.

Now, why do I make this distinction? Well, because Odum's position about energy contains in a nutshell what I believe are the most dangerous hangovers of a kind of world view based on a purely mechanistic observer-free science and philosophy. Take, for example, his notion of the *quality* of energy in analogy with food chains: as you move "up"in a certain direction, you increase the "quality" of energy. And it's this nice exponential that he draws; that the President, with the negligible energy of pushing a button, can blow up a whole continent. In more specific terms the way he draws it is by having a system with a source and a waste, then somewhere here in the middle, in the flow, there is a nice little symbol which he calls *order*. You can call it information. This, for me, flattens out completely what I would consider what information can possibly be. Because order and information are not absolute concepts. They depend on the system that is being described, and on the describer that sees it.

If I am going to take literally what Odum is saying, then energy somehow decreases and gets to the point where it is packed with information. We ask, what kind of information is this? Is that the bureaucracy? Or is that the power of the media? Or is that the power of the workers? Whether I see the bureaucracy as having the information or the media as having the information, or the workers as having the information, these are very different points of view. I am not saying that one is particularly better than the other. Depending on where you are, order and information are going to mean different things to you.

In a compact form I could say that order is nothing more than my ability to distinguish a pattern. And randomness, by contrast, is my inability to distinguish a pattern. There is nothing "in" nature that is order, and nothing that is chaotic. There is for us the possibility of making some distinctions and drawing some inferences. And that says more about what we are doing than about what poor Mother Nature is supposed to be doing. If I show you a piece of paper and you say that it is a dirty picture, it says nothing about the paper, it says a lot about you. Similarly, if I say that there is order in society, it says nothing about where that order comes from, or how it is specified. Who is specifying that order? To put in continuity energy and information flattens out the most essential aspect of both. These notions are a reflection of a point of view, a reflection of a human stance, a cultural tradition which we all have, and in which we all move. Each of those views of order and information is going to come from such a tradition and is going to produce nothing else but another interpretation of that tradition. And it is not going to constitute a description of a state of affairs in any sense of outside, in any sense of out there.

I am claiming, in direct opposition to Odum, that information and energy have little to do with each other. Energy says as much about information as, say, block print will say about language. There is obviously the need to have some sort of structure, of a concrete physical conveyor, of a certain action that we classify as informative. It says nothing about what the informative act is all about. And to put those two levels together is to fall into the trap of the old objectivistic ideology. I believe that when it comes to issues like energy and information, particularly information, we need to bring to the foreground, and not to flatten out in neat block diagrams, these questions: Where is information generated? How is it generated? By whom is it generated? In this I am, you know, a student of Gregory Bateson, who is, as far as I know, one of the few people who really argued about this, as a lonely voice in the desert, for many years. Well, it's about time for him to be not so lonely. When somebody says things such as Odum did in this kind of a gathering, it's time for us not to just sit and relax and say, "Isn't that all very groovy?" Maybe he was using the analogy between energy and information in a metaphorical sense. It can be taken that way. But it contains a lot of technological assumptions that I don't think we can just let go unchallenged. Now, I am taking obviously a somewhat opinionated position. It is not that I am that convinced about it, but given the kind of group that this is, I thought that I might as well be somewhat less nice than I tend to be.

Energy itself is a concept that is rarely questioned at all. We forget, for example, that energy as a concept

has all the connotations of organic action at its origin in the seventeenth century. That's what energy means also, etymologically. It is usually forgotten that the discovery (or the so-called discovery) of the notion that one form of energy can be converted into another is a very interesting case of how a world view can, all of a sudden, be congealed into a solid perspective, and that people become completely oblivious to the origins. Tom Kuhn has written a marvelous paper on the idea of the interconversion of energy as a case of simultaneous discovery, how, within a period of three years, many people stumbled upon the same notion that I can take light or electricity and somehow find an interconversion factor with heat or with other forms of energy. Now, it is a historical fact that many people in Europe stumbled at the same time upon the notion that you could define this factor of interchangeability. That's what people were looking for. But that becomes an operational meaning; so many calories can be converted into so many watts or whatever, there is a very definite relationship between the two. How I interpret that is an entirely different matter. And it was in the fancy or frame of mind at the end of the nineteenth century to project the possibility of interchanging different forms of these forces that we call energy, to project that possibility of transformation, into a unified notion that energy is a *fundamental* "substance" out of which the universe is made. That is very nice metaphysics, but it is neither more nor less than that. It is not a statement about the ultimate picture of the universe. As a matter of fact, if you read, for example, Feynman's *Lectures on Physics,* published in 1965, he has no qualms in saying, in effect: "Look, I don't know what energy is. I haven't the faintest idea. All we know is that this frame of mind (of looking at different forms of measurement, these different forms of phenomena, and seeing that they can be converted into one another by some quantitative factors) is a useful one. So I go along with it. But don't ask me what energy is. I don't have the slightest idea." When good technologists forget Feynman's point and go along with the notion that the universe is fundamentally made out of energy, their quantitative point of view says that we have an energy crisis. I say we don't have an energy crisis. We have a crisis in our ideas about energy. Obviously, again, I am being one-sided about this. The case can be argued on the other side. But I won't.

Well, why does all this have anything to do with Chile?

Well, it has to do with Chile, because the Civil War gave me the experience that epistemologies are not something abstract to be given over only to historians of science; epistemology creates the kind of world that we live in and the kind of human values that we have. Not to be aware of the fact that we construct this world perspective with an epistemology is even more dangerous than a bitter argument between two philosophies. And I was trying to make a case for this in the example of energy.

You see, here the whole thing becomes personal. Chile was, for me, a process of understanding, in the midst of a traumatic social transformation. Only then were these issues made apparent to me, or at least that was my lesson from the process. And to my surprise when I left my country, I realized that whatever happened in Chile had acquired somewhat of a mythical connotation, had become somewhat of a paradigm. A lot of people were so interested in it that it was hard for me to understand why, until I saw that it is a capsule statement for many similar situations, locally, nationally, and internationally. A friend of mine recently gave me a book of poems about Chile. It's entitled *For Neruda, For Chile,* and the most interesting thing about the book wasn't what was printed, but what she wrote on the cover of the book: "There is not such a thing as a personal story." This seems to be quite true. Everybody's story becomes our story, and some of them seem to resonate more than others. So I guess this is why I thought it might not be idle to convey to you some of the experiences in Chile.

Chile is a strange country. I cannot separate it from its landscape. You go to Chile to find yourself in the middle of a mountain and at the edge of the sea. You cannot get away from that haunting sensation of being sort of dangling almost out of nowhere, with only about two hundred miles to move across. The fact that it is such a long country, going almost all the way from the equator to the antarctic, gives one the feeling of being in a long corridor. That gives the Chileans a character somewhat different from that of other South American peoples in the Inca-based countries (Peru, Bolivia, Ecuador) and very different from heavily European-influenced Argentinians. Argentina is more like the United States than any other South American country. Chileans, by contrast, are very withdrawn—a somewhat melancholic people used to the rain and cold. One of the most impressive things about the country is the Chileans' love for poetry. For some reason, everybody in Chile writes—or at least loves—poetry, and poets are the best national heroes. I have never been to a country where ten or twelve major poets are sold together with the porno magazines and Donald Duck. Well, that is partly what the country is.

In 1970 came the well-known election of Allende, the first Marxist politician ever elected in a free election. The thing to realize here is that the 1970 election cannot be taken in isolation, cannot be taken out of context, but must be seen in a forty year or forty-five year long and slow-moving growth of a broadly based worker movement. When 1970 came, Chile probably had, percent-wise, the largest organized labor force in the whole world. Literally half of the workers were part of active political

movements and had been involved for years in the labor movement and in labor participation, so that the level of political sophistication is something unusual in South America. Allende wasn't an accident, he wasn't a weird thing, but the conclusion of a long process and a long tradition.

Now, I suppose it is very hard to convey the sense of what the election generated for all of us, the sense that everything was possible. The 4th of September, the night of the election, I remember everybody poured out onto the street and started jumping like kids. For about two hours you could see 500,000 people jumping up and down like kids. We had a sense of a tremendous opening, a tremendous hope. I won't make a political analysis of the three years of Allende, because I couldn't do it. I'm not really a political scientist. Others probably would know much more about it than I would. But what I do want to paint for you are some of the events during those three years, the general way things began to go, and what forces were brought to bear upon it, internal and external. From this sense of opening and exploration, what began to happen was the development of polarity: in other words, polarity in terms of either supporting, being on the side of or against the movement, not the government, particularly. That's another misconception that I always find. The government wasn't so important as the parties behind the government. The coalition of parties was an indication of the kind of political mentality prevailing at that time. Allende wasn't caudillo. He wasn't a leader per se. He was the head of a vast force, a political party. And that was what really carried punch. So polarity revolved around siding for or against the popular fron, which by 1973 was about 43 percent of the vote. It quite literally split the country in two.

I cannot be emphatic enough in saying that this is literally splitting it in two. You could go to the newsstands in the morning and one newspaper would say "It's raining," the other would say "It's not raining." "A is a son of a bitch"; "A is the king of the universe." It was literally like that. And you know, three years before, these two were reasonable newspapers, who agreed that a table is a table and blue is blue. But by 1973 this was not possible any more. They couldn't literally agree on anything, the time of the day or the color of the sky. It was absolutely and right down the middle a complete split. And that sense of polarity created a sense of "we're right," or "they are right." The polarity created a continual exaggeration of the sense of boundary and territoriality: "This is ours; get out of here."

For me, this was the time at which things began to get very, very confusing. I started out being very supportive of the whole thing. I worked pretty hard, like many other people, doing what I felt was possible. I was doing nothing fancy. I wasn't ever a high official in the government; I was just doing my sort of grassroots work. But by the second year the polarity began to develop, and I began to have my serious suspicions, to doubt whether this was making sense or not. I couldn't believe that the other guys, on the other side of the fence, were so bad, stupid, wrong, immoral, ugly, and so on and so forth, as I was supposed to believe. There was something that wasn't jibing any more. And I was very, very confused by the whole thing and caught in a dilemma of loyalty to what I felt was essentially my people, my friends who were into this together. I mean, I wasn't apt to jump out of the boat, but I was beginning to lose my whole conviction, my whole commitment to the idea of defending this thing.

That was the state of affairs in which I was by the end of 1973. I didn't have any sense of understanding at all. I was in the uttermost confusion about the whole thing. And the only thing that was keeping me going was simply a sense of solidarity. I remember walking down the streets the first days of September, having a burden on my shoulders, I guess like everybody else. I had a sense of impending doom and no understanding any more of what this was all about. Where did it all begin? I don't know how to say it vividly enough; it was absolutely and completely chaotic. In the literal sense of the word chaotic. There was no possibility of distinguishing any order or any rule any more.

So it is Tuesday, September 11th, 1973. It is not raining, but the radio says it is raining. I am waking up in the morning at around 6:30, taking my little daughter to her nursery school and the radio keeps saying "it is raining," but it is not raining. I thought: These guys are crazy. And as I am walking out of the house to take my car, the young neighbor runs across the street and says; "Don't you know?" "No, I don't know." And only then did I learn that half of the radio stations are taken over by the army. And they are broadcasting their decision to overthrow the government. Then I remember—stupid of me—that the code, "It's raining" means that a coup has begun. I had been told that about a month before and had forgotten. So I take my daughter back to the house and take the rest of the family to a next-door neighbor, who was a very quiet person. And I go to join, as it was agreed, the people that I was working with at the university to see, you know, whatever is to be done. Supposedly it is civil war, so everybody is assigned certain tasks. So it is ten o'clock in the morning, and three-quarters of the radio stations are already taken by the army. And we're all sitting; we are supposed to be waiting for the instructions to do whatever. But no instructions come. We all sit there with the same sense of impending doom, not believing that this is happening. The war is still an abstract thought, still something that is not really happening. We have never had a war in Chile before. I have never seen a war. Nobody has ever seen

the army on the streets before. Nobody has ever seen the police be anything except very nice people. So there is no frame of reference. This is abstract.

So it's ten-thirty in the morning, and most of the radio stations, except one, are already taken by the army. And I begin to see tanks rolling down the streets, and I begin to see wagons loaded with soldiers driving down the street, and I begin to see the airplanes, war planes, flying over the city. And I begin to recognize that funny sound of submachine guns, distant from where I am. It is eleven o'clock in the morning, and we know that every faction of the army has turned against the government, or those that haven't have been isolated. We know that the President has decided not to surrender, but to stay in the presidential palace, and they give him an ultimatum before bombing. So we know that there is no way back. Bullets are already screaming over your head, so you know that the war is not abstract. It has a very concrete sound to it, that funny whistle of the bullet, that you can't locate except after it is gone. And still we don't have instructions. So the local leader decides that we are to disperse to different places and hide out until we receive instructions. So I go with four other friends to a place in which we are going to hide out and wait until the moment to do something comes. We must walk, oh, twenty blocks to where we ought to go. And as I walk out, the reality of war becomes already vivid. I see a tank bulldozing over a wall in a factory that is occupied by some twenty-odd people with some light guns. The tank blasts through it and turns around the thing after it is blasted, so I see some twenty or twenty-five people, the first twenty-five or so people, in which polarity is not any more an abstract idea but twenty-five people whom I can hear. I am scared. I have never been in a fight before. I hardly know how to use a gun. Down the street, a couple of blocks away from where I am, a man runs down the street to the intersection, and as he reaches the corner, I see coming from the other end a soldier who riddles him with bullets. So we keep walking and we finally get to the place where we are supposed to go.

Now, at this point, one o'clock, the presidential palace has been bombed. We can still see the Hawker-Hunter plane hovering around not only the palace but other important places in the city. And we know that the rug has been pulled from under us, that there is no sense in which we know what is happening any more. There are no instructions. There is no government. The military, whom we had seen before as somewhat respectable people, now we can see that they are not. I remember very well that the soldier, whom I saw machine-gunning the other fellow who was running down the street, was probably a nineteen-year-old boy from somewhere in the south. A typical face of the people of the south. Probably, if you had met him two months before in a bar, you would have had a swell conversation—a sweet boy. He couldn't be more than nineteen, yet I could see in his face what I had never seen, a strange combination of fear and power. So those people I don't recognize any more; I don't know their faces any more. We are all stranded in this place, and we know that there is simply no hope. If they decide to come after us with automatic M-2 rifles, the best you can hope for is not to be treated too roughly. So, it is three o'clock in the afternoon, and the whole city has been vacated. There is nobody on the streets, because curfew has been imposed. The only thing you can hear is the constant rattle of the machine guns, a sound that you hear for the next two weeks, which by now is a familiar sound to me. And you start waiting. And there is no radio, no communications. So I waited Tuesday afternoon, Wednesday morning, Wednesday evening, Thursday morning, Thursday afternoon. Curfew is lifted. So we can go out. But those days we wait with that strange sense that you don't know when your last moment will be. Anytime they might come in, and that's going to be it. So you have that funny relationship with people, knowing that you might be doing the last thing you will ever do, you might be saying the last thing you will ever say. So what do you say? Little silly things. You draw little figures on the foggy windows.

For me, at that time, the ground had been pulled from under me. Nothing else was left to hold on to. At the same time a very funny and contrary process happened; as things got more and more chaotic, the evidence of what a war is, there was a strange form of clarity coming more and more, a strange form of understanding, which I can't really express. I suppose it is somewhat like a semi-dream state. At the same time it was very real, because in this room with these people I could literally see how this whole thing wasn't me here and they there. But I could literally see how the army, and that nineteen-year-old boy shooting somebody down, wasn't distinct really from me. I could somehow contemplate that murder with a sense of brotherhood at the same time. Polarity wasn't any more this and that side, but something that we had collectively constructed. Literally a collective action that we had all done. As this became more and more clear to me, it dawned on me that whatever my stances had been, my opinions had been, or whatever somebody else's opinions had been (and the workers' opinions and what not), were fragments that constituted this whole, this complete mandala of sorts. That all of a sudden it revealed a craziness. Total craziness. I mean, this is somewhat as when literally someone is really crazy. You see the mind completely out, the brain turned upside down or inside out. Well, this was like that, except this was a whole country, or a whole city of three million people. That's what my actual experience was; three million people being turned upside down the same way. And you see the

craziness, the way in which there was a collective pattern in which I was responsible, everybody was, and in which my views couldn't any more signify anything except that piece of a larger puzzle for which I really didn't have any answer.

So, it might sound strange, but Wednesday night I gave in to it, and I sat down and wrote some twenty or so pages that I entitled "The Logic of Paradise," because it seemed to me for the first time that this had a logic to it. The whole thing had an intrinsic logic that was essentially good, in that it gave me a handle on what paradise is, for the first time. I know that might sound strange, but that is what it felt like—that being rooted in the complete chaos and mass killing, out of that was emerging a completely inverse understanding. And I was too scared or something to resist it. So somehow it just got transformed into those pages.

Now, that experience is what was given to me, is what I have had to deal with ever since. Because it revealed to me the connection between the world view, political action and personal transformation. It revealed to me, in a way that I knew but really didn't know, that I somehow vaguely understood but hadn't experienced, that unless I was able to cut through my sense of identity and attachment and identification with what I believe are my ideas, my things, my territory, my limits, I had no hope of understanding what the hell was going on. And it literally turned my life inside out. What that experience told me was: "Unless you build on the foundation of working with that sense of spirituality, (what later on I began to understand was what religions are talking about) unless you build on that base there is simply no hope of understanding." I have found, for myself, expression of that understanding in Buddhist practice. I cannot separate that practice, that sense of working with the contemplation of how my mind and my actions generate and operate. I cannot separate that from political action and from what my understanding of the world is. I suppose this is why I become so passionate about issues on epistemology. Because epistemology does matter. As far as I am concerned, that civil war was caused by a wrong epistemology. It cost my friends their lives, their torture, and the same for 80,000 or so people unknown to me.

So it is not an abstract proposition for me when I say that we must incorporate in the enactment, in the projecting out of our world views, *at the same time* the sense in which that projection is only one perspective, that it is a relative frame, that it must contain a way to undo itself. And unless we find a way of creating expressions of that nature, we are going to be constantly going around the same circle. Whether that can be done or not I do not know. But if it can be done at all, it can be certainly done with a group of people like this. My deep conviction is that we must try to see to what extent our political views and our projections on the world can express this form of relativity, the fact that every position we take will also contain the opposite one. That ultimately I cannot follow a form of political action that is based on truth any more. I cannot say that my political stance is true as opposed to yours, which is false. But every political stance contains the elements on which the truth of the other is based, and that all we are doing is a little dance. Sure, I have to take this side, and that is cool, but how do I really embody in that action that I acknowledge the importance of the other side and the essential brotherhood between those two positions? How can I go to Pinochet and say, "Hello, my brother?" I don't know. I don't think that I am that enlightened at all. I wouldn't be able to do that, but in some sense I realize that is a great limitation. That should be in some sense possible.

I am going to end here by summarizing this theme that is one of my major concerns: I don't believe any more in the notion of a cultural revolution in the sense that one form of politics and knowledge and religion is superseded by a new one. If I am interested in doing anything at this point, it is in creating a form of culture, knowledge, religion, or politics that does not view itself as replacing another, in any sense, but one that can contain in itself a way of undoing itself. If we are not here to do that, I quite frankly would rather go skiing.