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Man and Nature as a Single but Complex System

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No matter how lightly we tread on the Earth, we cannot avoid altering it. And, as it alters, so the way we tread on it – our ecological footprint, as it is sometimes called – is, in turn, altered. On and on. Natural scientists tend to look at this interaction of the human and the natural from the Earth's perspective, The Earth as Transformed by Human Action *(Turner* et al., *1990) being the classic text. Social scientists tend to look at the interaction from the socio-cultural end:* Living with Nature *(Fischer and Hajer, 1999), with its subtitle* Environmental Politics as Cultural Discourse, *is a recent example. But can we go further? Can we push each of these approaches (the natural scientist's and the social scientist's) to the point where they actually meet and give a single, unified theory of our relationship with nature?*

Yes we can, chorus two schools of thought: one sociological, the other ecological. The first has its roots in social anthropology and is, properly speaking, a theory of socio-cultural viability (but, since that is too much of a mouthful, it has been shortened to Cultural Theory, with the capital letters serving to distinguish it from other theorizing about culture). The second has emerged from natural resource ecology, where those whose interest is in grasslands, fisheries, forests and so on encounter the institutions that are doing the exploiting and the managing, not as organized arrangements of people and their various convictions as to how the world is, but as patterned interventions in the ecosystems they are studying.

In this article, we describe a unified theory, and some of its implications for policy.

A ROAD WITHOUT END

The classic assumption, in both ecology and social science, is that there is a one-way transition from state A to state B. In ecology, the process of succession (Clements, 1916; Odum, 1969) ensures that an initially unstructured state of affairs (one huge niche filled with anarchic, opportunistic and competitive organisms (the r-strategists)) is steadily transformed into a climax community: a structured and stratified arrangement of diversified niches, with clearly defined interrelationships between the species (the K-strategists) that occupy them (*see* **r–K Strategies**, Volume 2). In social science, this predictable, linear and equilibrium-seeking model of change is paralleled by a number of grand theories in which some inexorable logic moves us all from mechanical to organic solidarity (Durkheim, 1893); from community to society (Gemeinschaft to Gesellschaft, Tönnies, 1887); from traditional to modern (Weber, 1922); from status to contract (Maine, 1861); from capitalism to communism (Marx, 1859); or, as modern theorists of institutions put it, from markets to hierarchies (Lindblom, 1977; Williamson, 1975). Different masters may define their A's and their B's differently, but all subscribe to a two-fold scheme and to some driving force (such as rationalization, internal contradiction, or spiraling transaction costs) that carries the totality from A to B.

These transitions, whether ecological or socio-cultural, are all in the direction of more orderliness, more differentiation, more connectedness, and more consistency and, once they have gone as far as they can go in that direction, that is that. In other words, these models of change end up making change impossible. Of course, something on the outside may intervene and mess things up, thereby setting the whole thing in motion once more but, left to themselves, these models get ecosystems and socio-cultural systems from A to B and then stop. Change, these models tell us, is a temporary phenomenon.

These models are beginning to be seen as less than satisfactory. They explain change by getting rid of it, and they are increasingly incapable of making sense of what is actually going on. They have now been challenged by models that are indeterministic (i.e., more than two-fold) and make change a permanent and essential feature of existence: the four-fold institutional scheme proposed by Cultural Theory (Thompson *et al.*, 1990) and the four-fold ecocycle advanced by Holling (1986). If social and ecological systems are as these models say they are, their interaction will inevitably result in complex and non-linear dynamics, giving an unpredictable, always out of equilibrium, and never ending sequence of transitions between multiple states. And none of these will ever be the end of the road.

In the classic social science formulation, two kinds of solidarity interact. *Markets* are the competing players, all merrily bidding and bargaining with one another; *hierarchies* are the benign authorities who ensure that the various conditions for playing of this trading game (a level playing field, for instance) are in place. Cultural Theory does not reject this foundational distinction. Rather, it argues that there is more to life than just markets and hierarchies and that you will lay yourself open to all sorts of unwelcome surprises if you go on assuming that hierarchies and markets explain it all. Take, for instance, the Brent Spar oil storage structure.

If there were only markets and hierarchies, then the solution that was agreed between Shell (the market actor) and the British Government (the hierarchical actor) would have come to pass, and the Brent Spar would now be mouldering in its watery grave (*see* **Brent Spar**, Volume 5). It is not; it is sitting bolt upright in a Norwegian fjord. Greenpeace, an actor from a third kind of solidarity (we call it *egalitarianism*), winged its way in, literally, and totally transformed the outcome. Since this was written, a final decision (negotiated between Shell and Greenpeace) has been reached, and the structure is now being cut up into cylindrical sections to a roll-on/roll-off ferry terminal in Norway.

Nor is it just Brent Spars that cause trouble for the simple markets and hierarchies approach. A recent analysis of how things are actually done in Himalayan and Alpine villages (Price and Thompson, 1997; this article is based, in large part, on this 1997 paper, which has a more extensive set of references than is included here) strongly suggests (as we will see in a moment) that, if these mountain farmers relied on just markets and hierarchies, neither they nor their environments would be the way they are. Nor is this inadequacy of the markets and hierarchies framework confined to economically marginal mountainsides.

The ills of the American city have recently been blamed on the public-private partnerships that were seen as the solution (Brion, 1992). Hierarchies and markets, in coming together in this cozy and unseemly way, have totally excluded community (the egalitarian solidarity) and forced the citizenry into a state of "atomized, alienated subordination and systematic exploitation" (*fatalism*: the fourth and rather passive, solidarity that completes the typology).

At the global level, the three active solidarities (markets, hierarchies and egalitarianism), altogether with the markedly different problem definitions and solution definitions that each of them generates, are clearly discernible in the climate change debate. Indeed, they are what make that debate possible, each voice all the time defining itself in contradistinction to the other two. Hierarchists pin the blame on population. Individualists (the supporters of market solidarity, which Cultural Theorists call individualism) see it as stemming from people being able to treat the environment as a free good. Egalitarians insist that it is profligacy (excessive consumption, especially in the richest nations of the world) that is the root of it all.

Their solutions – essentially, reduce population (hierarchy), get the prices right (individualism) and frugality (egalitarianism) – are so divergent that each constitutes part of the other two's problems. Frugality, it turns out, requires the abdication of capitalism: the driving force of the individualist's solution. The population diagnosis, as far as the egalitarians are concerned, blames the victim (the South, which is where all the population growth is), and lets the guilty party, the North, off the hook. And the sorts of market interventions that both the hierarchists and the egalitarians, in their different ways, are intent on will, the individualists insist, get the prices even more wrong than they are at present! (See Chapter 4, Vol. 1 of Rayner and Malone, 1998, where the self-organization of these three voices is set out by means of a painstaking discourse analysis).

This means that human interactions with the environment cannot be effectively analyzed using theoretical frameworks that allow just one or two positions. Such frameworks are insufficiently variegated.

This is the main practical message from Cultural Theory, and it is a highly discomforting message for policy makers generally and, in particular, for those who build the computer-based models that underlie most policy making within the broad area that is now labeled sustainable development.

In most of these models, the representation of the micro-level, the household (in energy modeling) and the farmer (in land-use modeling), is singular: an economically rational utility maximizer. Such a representation recognizes just one voice (that of individualist solidarity) and silences the other two.

More recently, modelers have progressed to the classic formulation and recognized two of the voices. The International Geosphere Biosphere Programme–Land-Use and Land-Cover Change (IGBP–LUCC) project (*see* **IGBP Core Projects**, Volume 2), for instance, notes that land-use and land-cover change is taking place increasingly under the influence of the market, and that this justifies a model based on economic theory: a decentralized setup in which all agents individually solve their inter-temporal maximization problems, consumers maximizing utility, firms maximizing profits and so on. If the markets are competitive, so the argument runs, these agents can take prices as given, but in those instances where markets are not competitive, the optimization has to be done by government or some other higher level authority. But the third voice (that of egalitarian solidarity) is still excluded, leaving the policies that such models underpin wide open to the sorts of nasty surprises that have overtaken Shell and the government in Britain and the public–private urban regeneration partnerships in the United States.

Two-voice modeling, though an improvement, is still insufficiently variegated. Like one-voice modeling, it is still wedded to optimization and managerial control, when what is needed is constructive negotiation between all the voices: the democratization, in other words, of decision processes that have been depoliticized and treated as merely technical. This is a topic that, since the debacles

over mad cow disease (bovine spongiform encephalopathy) and genetically modified crops in Britain, the dismantling of the Millau MacDonald's by the French sheep farmer José Bové, the Battles of Seattle and Prague (vehement demonstrations against the World Trade Organization), and a host of similar events around the world, is increasingly on national and international agendas. But, to actually do that democratizing, we have to avoid silencing any of the voices, and that is something that current approaches, being insufficiently variegated, cannot do.

To help clarify what sort of differences a sufficiently variegated framework makes, and to gain a more reflexive (personal) understanding of what is going on in our own social systems and environments, we can take a close look at the surprisingly complex lives of the seemingly simple folk who live in the Himalayas and the Alps. These people, Cultural Theorists would point out, know something that the single problem-single solution merchants who tend to dominate policy-making in advanced industrialized societies have managed to forget.

Solidarities in Action

Himalayan villagers parcel out their transactions with their physical environment into four distinct solidarities, each of which is characterized by a distinct management style. Agricultural land, for instance, is privately owned whilst grazing land and forests are communally owned. But grazing land and forests do not suffer the "tragedy of the commons" (*see* **Commons, Tragedy of the**, Volume 5; **Property Rights and Regimes**, Volume 5) because transactions in their products are under the control of a 'commons' managing institution. Villagers appoint forest guardians, erect a social fence (a declared boundary, not a physical construction) and institute a system of fines for those who allow their animals into the forest when access is forbidden, or take structural timber without first obtaining permission. If the offender is also a forest guardian, the fine is doubled; if children break the rules, their parents have to pay up.

Informal though they may seem, and lacking any formal legal status, these arrangements work well in the face-to-face setting of a village and its physical resources. Drawing on their home-made conceptions of the natural processes that are at work (their *ethnoecology*), the forest guardians regulate the use of these common property resources by assessing their state of health, year by year or season by season. In other words these transactions are regulated within a framework that assumes, first, that you can take only so much from the commons and, second, that you can assess where the line between so much and too much should be drawn. The social construction inherent to this transactional realm is that nature is bountiful within knowable limits. This, to make a link with the ecological theories of Holling (1986), is the myth of *nature perverse/tolerant* (Figure 1).

With agricultural land, however, decisions are entirely in the hands of individual owners, and fields (unlike communally owned resources) can quite easily end up belonging to the moneylenders. In recent years, when forests and grazing lands have suffered degradation (for a variety of reasons, not the tragedy of the commons),

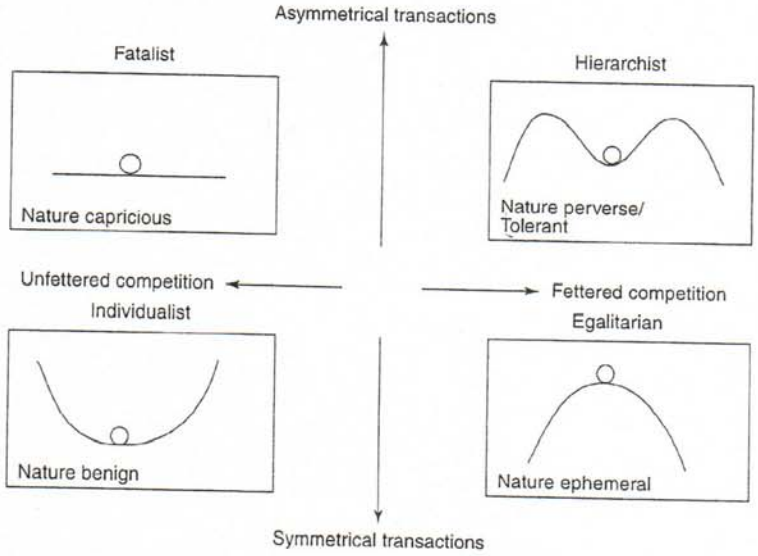

Figure 1 The Solidarities, their myths of nature and their transactional realms

villagers have responded by shifting some of their transactions from one realm to the other. For instance, they have allowed trees to grow on the banks between their terraced fields (thereby reducing the pressure on the village forest) and they have switched to stall feeding their animals (thereby making more efficient use of the forest and grazing land and receiving copious amounts of manure which they can then carry to their fields). In other words, transactions are parceled out to the management styles that seem appropriate and, if circumstances change, some of those transactions can be switched from one style to another.

Since they are subsistence farmers, whose aim is to remain viable over generations (rather than to make a killing in any one year) their transactions within their local environment can be characterized as low risk, low reward. However, during those times of the year when there is little farm work to be done, many villagers engage in trading expeditions, or in migrant labor in India. Trading expeditions are family based, family financed and highly speculative: high risk, high reward. So a farmer's individualized transactions, when added together over a full year, constitute a nicely spread risk portfolio. The attitude here (and particularly at the high risk end of the portfolio) is that "Fortune favors the brave," "Who dares, wins," "There's plenty more fish in the sea". Opportunities, in other words, are there for the taking. The idea of nature here is optimistic, expansive and non-punitive: *nature benign* (Figure 1).

Social scientists in general, and institutional economists in particular, would see these two realms as corresponding to their classic distinction between hierarchies and markets, and would have no difficulty in explaining the processes by which some transactions are switched this way or that (though they would be surprised to find that the hierarchy was a village-level commons managing institution, not the state). But (and this is the essence of the Cultural Theory argument) hierarchies and markets do not exhaust the transactional repertoire of the Himalayan villager. Some collectivized transactions do not involve formal status distinctions (such as those between forest guardians and ordinary villagers) and some individualized transactions are marked by the absence of bidding and bargaining (an essential characteristic of the markets that are generated by the individualist solidarity). The plurality, in other words, is four-fold, not two-fold.

In many parts of the Himalayas (especially the Indian Himalayas), village autonomy is always under threat, because powerful outside actors are also laying claim to the forest resources that are so vital to Himalayan farming systems. One very effective response to this external threat has been the Chipko Movement (*see* **Chipko Movement**, Volume 5). This is a grassroots and highly egalitarian social movement, in which women (who are largely responsible both for fodder gathering and fuelwood collection) predominate. *Chipko* means to stick, and the Gandhian strategy is to physically hug the trees, thereby preventing them from being appropriated. Those villagers of a slightly less non-violent disposition actually chase the logging contractors (and the government forestry officers who have been corrupted by the contractors) out of the forest with their *kukris* (long curved knives). In the Narmada Valley, farther to the south (where a vast development project is under way), they have now done the same to the representatives of the World Bank: a South Asian counterpart to the Brent Spar surprise. (Indeed, the World Bank pulled out in 1993 but the project is still being promoted by Indian State Government and market borrowings.)

So far as these threatening external transactions are concerned, it is certainly not a case of "plenty more fish in the sea", nor is there even a safe limit, within which the commercial extraction of timber would be sustainable. All external predation is seen as catastrophic in its consequences. Hence the spectacularly uncompromising collectivist response of the tree huggers, whose idea of nature is one in which any perturbation of the present low-key regime is likely to result in irreversible and dramatic collapse: *nature ephemeral* (Figure 1).

Finally, in every village, we may be sure, there will always be some people who sneak wood from the forest when no one is looking, who can never quite get together the capital, the contacts and the oomph to go off on trading expeditions, and who manage somehow not to be around when it's all hands to the tree hugging. These are the fatalists: people whose transactions are somehow dictated by the organizational efforts of those who are not themselves fatalists. Theirs is a life in which the world is always doing things to them (sometimes pleasant, sometimes unpleasant) and in which nothing that they do seems to make much difference. "Why bother?" is the not unreasonable response of the fatalist. If that is how the world is, then learning is not possible and, even if it were, there would be no way of benefiting from it. The idea of nature here is one in which things operate without rhyme or reason: a flatland in which everywhere is the same as everywhere else: *nature capricious* (Figure 1).

From Simple to Complex

Completing the typology with these two solidarities (egalitarianism and fatalism) makes some important differences. For instance, once we understand egalitarian solidarity, we can avoid the sorts of surprises that have been visited upon the Brent Spar and the Narmada River Project. And we can see that, only if all the transactions are in the fatalistic realm (the one realm where learning is not possible),

would the prevalent assumption (evident, for instance, in the hierarchist's diagnosis of the climate change problem) and the IPAT equation (*see* **Modeling Human Dimensions of Global Environmental Change**, Volume 5) that there is a direct relationship between population increase and environmental degradation hold true. But there is much more to it than this.

Change, in the conventional theory, is deterministic. If you're knocked out of hierarchy, you'll end up in the market, and *vice versa*. But, in Cultural Theory, change is indeterministic: leave A and you can end up at B, C or D, and when you leave whichever one of these you have arrived at, there are three possibilities, on and on. Conventional theory treats human systems as simple (linear, deterministic, insensitive to initial conditions, equilibrium seeking, and predictable); Cultural Theory treats them as complex (non-linear, indeterministic, sensitive to initial conditions, far from equilibrium, and unpredictable).

Simple systems are manageable in the sense that, once we understand enough about them, we can define some desirable state of affairs (*sustainable development* is the current favorite) and then steer the totality towards it. But this, as our next example makes clear, is not possible if the system is complex.

A Swiss Example

Moving from the Himalayas to the Alps, we find much the same four-fold allocation of transactions, with agricultural land being privately owned and grazing land (and sometimes the forests) being communally owned. But the Swiss forests, unlike those of the Himalayan villagers, are physically sandwiched between the high pastures (communally owned) and the valley floor (privately owned fields, houses and hotels). Over the centuries that the Davos valley has been settled, to take a specific locality, both the fields and the grazing land have expanded at the expense of the forest. The trees on the steeper slopes have stayed in place, acting both as a source of timber and as a barrier against avalanches. However, it is difficult to achieve both these functions simultaneously. The Davosers have often set in train changes in the forest's age structure which, decades later, have resulted in exceptional avalanches reaching the valley floor and threatening the destruction of the entire community.

Every time this unpleasant surprise has befallen them, the Davosers have responded by switching their forest management onto the "all in the same boat" egalitarian style. Later, it has sometimes shifted to the hierarchist style, often to the individualist style (with farmers owning long thin strips of forest running all the way from valley floor to alpine pasture), and sometimes to the fatalist style (as happened, for instance, when the avalanche danger was clearly perceived yet extraction continued in response to the demands of various mining booms and, in more recent years, the demand for ski-runs).

Surely, you might think, they would have got it right by now. To think that is to assume that there is one right way; but as Cultural Theory shows us, that is not the case. There is no way of ever getting it right, because managing one way inevitably changes the forest, eventually to the point where that way of managing is no longer appropriate. This would happen even if there were no exogenous changes (like the mining and tourist booms) which, of course, there always are (even in seemingly remote places like the Himalayas). Viability can only be achieved, therefore, by covering all the bases: by the villagers ensuring that they have the full four-fold repertoire of management styles, and by their being prepared to try a different one whenever the one they are relying on shows signs of no longer being appropriate. The Davosers, like their Himalayan counterparts, have now been in their valley for more than 700 years, without destroying either themselves or their valley in the process. This achievement would not have been possible if they had opted for just one management style, or even for the two that the prevalent orthodoxy allows!

Multi-vocality

Himalayan and Alpine villages, with their transactions parceled out in these four very different ways, are impressively multi-vocal. More than that, as is evident from the examples of stall feeding and trees on private land (in the Himalayas) and of alternative forest management styles (in the Alps), they have the ability to switch transactions from one way to another whenever it seems likely that this might be more appropriate. Since the behavior of the villagers is continually altering the resource base on which they depend, their villages would not be viable if they did not have this in-built (messy, noisy and argumentative) mechanism. Schapiro (1988) has dubbed this sort of setup (in which each conviction as to how the world is, each myth of nature, is given some recognition) a *clumsy institution*. This is in contrast to those more elegant, and more familiar, arrangements (tidy, quiet and suavely consensual) in which just one conviction holds sway. The terminology is deliberately counter-intuitive, clumsy institutions having some remarkable properties that are not shared by their unclumsy alternatives.

To understand just how remarkable clumsy institutions are, imagine for a moment that you are some God-like experimenter, able to reach out and change this is or that variable in a Himalayan village's environment, or to move it bodily east or west, north or south, across the convoluted landscape. As you bring in the logging contractors, or take it 100 km eastwards or 1000 m higher, the village will shift its transactions this way or that between its four options

until it has adapted itself to its changed circumstances. In other words, it will maintain its viability thanks to the very practical learning system that is part and parcel of its four-fold plurality. If the village did not have this plurality, and was an elegant and unclumsy institution, like many national forestry services, including Britain's Forestry Commission (Tomkins, 1989) and the United States Forest Service (Hirt, 1994), it would not be able to do this. Something along these imaginary lines, it turns out, is what has actually happened, and continues to do so.

As we go from one Himalayan village to another, the relative strengths of the four ways of organizing vary. Egalitarianism, for instance, is strongest in those parts of the Himalayas that are most prone to commercial logging. As one moves eastwards, from India (with its powerful center and its colonial heritage of Reserved Forests) into Nepal and Bhutan, so the Chipko Movement and its counterparts become less of a force to be reckoned with. If the inequitable external threat is absent then so too, it appears, is the communitarian response to it. However, the most dramatic of these variations is north–south: between the strongly individualized Buddhist villages and the strongly collectivized Hindu villages a day or two's walk downstream. These are Fürer-Haimendorf's (1975) adventurous traders and cautious cultivators, respectively: apt characterizations which readily map onto two of the four social beings (individualists and hierarchists, respectively) that we have described above.

Cultural Theorists, we should explain, use the term *social being* to describe the behavior to which an individual must conform, and the convictions that he or she must espouse, to help maintain the form of social solidarity to which he or she belongs. The prime mover, therefore, is not the individual (the psycho-physiological entity) but the form of social solidarity. Thus, the terms hierarchist, individualist, egalitarian, and fatalist denote available roles (or management strategies) that individuals step into, or out of, as their daily lives, or the changing seasons, take them from one transactional realm to another (Figure 2). (See also Box 1: A Swiss villager's day). Though all four roles are present in both the Buddhist and the Hindu villages, more transactions are in the individualist quadrant in the former, and in the hierarchist quadrant in the latter.

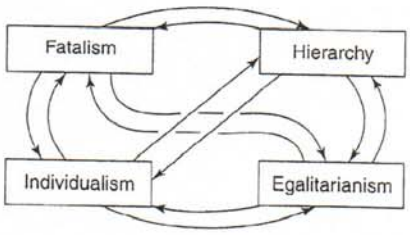

Figure 2 Transitions between solidarities and their associated transactional realms (individuals are able to move without causing change. It is when some transactions are shifted from one realm to another that we get change)

Fürer-Haimendorf (1975) shows how the small agricultural surpluses of the cautious cultivators become the payloads of the adventurous trader's yaks as they set off on their journey into Tibet, and how the salt they bring back eventually finds its way to the cautious cultivators who cannot produce this vital commodity. The distinctive strategy of each thus makes viable the other's, and we begin to see how it is that each village, in adjusting to its circumstances (which include the other villages), creates and takes its place in a social and cultural ecosystem, in which the marked divergence of the parts sustains the whole. Nor is this a fanciful analogy. As we show below, the adventurous traders' strategy matches that of the omnivorous and opportunistic r-selected species; the cautious cultivator's strategy matches that of the specialized and niche-dependent K-selected species (*see* **r–K Strategies**, Volume 2). The fatalists do for social systems what compost does for natural systems (provides a generalized resource for renewal). The egalitarians, through their small-scale communal fervor, are creating enclaves of low-level energy (what Marx, 1967, called primitive capital) in places where neither the r-selected nor the K-selected species can make any impression (Holling, 1986; Thompson *et al.*, 1990; Holling *et al.*, 1993).

So the ambitious hypothesis that is being sketched here is very different from the way people usually think about the interactions of social and natural systems. There is, on this view, no way of ever getting it right: of bringing the social into long-term harmony with the natural (which, of course, is the whole idea behind sustainable development). Instead, each is a four-fold and plurally responsive system, and their time-lagged interactions ensure that there can be no steady-state outcome. The whole system is in a perpetual unsteady state: changes at each level (the social and the natural) adapting to the other and changing it in the process, thereby setting in motion another set of changes. On and on. Nor are these changes predictable, as they would be if each level had only two possible states: hierarchies and markets, for instance, or, as is discussed below, their ecological analogues. Order without predictability (as opposed to transition from A to B, or oscillation between A and B, that the two-fold hypotheses give us) is the crucial idea behind this Himalayan story.

THEORIES OF CHANGE THAT MAKE CHANGE PERMANENT

Change, Cultural Theory argues, occurs because the four forms of social solidarity are not impervious to the real world. Just because people insist that the world is as their myth of nature tells them it is, it does not follow that the world really is so. If it is, that is fine, but if it is

Box 1 A Swiss villager's day

During the growing season an individual may on one day milk his cows, cut hay, thin saplings, maintain an avalanche control structure and wash dishes in a restaurant. The cows though privately owned are grazed on pasture owned by a specific set of long-established families. The hay is on his own private field; the saplings are part of a forest owned by another set of families; the avalanche control structure is on private land but maintained by agreement by the village; and the restaurant is owned by a multinational hotel chain.

This framework is fairly stable from season to season but the individual has a very different pattern of activity in the winter when the cows live in his private byre and much of the land is snow covered and barely used unless the valley includes a ski resort. If it does, then he has opportunities for work without leaving the valley. If not then he may leave to work elsewhere, thereby reducing the use of scarce resources at home. Thus in winter the human ecosystem centered on the valley is concurrently simpler and wider.

So our Swiss villager has a portfolio of transactions and management styles that fluctuates with the seasons and also with the longer-term dynamics (such as those that in altering the age-structure of the forests can eventually shift a whole category of transactions from one style to another).

- Like his Himalayan counterpart, he owns his hayfields and cows. These are private property; he can buy or sell them acting as an individualist, subscribing to the myth of nature benign.
- Coming from an old-established family, he is a member of a forest cooperative (Waldgenossenschaft) that gives him specific rights to cut trees and imposes a duty to maintain the forest. He is also a member of a pasture cooperative (Alpgenossenschaft) which annually decides the grazing season and the number of animals he may graze and requires him to contribute to the cowherd's upkeep. These are small-scale hierarchical institutions which have developed over the generations (in between the periods when the forests are privatized and their associated transactions transferred to the more exploitative individualist management style) in response to the limitations as well as the opportunities imposed by the natural environment: nature perverse/tolerant.
- As a voting member of the commune, he also has a duty to maintain resources that contribute to its survival such as the avalanche control structures that protect houses, fields and roads from damage. This tends to be an egalitarian involvement which recognizes that when it comes to these sorts of hazards, all the members of the community are in the same boat and that each should contribute his equal share: nature ephemeral.
- Lastly as a dishwasher in a multinationally owned restaurant, he is effectively a replaceable fatalist. His involvement is necessary if the enterprise is to continue but he has no interest in its future nor it in his and he can be paid off at any time (he will almost certainly lose his job at the end of the summer season).

not, they have an uphill struggle. Surprise (the outcome of the ever widening discrepancy between the expected and the actual) is of central importance in dislodging people (and their transactions) from their form of social solidarity. And it is these various mismatches between what a way of life promises and what it delivers that continually tip people (and transactions) out of one form of social solidarity and into another. Of course, this hypothesis does require that the world, at times and in places, be each of these possible ways: otherwise we would all eventually end up surprised into the single true way. And it would help the surprises to continue indefinitely if the world itself kept changing.

Neither of these suggestions, some ecologists would argue, is particularly far-fetched. Holling (1986) and Holling *et al.* (1993) for instance, have elaborated the notion of requisite variety into a powerful critique of the conventional idea that the *climax community*, the ecosystem in which each specialized species has its stable and ordered niche, is the end of the organizational road. This critique exactly parallels Cultural Theory's dissatisfaction with the conventional hierarchies and markets account of things, in that it argues that there must be four, rather than just two destinations. Holling's critique is that the climax community eventually complexifies itself to the point where it undermines its own stability: an inevitable collapse, which has been proved mathematically by May (1982). This does not mean that an entire climax community (the Amazon rain forest, for instance) will suddenly disappear, but it does require any climax community to be patchy: to always include some localized areas in collapse as, for instance, happens when a mature tree crashes to the ground.

At this catastrophic moment, all the energy that is tied up in all the niches and interdependencies of the climax community is released. Holling, well aware of the parallel with Schumpeter's (1950) theory of economic maturity, collapse and renewal, refers to the transition from the climax community to compost, as *creative destruction*. Nor, he argues, is this the end of the road. With the whole place suddenly awash with capital (loose energy), the challenge is to fix it before it all disappears, by soil leaching, for instance. This, of course, is where the unspecialized and cooperative fence builders (microorganisms mostly) come into their own, gathering up the loose energy into small bundles that, as yet, have no connections with one another. But even this is not the end of the road, because the stage is now set for the appearance of yet different ecological players. These are the unspecialized

but opportunistic, fast breeding and highly competitive r-selected species. These generalized exploiters (weeds, rodents and so on) are able to harness all the energy gradients that are now in place between all these unconnected bundles of energy. But these r-selected species, as they exploit and colonize this environment, inevitably begin to push it into a rather more patterned and interconnected state, thereby making it less conducive to their way of doing things and more suited to the sort of energy-conserving strategies that characterize the K-selected species: those specialized, slower breeding and often symbiotic, plants and creatures, which are the vanguard of the complex and increasingly ordered whole that constitutes the climax community.

In other words, once you bump up the number of ecological strategies from two to four, there is no end to the road. Instead, there is a never ending set of transitions (twelve in all) that exactly parallels (in terms of dynamics, not substance) the social transitions of Cultural Theory. Holling goes on to argue that, while all twelve of these transitions do happen, there is a tendency for some to predominate at certain stages, thereby creating a fairly regular sequence of transitions: from specialized interdependence (the climax community) to unstructured fragmentation (compost) to unspecialized cooperation (energy fixing) to unspecialized competition (the pioneer community) to specialized interdependence (the climax community, again) and so on. He calls this sequence an *ecocycle*, and its description (which can be supplemented with descriptions of all the other cycles that are possible but, Holling believes, less pronounced) helps us to see the gulf (some might use the expression *paradigm shift*) that separates this model of change from the conventional one (Figure 3).

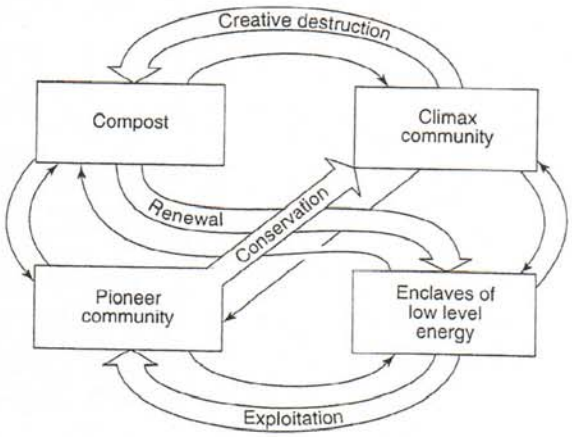

Figure 3 The complex critique of the conventional assumptions about natural systems (redrawn from Holling, 1986 to be homologous with Figures 1 and 2)

Is there, then, a socio-cultural equivalent of Holling's ecocycle? Yes, there is, and it can be most easily set out by reference to the theory of surprise: the theory that provides the bridge between the institutional and the natural: between us and the rest of nature.

ALWAYS LEARNING, NEVER GETTING IT RIGHT

A myth of nature provides its holder with a way of seeing the world and with a way of not seeing it. This means that, if the world happens not to be the way the myth holder is convinced it is, he or she will not notice this discrepancy straight away. Enlightenment, therefore, is always time lagged and, since it results in the enlightened one being tipped out of one quadrant of the Cultural Theory scheme and into one of the other three, it comes as something of a shock: a surprise. Surprise, in other words is always relative, which explains why, whenever something unexpected befalls us, there is always someone who saw it coming! The theory of surprise (Thompson and Tayler, 1986; Thompson *et al.*, 1990) is built on this relativistic, but far from unconstrained, foundation:

- an event is never surprising in itself;
- it is potentially surprising only in relation to a particular set of convictions about how the world is;
- it is actually surprising only if it is noticed by the holder of that particular set of convictions.

For instance, an individualist, whose myth assures him that an ecosystem is so robust that it will recover from any perturbation, will be surprised when it collapses catastrophically. Similarly, a hierarchist who is convinced that all ecosystems can be managed, with predictable results, will be surprised when this turns out to be untrue. Conversely, an egalitarian, who believes that nature is precarious, will be surprised when those who have disregarded precautions do not reap the expected disaster. And a fatalist will be surprised if benefits, which he expects to be randomly distributed, continue to arrive.

Thus, surprises may be either pleasant or unpleasant, and a never ending sequence from one myth of nature to another may be proposed. Though all twelve transitions (see Figure 2) are possible, and we cannot say for sure what their order will be, we can spin a story to help us understand what is going on by privileging one particular sequence of possible changes so as to generate the socio-cultural analogue of Holling's ecocycle.

- Let us start with *nature benign*. In this state of the world, there is an excess of opportunity over existing investment, and this state, when interrogated by the myriad actions of individual agents, results in a positive-sum game in which a hidden hand keeps

adding to the welfare of the totality. As long as the excess continues (that is, as long as there is no rim to the deep basin that contains the ball), and learning by experimentation continues, we have the state of affairs assumed by neoclassical economics.

- But, as they say in show business, "Nothing recedes like success" and eventually exploitative behavior causes the upper edge of the basin to turn downwards: *nature perverse/tolerant*. The excess, for some actors, has now vanished. Transaction costs rise steeply, innovation brings losses more often than profits, and markets fail. This is the transition from markets to hierarchies described by the new institutional economics (Williamson, 1975).
- Hierarchically sustained transactions, in their turn, transform the environment that ushered them in and eventually the pocket of stability implodes: *nature capricious*. Both hierarchy and individualism (which has, of course, survived in the pocket) now start to lose their transactional grip and the world becomes a confusing, contradictory and unpredictable place: a place of which the fatalist's attitude; "Why bother?" makes perfect sense.
- This flatland, however, is less hostile to those small, egalitarian and self-disciplined groups that strive to bring their needs down within what they perceive to be Mother Nature's frugal limits, and these groups are therefore well placed to take advantage (though that is not quite the right word) of the recessive realities that are about to overwhelm the conventional institutional arrangements: the hierarchies and the markets.
- In this next stage, *nature ephemeral*, all increases in scale bring punitive diseconomies, and the economy (like the universe that contains it) winds down and down. The entropy principle (Georgescu-Roegen, 1971) and the dictum *small is beautiful* (Schumacher, 1973) make economic sense (*see* **Small is Beautiful**, Volume 5). Yet, no matter how lightly everyone treads on the Earth, the ball eventually rolls down the slope, coming to rest in some other basin (*nature benign*) and we are back where we began: in a positive sum world that rewards the bold and skilful and that brings increasing returns to those who are prepared to act expansively.

Throughout this process, changes in the environment result from the actions of those whose strategy happens to be best suited to making the most of the environment in which they find themselves. As more and more of these strategists act, these endogenous changes accumulate, and the environment passes over a threshold into a state better suited to one of the other strategies, *ad infinitum*. Though this complex model may start at the same place as the simple one and have the same dynamics, its paths are infinitely more surprising and unpredictable. In this inherently complex system, in which ecological and sociocultural components interact, each myth of nature captures some aspects of the world at some time. No one of them is ever right all the time and everywhere, and this means that each has its vital part to play. Clumsy institutions nurture that vitality; elegant ones destroy it.

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