

General Systems Theory as a Conceptual Tool for
Village Designers

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General Systems Theory (GST) has been an innovative developing science for the past fifty years, offering application to almost every field of inquiry. GST began as a response to the over-specialization of science into ever-more detailed, obscure, and isolated disciplines and sub-disciplines. The mechanistic, reductionistic, and atomistic mindset and prejudice of classical science produced knowledge with the same characteristics: detailed, obscure, and isolated – which was effective for describing and modeling predictable states of material reality but which was always inept at describing and modeling the behavior of self-organizing, living systems. Developing theories from diverse disciplines began to outline a unifying principle underlying the structure of the various levels of reality – that of the system. Systems Theory is an inter-disciplinary, naturalist philosophy, integrating the sciences and establishing useful conceptual models for holistic, multi-level thinking.

GST has been successfully applied to the physical, chemical, sociological, ecological, psychological, industrial, etc. – and especially biological fields. Here I want to demonstrate how GST can be used as a meaningful model in the field of *Ekistics* – the multi-disciplinary, scientific approach to the design of human settlements.

A systems approach treats all inquiry as an investigation of “wholes.” Such wholes could be atoms, organisms, or societies, it doesn’t matter; at each level of reality the corresponding wholes “exhibit irreducible properties and traits of structural similarity” called “isomorphisms.” Each whole system can be seen as embedded in larger super-systems and comprised of smaller sub-systems, so that all of Nature can be perceived as an hierarchical order of many different levels of structural manifestation, each corresponding to an overall, functional archetype of organization – that of the system.

A systems approach gives primary consideration to the inter-relationship and interdependency of component parts within any organized whole. Discrete components have less value as entities in their own right and only acquire meaning in terms of *relationship*, both within and to the whole. Such holistic perception reverses the trend of knowledge toward separatist reductionism, and provides a conceptual context for reweaving understanding back into its interdependent, multi-dimensional, supra-ordered completeness.

All living systems are open systems; that is, they maintain themselves in a state of dynamic equilibrium by importing free energy from their environment, converting this energy into order (negentropy), and then expelling entropic (degraded) energy back into the environment, energy which can be used at a subsequent level of the hierarchical order. All living systems are self-organizing, self-maintaining, self-repairing, self-differentiating wholes. Self-differentiation implies segregation into diversified partial systems and an increase in complexity. Living systems also express “equifinality;” that is, they are able to achieve a common end-state of self-actualization despite disturbances, false starts, or overshoots along the way. This remarkable ability of living systems to be self-directed – to provide their own order, organization, and spontaneous unfoldment from within – both defines the system as a “whole” and gives it vitalistic, soul-like, or nature-encoded properties.

One class of living system is the “organism.” Organisms have the generic qualities of all living systems, and some specialized ones. Organisms maintain themselves in a quasi-steady state at some distance from equilibrium so that work can be achieved. Organisms can be characterized by terms like goal-seeking, teleological, or purposeful, “reducing random behavior and moving inexorably toward a pre-ordained finality”. An organism processes *information* to move toward a state of higher order and organization, which promotes adaptability. Organisms create themselves over time. Organisms (essentially organic, carbon-based) can be defined by the fundamental characteristics of Life: metabolism, growth, development, self-regulation, and response to stimuli from the environment. Ultimately, and if successful, an organism is able to maintain itself in a time-independent state, maintaining internal order despite fluctuations in the environment.

Given all these characteristics, it is now possible to visualize human settlements from a systems perspective. A possible hierarchical order, in ascending complexity, could look like this: atoms, molecules, organelles, cells, tissues, organs, bodies, families, clans, hamlets, villages, village clusters (formerly cities), ecoregions, bioregions, continents, Gaia, solar system, galaxy, universe. These categories are culturally specific based on an ecological reorganization of the world. Each level of the hierarchy is an independent, autonomous whole system unto itself, yet intimately connected with the whole systems above and below it in dynamic, interdependent relationship. A weakness in any of the sub-systems detracts from the health and vitality of the over-arching supra-system; correspondingly, the health and vitality of the supra-system can be ensured by maintaining the health and vitality of each constituent sub-system. This is obvious because the hierarchy reflects a natural order.

Each of the human-managed systems in this arrangement is ecologically embedded within the larger systems of which it is a part in a continuous, uninterrupted

progression from micro- to macro-scale. Absent are the arbitrary human configurations such as nations, states, counties and cities, which exist contrary to ecological sensibilities and which often stand out in stark relief as separated from a natural order. These entities exist outside a systems perspective, as discrete components lacking any well-defined relationship, and this causes enormous stress for the larger super-system, Gaia. Once ecologically embedded, the human-managed systems can participate directly in the positive evolution and maintenance of Gaia simply by attending to matters at their respective scales. Attending to matters means ensuring health and vitality.

The word 'civilization' has as its roots the Latin *civitas* – city. Essentially, the rise of civilization is the rise of cities. Since the rise of civilization corresponded with the rise of a scientific worldview, we can expect them both to have similar characteristics: ever-increasing isolation, fragmentation, mechanization, specialization, and disproportionate concentration on strictly material reality. Since the paradigm which produced both the scientific worldview and civilization was neither able to incorporate nor successfully model the behavior of living systems, the resulting essence and structural configuration of their manifestations is lifeless, devoid of the qualities of living systems. This is a root cause of the troubles humanity faces at the close of the 20th century: The grand-city-metropolis, the pinnacle of achievement for civilization, destroys its environment as it alienates its inhabitants.

The emerging new paradigm, which includes an holistic, systems perspective, will insist that human settlements reflect a natural order. These new settlements will assume the characteristics of living systems: self-organizing, self-maintaining, self-repairing, self-differentiating wholes. As living systems, they will be functionally integrated into the larger systems of which they are a part – the ecoregions and bioregions – similar to the way an organ is integrated into the body. From this perspective, they will benefit spontaneously these larger systems by being self-contained, autonomous sub-systems carrying out their unique functions within the larger body in complementary unison with all other sub-systems. They will maintain themselves in a state of dynamic equilibrium with their environment by importing free energy, converting this energy into order, and then consciously expelling degraded energy to be used by a sub-system within the settlement. They will be designed to achieve maximum symbiotic relationship with other component parts, other settlements within the supra-system. Internally, they will manifest numerous sub-systems that are holistically integrated to benefit their host, the settlement. They will express “equifinality” in that they will inexorably move toward a time-independent state

of *sustainability* – able to maintain themselves indefinitely despite fluctuations in the environment.

It has been argued that cities and towns as they already exist do behave as living systems. I think this argument falls flat for several important reasons: Current settlements have absolutely no self-constrained limits to growth; they expand far beyond the carrying capacity of the regions they impose upon. Natural living systems always assume a scale defined by the physical characteristics of their context. Current settlements certainly import free energy from their environment, but they do so by rapidly, wastefully depleting this energy and exhausting the environment, thus ensuring a *time-dependent* state. Current settlements have no end-state in mind, no goal, no condition of equifinality. They will just continue to grow until they destroy their host. Their final form is still unknown for there are no natural comparisons! Current settlements and human-managed systems in general lack mutually beneficial relationships with one another; they exist as discrete components in competitive economic relationships, accelerating the depletion of resources and weakening one another. Finally it can be shown that cities and towns are not self-organizing, self-maintaining, self-repairing, self-differentiating wholes. The essence of civilization is the ever-increasing consolidation of arbitrary power into fewer and fewer centers (see Schmookler). As decision-making and control is removed from local, decentralized centers and transferred to distant, centralized power centers, the local centers lose their ability to be self-directed. Their organization, structure, and maintenance ends up depending on the decisions made by these arbitrary power groups and their need to maximize and consolidate even more power. So, it takes a far stretch of the imagination to suggest that current settlements behave as living systems. Their autonomy, their independence, their capability for self-regulation are all drained away by distant, outside influences which assume no responsibility for maintaining the health of the system. Traditional villages, however, were the archetypal examples of living systems.

The evolving new concept of the “full-featured ecological village” is certainly a living system in all regards. By its very definition it seeks to harmoniously integrate itself into the natural ecology of which it is a part in a time-independent state of sustainability. It is consciously and purposefully designed to be a self-organizing, self-maintaining, self-repairing, self-differentiating whole system benefiting the health and vitality of the whole systems above and below it in mutually-dependent relationships. The ecological village assumes all the characteristics of the emerging new paradigm and will become the quintessential model for human settlements in the 21st century. As civilization exhausts itself by depleting its resource base and exploiting the community upon which it depends, it inevitably will approach a state described as “chaos.” Chaos Theory teaches us that as a system moves into chaos, there are hidden patterns of order

amidst the seemingly random confusion. Eventually the system will reach a bifurcation point where it has the opportunity to leap spontaneously to a new level of order. We may be approaching such a bifurcation point today. The hidden pattern of order is a growing ecological awareness of the necessity for maintaining “wholes.” The demise of “civilization” – the culture of cities – and the ensuing chaos that will follow will transition into a spontaneous leap into full-blown ecological consciousness, and the ecovillage will be a foundational component part of this new systemic order.

General Systems Theory (and the associated disciplines of Cybernetics, Information Theory, etc.) is already providing useful conceptual tools for visualizing this new order and will continue to do so with increasing refinement and practical application. GST is well-suited to the multi-disciplinary approach of Ekistics. While it is obvious that ecological villages are *living systems*, is it possible to expand the metaphor, specialize the system, and describe truly ecological villages as *organisms*? This, I think, will be the ultimate challenge for village designers in the coming century: to design human settlements so that they assume a biological reality, incorporate teleological qualities, and incarnate vitalistic, soul-like, or nature-encoded properties.

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