Short-Loop Living

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• This article is reprinted from the July 1974 issue of *Equilibrium,* published by Zero Population Growth, Inc., Washington, D.C. Sam Love is associated with Environmental Action Foundation, specializing in energy-related issues.—*Editor.*

RECENTLY IN NEW YORK one of General Motor's companies unveiled a new line of big autos. Dubbed the Spirit of America, these vehicles symbolize an American corporate dream of big cars, big engines, Rube Goldberg smog control contraptions, massive highway building programs, zillions of parts, and big promotions.

General Motors can't be condemned for its choice of advertising slogans. In many ways this one is apt because it represents the spirit of the American economy. Perhaps in the bicentennial spirit many other environmental horrors such as nuclear power plants, strip mining shovels, and throwaway cans will be similarly named. It would only be fitting because most American economic policies are dedicated to that spirit. Yet increasingly that spirit is haunting us—and not just us, but also other industrial nations.

Inflation appears uncontrollable. Resources are getting tighter. Technological promises like nuclear power are proving to be laden with unreliability and dangers. And on top of all the separate problems some social critics, such as Roberto Vacca in *The Coming Dark Age,* believe that the separate problems will interact to produce a complete breakdown of technological support systems.

Yet even more distressing than tomorrow's dismal outlook is that sensible answers and directions seem missing. The social economy is now so complexly interdependent and mammothly scaled that it appears impossible to even model for decision-making purposes.

But even though detailed models may not exist, a pattern is observable. In contemporary industrial societies material goods, energy, and capital move through large loops and flow patterns that weave through each other. Such intricate interdependencies have evolved that any model that might be constructed of the flow patterns of the contemporary economy would undoubtedly resemble a giant cobweb. Urban areas are supported by resource networks extended hundreds, even thousands of miles. Los Angeles depends upon New Mexico for electrical power. New York gets food from all the country and the world. Middle Eastern oil fuels the Northeast. American capital markets react rapidly to events in London, Paris, Tokyo, and so on.

Overconnectedness

Interconnection of systems has long been understood by ecologists and they are fond of quoting John Muir's description of the natural world: "When we try to pick out anything by itself we find it hitched to everything else in the universe." Although Muir described systemic interrelationships he didn't caution against systems getting *overhitched* or *overconnected* to the point where small disruptions can cascade through the interconnecting networks to impact larger and larger areas. Possibly one reason he neglected to warn us is that natural systems may be linked, but nature dampens the impact of cascading disruptions by diversification and decentralization. By simplifying diverse natural systems to agricultural and forestry monocultures, humans remove the stability that nature builds into diverse systems and increase the possibility of disruptions or collapses. To illustrate this, ecologists can site numerous examples of ecosystem decimation by such infestations as corn blight, cotton boll weevil, and potato blight.

Even though the values of such concepts as decentralization and diversity are understood, the tendency is toward the large-loop, overconnected society. Produced by powerful forces such as technological advancements, economics associated with large scale, capital's tendency to concentrate, and psychological fascinations with bigness, such a society seems a certainty. But careful observation indicates that the historical momentum to create an ever larger and intricate cobweb economy is now breaking. With serious disruptions occurring in the energy and material flows needed to weave the new socio-economic web, new directions are now essential.

Toward Smaller Flow Systems

As an alternative to the cobweb economy, we can move toward small loop and flow systems that are disconnected. Disconnection and self sufficiency have always been a dream of some and the back-to-the-land movement has cherished it for years. Now, with new technologies, totally new dreams are possible, and their realization could radically alter the shape of future communities. For example, architectural students at the University of Minnesota have developed and constructed a house which makes a living area more self-sustaining. The house, named "Ouroboros" after a mythical dragon which survived by eating its own tail and feces, is heated by the sun, insulated with earth and sod, and powered by the wind. Sewage is composted, water use is minimized by misting through the shower, and food is grown in a greenhouse area. The house makes maximum use of energy conservation techniques in cooking, ventilation, heating, and lighting. According to Tom Bender, an architect who was on the staff of the University in 1973 when the Ouro-

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boros house was designed, about 100 such experimental "ecology houses" are being built around the country.

In another experiment Day Chahroudi, an imaginative solar energy pioneer now at MIT, has developed a similar concept for a house, which he calls the "Biosphere." He has as a goal the replacement of "long distorted communication loops by short accurate loops." He accomplishes this by integrating a house, greenhouse, solar heater, and solar still. Much of what a living area requires—food, heat, fresh water, and waste treatment—are performed in his house by a greenhouse and solar collector. When coupled with such power sources as wind generators, the net effect is to reduce the dependence on outside systems. A Biosphere would not make a person living in it completely self-sufficient, but it would meet many of his or her needs. Chahroudi has designed and built, separately, all the components of the Biosphere. He is now seeking support to combine them in a prototype structure, but so far he hasn't found anyone bold enough to build the first one.

Densification

The concepts underpinning Chahroudi's work can be applied to other situations. He has also designed urban greenhouse forms that would utilize the roof space of city buildings to generate heat and grow vegetables. The effect might be to allow people to continue living at the high densities required to generate the social dynamic of urban living, but still partially break up the food and energy loops and flows. Such a configuration would also take advantage of the considerable transportation energy savings that are possible when people live within walking or bicycling distance of services, jobs, entertainment, and so on.

Studies such as the New York Regional Plan Association's report on how much less energy citizens of the New York area use than those in rural areas provide evidence that energy savings are possible through densification. Although transportation savings are certainly possible, the New York study's sweeping conclusions about urban citizens using less than rural people should be qualified. Contemporary cities, like New York, can function only because they have huge energy subsidies. The food, energy, goods, and water that support the urban organism all require energy for manufacturing and movement.

By producing some of the essentials for existence within the city itself, the subsidies and large complex networks built around them can be reduced. This reduction of interdependency and network decentralization is possible in relatively dense areas. Already, roof space is being utilized in cities such as New York. Chickens are raised on roofs in Taiwan and other eastern countries. Poultry and local ordinances may not be compatible, but roofs can support vegetables either grown naturally in soil or hydroponically in solutions. Such gardens can range from millionaire Stewart Mott's $1.25 million greenhouse in his New York penthouse to simple tubs of earth supporting tomatoes on an apartment terrace.

Urban areas also have a significant amount of unused land that could be utilized for gardening. The feasibility of food production in cities is shown by the current resurgence of urban gardening. This new interest in home food production which has been generated by Third World hunger and high prices, offers communities an opportunity to exert leadership by assisting citizens who want to grow their own food. Fairfax County, Va., is one area which has initiated a very progressive program of neighborhood gardens on county-owned land. Under this effort the county provides gardening classes and water outlets.

Other possibilities also exist. One group in the Adams Morgan neighborhood in Washington, D.C. is experimenting with raising trout in basement tanks. So far no ordinance has been passed against basement aquaculture.

Stabilization through Diversification

The technology already exists to construct the small-loop society. Such a society could function at energy levels much lower than those of today. It would also have stability from the disruptions of large-scale technological breakdowns. But even though the tools are ready for the construction of such a society, they may not all be as economically competitive as plugging into centralized networks. Research will make such technologies as solar power more competitive, but the skyrocketing social and monetary price of systemic disruptions could make the act of unhitching from an overhitched world so attractive that economics becomes a secondary consideration.

Until now we have tended to associate concepts such as decentralization with merely moving people from the cities to the land. But when applied to physical networks—and not just people—it involves much more. Already some social planning recognizes the pitfalls of not controlling centralization, scale, and interconnection. The telephone company, for all of its faults, offers us a good example of the utilization of stabilizing principles in systems design. Technological capability has reached the point where one of its four-inch cables, the L-5, can carry 108,000 simultaneous conversations or a new microwave system can carry 15,000. The company recognizes that the cable's capacity is so large that it could handle nearly all of the traffic on a major route at one time, yet all of its calls are not routed through the cable. As an official policy, message loads are always routed through at least three routes, so that a break in the main cable would not completely shut down the system. Thus by applying the principle of diversity, the company unhitches networks and gains stability. It does not use the L-5 to its full economic potential, but the company places a high enough value on systemic stability to make the necessary commercial sacrifice.

Perhaps if other institutions followed the example of the phone company and placed increased value on stability and less on short-term economic gain, decentra-

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While the use of the population sampling board was only one segment of our biometrics course, we feel it was a very succesful vehicle for introducing some of the basic concepts of statistics. In fact, the students constructed their own sampling boards and will be using them in their various colleges in their own courses.

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lization and diversity would become accepted design concepts.

Tomorrow Can Be Better

The implications of short-loop living are far reaching. One impact could be the realization that the size and complexity of networks are not the only important criteria. The amount of flow is also important. Thus using less could become a critical value for the short-loop society.

Short circuiting networks could also contribute to the creation of shorter loops. For example, instead of eating meat which is now the end product of a long food chain involving petroleum, tractor factories, soybeans, grass, cattle food processing, butchering, and packing, the protein could be consumed in more direct forms, such as soybeans. This short-loop consumption might also serve to release food and resources for consumption elsewhere.

The most significant implication of the short-loop society could be surprising. To understand this impact it is important to look at what has happened to other visions of decentralized communities. Some of the turn of the century dreams of satellite communities, such as Sir Ebenezer Howard's Garden Cities outside of English cities like London, offered us a decentralized model. Several were actually built in England and although they were only able to provide residences for a small number of people, they did make a major contribution. In addition to providing a strong influence on urban planning, those early dreams offered a positive vision of a desirable tomorrow with people living in harmony with nature.

Given the current rampant pessimism about the prospects for the future, it may not be important that an urban greenhouse or a basement fish tank can't overnight provide us with a solution to either the world's food problems or urban instability. The fact that they exist could provide a promise that tomorrow can be better. That idea alone could be an important contribution.

The Test . . .

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B more appealing than the correct choice. The wording of choice B may have misled the students or, more importantly, a concept or idea was incorrectly learned or taught. At times I have found that students actually learned the opposite of what I thought they were learning! This type of analysis will prevent such catastrophes from being promulgated. In cases of questions which are too easy, further analysis, as for question 5, will not yield much information.

The Test: an Integrating Factor

For an examination to be a good teaching, learning, and diagnostic tool, construction must highlight levels of the cognitive domain: knowledge, comprehension, application and analysis, synthesis, and evaluation. All levels can be adequately tested by means of an objective examination. It is time that we move away from a purely knowledge examination to one which allows a student to show his true ability, not his memorizing capacity. An examination is not a marking tool, separate and distinct from a student's learning experience. With proper application of these construction and analysis techniques, we can truly test ability and understanding. A grade on an examination will become a meaningful measure of both teaching and learning, and, in the end, a means for improving both.

NABT Convention Calendar

The following are dates of seminars and conventions sponsored by the National Association of Biology Teachers. For additional information, write to NABT, 1420 N Street, N.W., Washington, D.C. 20005.

May 12–14, 1975. NABT-ICFAR Seminar, Indianapolis, Indiana.

October 23–26, 1975. NABT National Convention, The Portland Hilton, Portland, Oregon.

October 14–17, 1976. NABT National Convention, The Regency, Denver, Colorado.

October 20–24, 1977. NABT National Convention, The Anaheim Convention Center, Anaheim, California.

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