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Cyberspace and the Ecotopian Dream

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Dedicated to Tim Berners-Lee

Abstract: In his recent book *The Alphabet vs the Goddess*, Leonard Shlain argues that we are presently in the midst of an *iconic revolution* in which written language is being superceded by a new visual language, and that this represents a return of the Goddess to her prehistoric and rightful place. Despite the certain decline of literacy in our time, we feel that the new medium is actually a partnership of written and iconic languages -- namely, hypermedia: the multimedia text, hypertext, and hypergraphic medium of the World Wide Web — and that this presages a return of the partnership aspect of prehistoric societies. While the World Wide Web is indeed *collective knowledge*, it will not truly be *collective intelligence* in the sense of Pierre Levy until it combines hypermedia with the computer modeling and simulation of natural and social systems by means of complex dynamical systems techniques. In this talk we will relate this vision of a dynamic cyberspace with the ecotopian dreams of our time.

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1. The General Evolution Research Group

The General Evolution Research Group formed in the 1980s around the kindly leadership of Ervin Laszlo. Two passions animated this group:

- The challenge to understand a universal dynamic at work in evolution scenarios everywhere.
- The explosion of global problems of population, environment, health, economics, and so on.

These two passions eventually merged, in our own general evolution, as seen in the theme of our recent publication, *The Evolutionary Outrider,* edited by David Loye: Human activist agents and their utopian dreams are crucial to our further evolution.

So we must carry on, collectively and individually, with utopian dreams and activist interventions, even when it seems we are having no effect. So here is yet another dream, this one inspired by the recent explosion of the World Wide Web.

We are grateful to the Grauso Foundation for the opportunity to meet once again to pursue our dream.

2. Collective intelligence

We are convinced we live amid a major cultural transformation. This conviction surfaces in most of our published works, quite explicitly in Ervin Laszlo's *The Age of Bifurcation*, and in the chapters of *The Evolutionary Outrider* by Riane Eisler, Hazel Henderson, and Paul Ray. See also the brief Commentary by Ervin Laszlo at the end of *The Evolutionary Outrider.*

One part of the shift of our time is the *iconic revolution* described by Leonard Shlain, in his recent book, *The Alphabet vs the Goddess*. This work argues the up side of the new illiteracy: the return of the Goddess, the feminine, and the partnership society. The *chaos revolution* is another component of our ongoing transformation, as described in my book, *Chaos, Gaia, Eros*. And the very fast rise of the internet and the cyberspaces it hosts — the World Wide Web, Virtual Worlds, Artificial Life, and so on, the *collective intelligence* of Pierre Levy — is an integral part of our millennial makeover as well.

Putting this together, we see we are a human collective webbed in cyberspace, evolving through a major bifurcation like the *omega point* of Teilhard de Chardin, becoming a collective intelligence le on a global scale, and facing anew the ongoing *world problematique*.

3. Collective erodynamical intelligence

Besides the further evolution of collective intelligence, with the necessary emergence of moral and spiritual qualities and green ethics, we must have within our web the cyberspace version of our sciences, integrated into massively parallel, global model,: namely, *complex dynamical models*. We urgently need them to expand our horizons of complexity, to see further into the future, to better understand the complex dynamic in which we are enmeshed in this planetary evolutionary scenario. Previously I have described such complex dynamical models of microcosmic, mesocosmic, and macrocosmic systems, uniting the physical, biological, and social sciences, as *erodynamics*.

By *collective erodynamical intelligence* I mean this vision of our current collective intelligence, augmented by the uploading of erodynamic models into cyberspace as a distributed processor for their computer simulation.

It may be useful at this point to include a concise lexicon of dynamical literacy.

3. Dynamical systems

A *flow*, or continuous dynamical system, is generated by a vectorfield on a state space. The *state space* may be a Euclidean space or a smooth manifold of any dimension, finite or infinite. For beginners, it is most helpful to think in terms of Euclidean spaces of dimension one, two, or three. The *generator* of the system is a field of vectors which may be regarded as giving the required vector velocity, at any given point, which the trajectories of the system must have.
A *trajectory* is a curve in the state space having at each point the required velocity vector. The *flow*, then, is the set of all points in the state space, moving along the trajectories like a fluid.

When followed for a long time, most trajectories end up in a dynamical equilibrium called an *attractor*. Attractors may be classified in three or more categories, such as fixed, periodic, or chaotic. Normally there are many attractors. Fixing attention on one attractor, we might mark each and every state which ends up at this attractor in the long run. The set of states so marked comprise the *basin* of the attractor. Basins may be fat, like lakes, or thin, like meandering rivers.

Distinct basins are bounded and separated by *basin boundaries*, also called *separatrices*. These may be *thin*, like points in dimension one, curves in dimension two, surfaces in dimension three, and so on. Very often, however, they are *thick*, that is to say, fractal.

The most useful image of a dynamical system is its *portrait*: the state space divided into basins by separatrices, with one attractor indicated in each basin.

4. Dynamical schemes

Dynamical systems are much employed in the mathematical modeling and computer simulation of the simpler systems found in nature. Such models usually have some *control parameters*, variable coefficients for example, which are tuned by the modeler so as to obtain the best fit between some given experimental data and the simulated data output by the model. A model with controls is called a *dynamical scheme*, or alternately, a parameterized family of dynamical systems.

When the control parameters of a scheme are fixed, we then have a dynamical system, one member of the parametrized family. This system may be visualized as a portrait. And if the controls are then moved, the portrait will be changed. When the controls are moved smoothly and gradually, the portrait may be seen to also change smoothly and gradually. Sometimes, however, the portrait undergoes a radical change even when the controls are moved very gently. Such an event is called a *bifurcation*.

Bifurcations are certainly the most important features of a scheme, and locating them is a difficult job for the experimentalist. One might begin a study of bifurcations by looking at some exemplary cases, and most elementary texts do just this. The simple examples fall into three categories:

- *subtle bifurcations*, in which the change is not immediately striking,
- *catastrophic bifurcations*, in which a basin suddenly appears or disappears, and
- *explosive bifurcations*, in which an attractor suddenly expands or contracts.

5. Complex dynamical schemes

The schemes described above, and those usually found in elementary texts, are *simple schemes*. Their state spaces have low dimension, and they have just a few control parameters. They are suitable for modeling only the simplest natural systems, such as a simple pendulum. More complex natural systems require model schemes made by combining several simple schemes in a network. These are called *complex dynamical schemes*.

One begins with a *directed graph*, that is, a diagram with blank boxes, *nodes*, connected by arrows, or *connections*. The nodes, corresponding to subsystems of the natural system, must be filled in with specific simple schemes. The connections must be specified by coupling functions, which enslave some controls (*inputs*) of a target scheme to the states (*outputs*) of a source scheme.

After being connected in this way, some of the controls of the node schemes are enslaved, and are thus no longer control parameters. Other node controls remain free. Thus, the fully connected complex scheme is still a dynamical scheme. The meaning of *complex* in this context refers to the means of construction of the model, as a system of subsystems.

Neural nets are complex dynamical schemes. So are most models in mathematical biology, ecology, atmospheric science, and so on. The evolving experience with massively complex schemes has led to an idea, called *connectionism*, that the network is more important than the choice of models for the nodes.

6. Conclusion

Returning now to our goal, the evolution of a collective erodynamical intelligence in cyberspace, we have envisioned a large part of our current mathematical sciences, in the form of dynamical models expressed as computer programs with graphical representations of natural subsystems, all uploaded into websites, virtual worlds, multiplayer games such as SimEarth, and so on. But we want these to be reusable like Lego parts, in the construction of ever more global mesocosms, by futurists, scholars, lay people, and school children. What is most necessary to achieve this capability is an international standard, such as Java Beans, for the input and output specifics of the subsystem models.

So this is my dream. Through the addition of small things, what we have already achieved becomes the basis for a radically new approach to our further evolution, a quantum leap in our understanding of whole systems, pushing back the horizons of complexity in our collective intelligence, turning the lemons of technology and reductive science into the lemonade of a sustainable future.

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