SYSTEMS THINKING: THE KEY TO SURVIVAL

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ABSTRACT

While most people support sustainable development, many believe that its benefits must be weighed against other objectives such as economic growth and consumer desires for recreation, comfort and status. However, sustainability is not an option but a requirement. Any economy that is not sustainable will go bankrupt: any biological system that is not sustainable will die.

Human societies are living social systems that completely depend on their environments for the resources needed to survive. But evolution is a ruthless process: most of the species and human societies that have ever existed are extinct because they either destroyed their environments or could not adapt to changing conditions.

Our industrial societal system is designed for constant expansion. While this model was viable in a world of few people and many resources, it is now obsolete because the global economy is consuming more resources and discarding more waste than our planet's ecosystems can sustainably produce and recycle. In the coming decades a combination of global warming, resource shortages and species loss will create growing environmental, economic and social crises.

This is a global emergency. If we continue with business as usual major ecosystems will collapse by mid-century. This will destroy the global economy and end our complex civilizations. But disaster is not inevitable. At the same time as industrial civilization has outgrown its biophysical limits, a new type of sustainable societal system has begun to evolve. Systems-based views, values, social structures, technologies and economic processes are rapidly emerging. The future is our choice: if we fail to act our children will be doomed to live on a dying planet; if we make the right interventions we can accelerate the evolution of a holistic societal system.

Constructive intervention is possible because societal systems do not have random designs. Human societies have evolved through distinct stages (historical "ages"). Societal systems with similar worldviews and structures emerge and endure in each age because they have environmentally relevant configurations. Their congruent and stable patterns constitute system attractors. For example, similar conditions and stages of development created the long-lasting agrarian kingdoms of Egypt, China, and Central America.

Societal systems are unified and organized around worldviews, which are overarching conceptions of reality that explain the place of humans in the world. Worldviews and cultures (learned traditions of thought and behavior) provide meanings and symbolic

tools for organizing the social institutions that in turn organize and regulate group and individual behaviors. For this reason the key to the evolution of a sustainable global system is the spread of a holistic worldview – a systems perspective that recognizes the interdependence of all life on Earth.

Evolution always involves both individual and group selection—since the survival of a species depends on group fitness, competition between individuals usually occurs within a wider framework of group (and ecosystem) cooperation. Most people are willing to make sacrifices for their children, community or faith. In times of war entire societies are asked to subordinate their personal desires to the needs of their nations. In the long history of humanity, the individualism of our consumer culture is an aberration.

The survival of our species is now at stake. This threat has the potential to unite humanity around a common task—developing a sustainable culture and economy. Our challenge is to clearly explain the global emergency and provide alternative pathways to a viable future. If we recognize that a systems-based worldview is the key to the organization of a sustainable society, we can help develop congruent social structures and technologies. Once a new system attractor has evolved, rapid structural transformation will be possible.

Keywords: social system; sustainable; attractor; worldview; holistic

THE GLOBAL EMERGENCY

Sustainability is not a choice

While most people support sustainable development, many believe that its benefits must be weighed against other objectives such as economic growth and consumer desires for comfort, status and recreation. However, sustainability is not an option but a requirement. Any economy that is not sustainable will go bankrupt: any biological system that is not sustainable will die.

Human societies are living social systems that completely depend on their environments for the resources needed to survive. But evolution is a ruthless process: most of the species and human societies that have ever existed are extinct because they either destroyed their environments or could not adapt to changing conditions.

Because our species is rapidly degrading the biophysical systems that support life on Earth, the survival of advanced human societies is now threatened. We have no choice—our overriding priority must be to create an environmentally sustainable global system. This article explains why evolutionary systems thinking provides us with the tools we need for this task.

The global emergency

Our industrial societal system is designed for constant expansion. While this model was viable in a world of few people and many resources, it is now obsolete because the global economy is consuming more resources and discarding more waste than our planet's ecosystems can sustainably produce and recycle. In the coming decades a combination of global warming, resource shortages and species loss will create growing environmental, economic and social crises.

In ten years the concentration of atmospheric greenhouse gases will be high enough to cause average global temperatures to rise by more than 2°C (Johnson and Simms, 2008). This will not only destroy most coral reefs and tropical rainforests, but also trigger runaway global warming through melting Arctic permafrost and releasing billions of tons of methane (Spratt and Sutton, 2008). The result will be the extinction of most life on Earth (Lynas, 2008), which will end our ability to maintain large-scale, complex civilizations.

Even if we manage to reverse global warming and restore a safe climate, another environmental disaster is looming. Humanity's consumption of biological resources and production of waste now exceeds the world's carrying capacity by approximately 30%. If our resource use continues to increase at current rates, by the mid-2030s we will be consuming twice as much each year as our planet can sustainably regenerate and recycle (World Wildlife Fund, 2008). Computer modeling indicates that this trend will cause environmental and economic collapse by 2050 (Meadows et al., 2004; Turner, 2008).

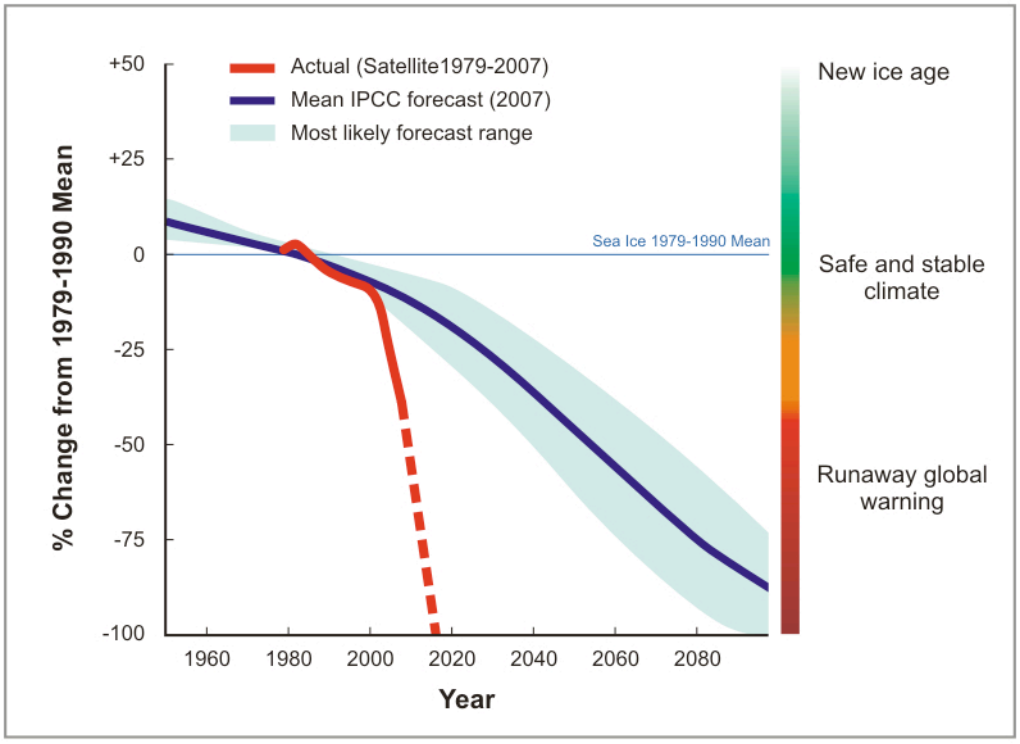

Figure 1: Melting of Arctic Sea Ice: Forecasts vs Reality

We are now facing a global emergency. In order to avoid catastrophe humanity must rapidly transform our unsustainable global system into a sustainable system.

This will be an immense and extremely difficult task. The global economic system is environmentally destructive because it is driven by a consumer culture that values individual greeds over human and ecological needs *(*Taylor and Taylor, 2007a*)*. Our challenge is not only to completely change the dominant global values and social institutions, but to change them quickly enough to avoid environmental and social disaster. But how is it possible to rapidly transform a world system based on exploitation, violence and inequality into one that is nurturing, peaceful and just?

The potential for constructive social interventions

Changing the world may seem impossible. But change is taking place constantly, making our planet a very different place than it was even ten years ago. Because the pace of global change is accelerating, the challenge is not so much to create change as to manage and direct it in constructive ways.

Global problems often appear to be too large and complex to understand, let alone manage. This is because human societies, like weather systems, are dynamic (open) systems with chaotic and complex dynamics. However, since all open systems operate

within definable parameters and follow predictable patterns, appropriate theories can be used to explain and predict the dynamics of both societal systems and weather systems. Constructive social intervention is possible because societal systems have functional designs.

Evolutionary systems theory provides us with powerful tools from both the natural and social sciences for analyzing complex global problems. The key to analyzing and managing global change is to recognize that our industrial civilization is not only a dynamic system (with all the characteristics of dynamic systems) but also a living and evolving societal system. It is much easier to understand major issues and trends once we situate them in the context of a historical process of change and transformation.

At the same time as industrial civilization has outgrown its biophysical limits, the components of a new type of societal system have begun to evolve. Systems-based views, values, social structures, technologies and economic processes are rapidly emerging. These represent a paradigm shift in scientific and social thinking: from viewing the world as a collection of unconnected objects to seeing reality as a nested holarchy of interacting systems. While the mechanistic worldview of our current system does not understand the relationship between human societies and the natural world, a systems perspective recognizes that our economies are subsets of their environments. The emergence of this holistic worldview creates the potential for the rapid development of a sustainable societal system.

Disaster is not inevitable because our species is learning how living systems function. We now understand biological and social processes well enough to make genetic and cultural interventions such as gene modification or marketing. This is both powerful and dangerous knowledge. While it can be used in irresponsible and destructive ways, it can also be used constructively—to help us design a sustainable societal system.

Because evolution is about innovation (the emergence of new forms and functions), it is possible for humans to accelerate evolutionary processes. We can support the emergence of a sustainable civilization through consciously inventing and constructing critical technical and cultural components. Like the invention of the Internet (an electronic system), supporting the emergence of a better societal system involves first imagining what is needed, then creating a (logical) model, then supporting the construction of needed components, then supporting their assembly into a functional system.

Of course there are profound differences between physical and living systems. Physical systems are externally created while living systems are self-organizing. Societal systems maintain themselves, reproduce themselves and change themselves. This means that in order to be successful, societal interventions must build on and support existing processes. If the interventions result in useful innovations (functional mutations), they are likely to be adopted and spread throughout the system (Kuhn, 1996).

Inventors know that a new idea will probably work if it is based on real science and has a functional design, and if all the parts are properly constructed and fitted together. It is not

necessary to have all the answers before beginning work: it is enough to know that the invention has the potential to do the task it is designed for. But our efforts will be useless unless we know what we are doing. The keys to successful interventions are accurate theories and viable designs.

The need for better theories

Two thousand years ago you had to be very brave to sail far from home. Without compasses or accurate maps, it was easy to get lost and find yourself shipwrecked on an unfamiliar shore. It was also terrifying to think that if you ventured too far you might be devoured by huge monsters or reach the edge of the world and fall off. Over the centuries, mariners acquired better technologies, better theories and more knowledge. This increasingly gave them the ability and the confidence to sail the deep oceans and eventually circumnavigate the globe.

We are only able to control our environments to the extent that we have relevant ideas and technologies. If we want to access new and qualitatively different environments (e.g. visit outer space or create a sustainable society) we first need to develop better theories and skills. Better theories are new paradigms (models) that are able to give more accurate and useful explanations of how the world works than the old theories. New paradigms are developed through careful study and analysis; they will only be adopted if they incorporate the strengths of earlier ideas while overcoming their weaknesses.

We can see how poor our current models are by the failure of most economists to predict the current global financial crisis, and by the inaccurate forecasts of the world's top climate change scientists (see Figure 1). Because human civilizations are now unsustainable, we are desperately in need of better theories. It will not be enough to understand what ecosystems require to be sustainable—if we wish to survive we will also need to know how we can stop human societies from destroying their environments and destroying each other.

While there is no lack of theories in the social sciences, they usually describe how the various parts of societies work without describing societal dynamics in general. University students are confused to discover that disciplines such as economics, anthropology and psychology seem to speak different languages. Taking social science and humanity courses can be like listening to blindfolded people talking about an elephant—while each can describe the part that he or she is touching, none of them have any real idea of what the whole elephant looks like or what it is. The lack of theoretical congruence causes many people to question whether economics, political science or psychology are even sciences, let alone sociology or history.

Theories are more developed and integrated in the physical and life sciences for very good reasons. It is much easier to test theories about the material world than social theories, because humans experience and see reality through cultural lenses, and no two societies have exactly the same culture. Moreover, cultures change over time.

These theoretical problems can be overcome once we realize that cultures and psychological states are not arbitrary creations, but functional (and dysfunctional) responses to the environment: they are needed to interpret events and organize social life. As a consequence views, values and behaviours develop and change in predictable patterns. Making sense of these patterns is still not easy, but we need to make the effort if we are to understand the causes of global problems and design solutions. As Matthew Melko says in *The Nature of Civilizations*: "It is no less reasonable to make a chart of a civilization cycle than it is to make a chart of a business cycle. And the comparative historian must chart the unknown, even though he is certain to err, just as the sixteenth-century cartographer was justified in making maps, even though they amuse us today." (Melko, 1969)

People have been attempting to explain why civilizations rise and fall for a long time. For example, the Chinese historian Ssu-Ma Ch'ien developed a cyclical theory of history more than 2100 years ago, and the Arab scholar Ibn Khaldun laid the foundations of sociology 650 years ago (Galtung & Inayatullah, 1997). Many models have been proposed since then, but because none of them have proven to be very accurate, there are at present no widely accepted theories of how societies function and change. However, as this article hopes to demonstrate, the emerging systems-based sciences are providing us with powerful new theoretical tools.

Once we realize that societies are living social systems, it becomes possible to understand not only how societies function and change, but also the relationships between social and psychological structures and processes on the one hand, and biological and physical structures and processes on the other. While the ideas presented in this paper build on the work of scientists in many different fields, they are based in particular on the work of my late father, Alastair Taylor, who was one of the first to use systems theory to study the historical evolution of societal systems and world-views (Taylor, 1999). The project I coordinate, BEST Futures (www.bestfutures.org), is continuing to develop and apply his theories.

There are always risks involved with model-making. While we need maps, we also need to remember that a map is not the terrain. Theories only approximate reality; on one hand bad models can misdirect people and make things worse, while on the other hand, the fact that good models work well often leads people to reject alternative interpretations of reality and to stop developing even better models.

So please do not take the theories advanced here to be the final word on anything. To the extent that they add to our understandings of how societies function and change, they are useful tools for analysing real problems and developing practical solutions. But in the end they are only ways of viewing and interpreting reality. Other perspectives can also be valid. Moreover, no theory is the ultimate theory. Like the process of evolution, each stage builds on the last, and each becomes in turn a stepping stone for further developments.

Nevertheless, we should not underestimate the value or power of systems-based theories. They not only represent a profound advance in our understanding of reality, but they give us the tools we need to avoid catastrophe and create a better future.

EVOLUTIONARY SYSTEMS THEORY

A self-organizing universe

When we look around us we see order, not chaos. From micro-cosmos to macro-cosmos, all that exists in the universe is organized energy and matter. Universal laws create recurring patterns and structures at every level. Even relatively chaotic and unpredictable events are organized by natural laws into patterned systems. Over time, stable systems and structures tend to endure and evolve into progressively more complex and conscious forms. The history of the universe is the history of the continuous self-organization and evolution of both matter and consciousness.

For most people, evolution refers to the biological development of plants and animals from rudimentary to more highly organized forms. But the biological world is built out of inorganic materials, and the inorganic world began to develop long before life began on Earth. The evolution of the universe (and everything in it) began with the "Big Bang" some 13 billion years ago. This cosmic explosion created a unified continuum (a curved-space hypersphere) of time, space and force fields. The Big Bang started an evolutionary process that first created increasingly complex inorganic forms, then (on Earth) increasingly complex forms of organic life, and then increasingly complex types of human societies.

The same laws that organized the dense undifferentiated energy that existed in the early universe are still causing it to expand and evolve increasingly differentiated and complex forms. When we apply evolutionary systems theory to the study of inorganic, organic and societal evolution, we can see that the universe is not only governed by physical laws, but also by regulatory and organizational principles.

Evolutionary levels

On one hand the universe is orderly, with many enduring processes and structures. On the other hand the universe is constantly changing and evolving. While (current) laws of physics are able to accurately explain continuous physical processes, they are not able to adequately explain discontinuous evolutionary processes.

Three key integrative principles help to explain the emergence of new structures and properties. The principle of *invariance* under transformation states that the evolutionary process is one of long periods of continuity (symmetry) interrupted by relatively brief periods of discontinuity (asymmetry). Discontinuity permits *quantization* (systemic transformation) to take place in a process that both builds on and changes existing

structures. These evolutionary leaps involve the emergence of more complex systems with new functional properties. The principle of *integrative levels* states that new evolutionary levels emerge through processes of structural transformation that both integrate and transcend previous levels of organization.

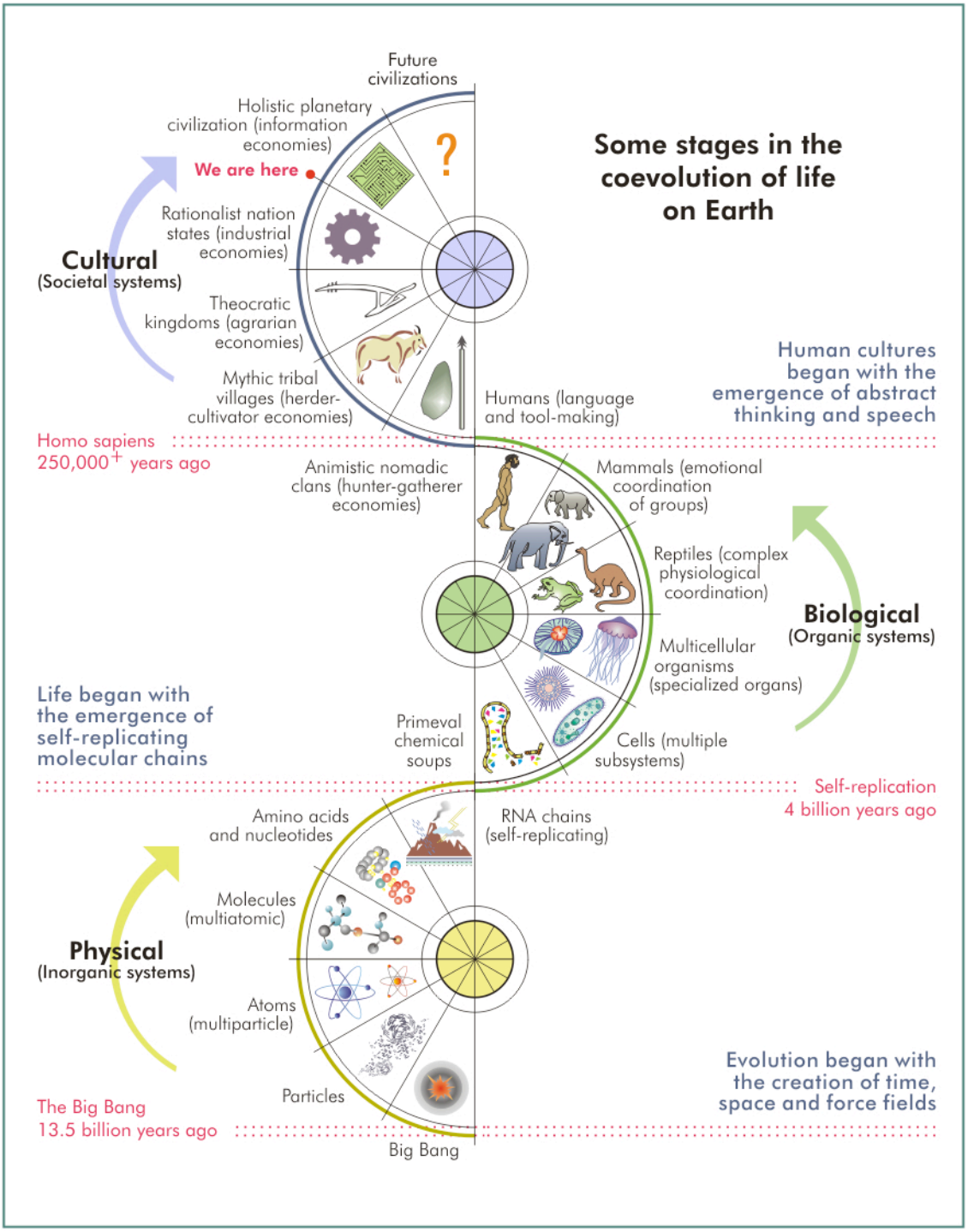

Figure 2: Evolutionary Levels

A universe of systems

A system can be defined as a whole functioning as such by the relationship of its parts. A system is more—and other—than the sum of its parts. When a system is formed, new properties emerge that are qualitatively distinct from the attributes of the system's components. (For example, hydrogen and oxygen are atomic systems with chemical properties. When combined into water they form a more complex molecular system with properties that do not exist at the atomic level such as liquidity, cohesiveness, and the ability to act as a solvent.)

The American philosopher Ken Wilber describes the emerging (Integral) world-view as an all-quadrant, all-level perspective (Wilber, 1998). In order to understand something fully we need to know not only the system level at which it exists, but also its relationship to subordinate and superordinate levels. An all-level perspective helps us to understand contexts and relationships.

An all-quadrant perspective recognizes that the subjective is as important as the objective. Because systems exist within other systems, everything has both an inside and an outside. Also, since things never exist alone everything is both individual and part of a collective. As a result there are four equally valid (and interconnected) ways of interpreting reality: the interior (or subjective) individual; the subjective collective; the exterior (or objective) individual; and the objective collective.

The universe is a mega-system that includes all other systems. Because every system is both a whole composed of parts and a part of a larger whole, systems are hierarchically nested within each other. Hierarchies of nested systems (wholes or holons) are called holarchies. Different holarchies describe different perspectives. For example, a chemical holarchy is different than a societal holarchy.

The sub-systems that make up the universe are constantly obtaining and expending energy. Energy fluctuations force systems to either equilibrate or quantize to a different level of organization: to either reorganize at more complex states or fragment to less complex states. The process of quantization progressively creates increasingly complex and conscious systems. Evolution is unidirectional because every system level builds upon its predecessors and adds new properties not found at the previous level. Quantization has produced three major evolutionary leaps (on Earth): all inorganic systems have evolved from the energy of the Big Bang; all organic systems have evolved from inorganic systems; and all human societies (societal systems) have evolved from organic systems.

Form, function and relevance

Systems comprise two organizational types: allopoietic (externally created) and autopoietic (self-created). The evolution of self-reproducing systems marked a quantum leap in evolution as it permitted the emergence of new properties such as motility and consciousness. Self-creation characterizes all living organisms from the cell of an organism to plants, animals and human societies. Organic life may have begun with self-reinforcing autocatalytic networks forming in primeval chemical soups. Autopoiesis occurs when a closed system of production processes evolves that is capable of regenerating itself.

Allopoietic systems (e.g. crystals) are inorganic and non-autonomous because their structures are not concerned with their maintenance or reproduction. Autopoietic systems (e.g. plants) are organic and autonomous because their structures are self-renewing, self-repairing, and capable of interactive linkages with their environments. Societies can accurately be described as self-organizing and adaptive social systems (Habermas, 1981; Luhmann, 1984; Kluver, 1999). describe.

Boundaries

All systems (whether stars, plants or societies) have boundaries. Boundaries are structures that manifest a system's underlying organization in a particular environment. In physical environments boundaries can be topological (e.g. the surface of the ocean); in social environments boundaries can be behavioral (i.e. ethnic membership).

Living systems have boundaries that are solid enough to preserve autonomy while being permeable enough to allow information and energy to be exchanged with the exterior. These boundaries enable systems to communicate and equilibrate with their environments. A system cannot maintain a congruent structure if its boundaries are exceeded—it must either collapse or establish a new structure with new parameters.

Societal systems and their sub-systems (e.g. families, schools, and businesses) are continually creating, maintaining and changing boundaries. A major function of specialized regulatory institutions such as legislatures, courts and the military is to control and integrate external and internal societal boundaries.

Equilibration

In order to exist, inorganic and organic systems must have structures that enable them to maintain themselves in relationship to their environments. Because living biological and social systems have a continual flow-through of matter-energy and information from their surroundings, they have self-regulating structures that are continuously equilibrating in response to internal and external developments. They use negative feedback to reduce

perturbations (fluctuations) and maintain their systems within functional parameters. For example, humans sweat when too hot and shiver when too cold.

Societies are stabilized through system components such as cultural values and social institutions. An example of negative feedback is the use of social and economic rewards and punishments to reinforce a societal system and minimize deviations.

Positive feedback causes systems to change. For example, our physical growth is stimulated by positive feedback from hormones. Societies change due to positive feedback coming from internal developments in societal and material technologies (e.g. new philosophies or economic processes) or by changes in their external environments.

Because all open systems exist in states of dynamic equilibrium with their environments, if a living system cannot control or adjust to changes in its internal or external environment it will go into crisis. This is a bifurcation point: coherent pressures for change can cause a system to re-equilibrate at a more complex system state, while dysfunctional stresses can cause a system to break down to a less complex system state.

System change is illustrated by the process of individual psychological growth. Every transition between developmental stages (from infancy to childhood, from childhood to adolescence, etc.) has similar dynamics. During every stage identity remains relatively stable (in dynamic equilibrium). However, biological and social growth eventually ruptures the identity's boundaries. The individual then enters into a period of crisis in which the old identity breaks down. The identity is normally then reorganized on a more complex (mature) level with increased understandings and competencies.

In cases where individuals are insufficiently prepared for a transition or poorly supported, they will enter into crisis but be unable to successfully reorganize their identity. Their identities may then fragment or regress, causing long-term psychological problems. A similar process causes societies to undergo systemic change. When change forces a societal system to exceed its boundaries, it can move the system to another stable configuration within the existing evolutionary level, cause it to break down to a less complex level of organization, or cause it to break through to a more complex level. New properties, structures and environmental relationships emerge at more complex levels. This process has caused societal systems to evolve from simple societies to complex civilizations.

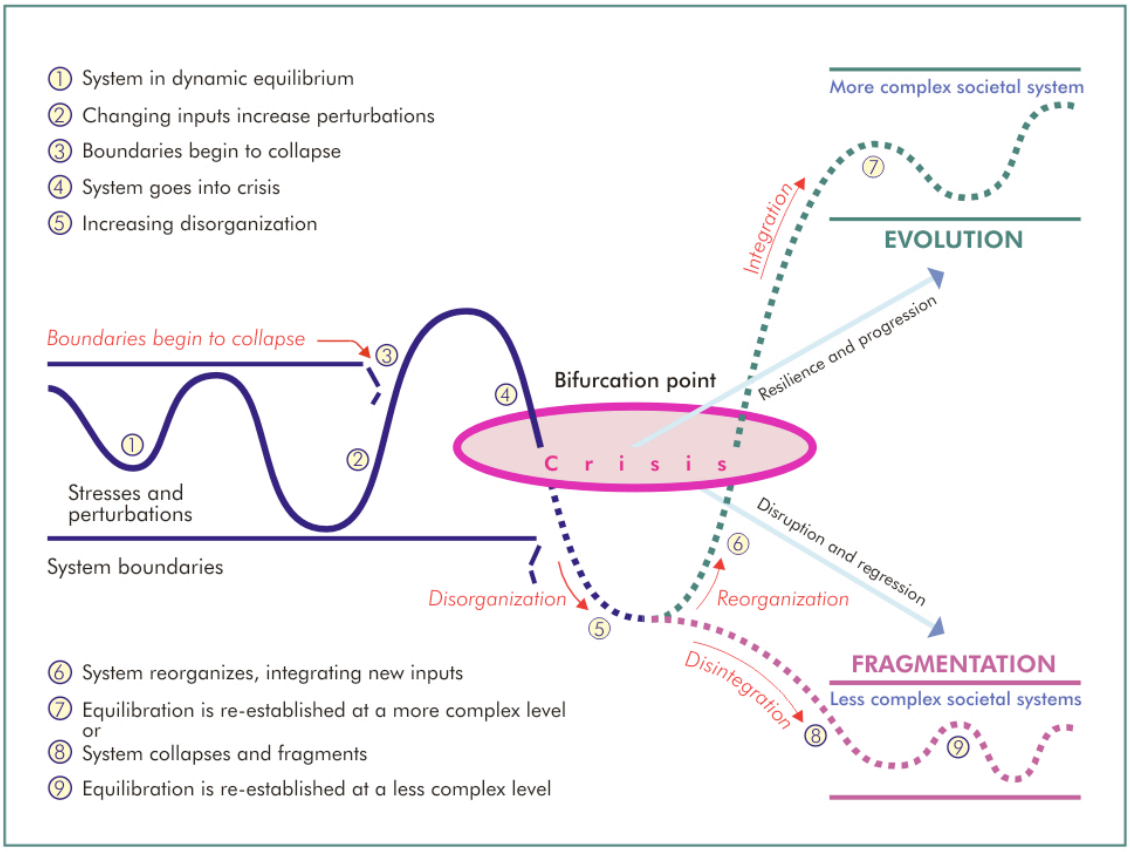

Figure 3: Societal Transformation

The external environment biases every open system to move to a configuration (attractor) that optimizes its relationship with its external environments. This process is called natural selection when applied to living systems. Evolution is an unpredictable process that involves the emergence of previously unknown properties that take hold and spread because they are more environmentally relevant and functional than previously existing attributes (Laszlo, 1987). The evolutionary process continually creates new forms with new environmental capabilities.

HOW SOCIETIES EVOLVE

The co-evolution of the human brain and complex cultures

Evolution has supported the emergence of increasingly conscious and active organisms that can search out more favorable environments. With the evolution of humans, self-consciousness and conceptualization emerge and with it the ability to alter and improve environments. This marks the emergence of a major new evolutionary level since our abilities go beyond adaptive equilibration (a reactive orientation) to manipulative equilibration (a proactive orientation).

While living biological systems are genetically patterned to maintain and reproduce themselves, living social systems are symbolically patterned to maintain and reproduce themselves. This is because human cultures and social institutions have co-evolved with the human brain and its capacity to use complex symbols and complex tools. Humans are the only species who rely on symbols and tools to understand and manipulate their environments. We need to live in societies because we cannot survive without learning language and other social and material technologies.

The need for environmental relevance

Historians have debated whether great people make history, or whether great people are made by history. Systems theory argues that interactive societal processes cause individuals, societies and environments to change each other and co-evolve. However, not all processes are equal: societies depend on natural environments—and not the other way around—and individuals depend on societies.

All living and open systems are maintained by a continuous flow of matter and energy. The evolution of more complex human societies has been marked by the appropriation of increasing amounts of resources from the environment. More complex societies require more energy per person than simpler ones because they have more networks, more information processing, more specialists and more regulatory hierarchies. In order to survive, a societal society must be environmentally relevant: it must live in (and maintain) an environment that is able to produce a continual flow of needed resources, and it must have the technologies required to acquire those resources.

Every society takes more energy out of its surroundings than it creates. Societies collapse when the energy flow is no longer available in sufficient quantities to sustain increased populations, defend the state from attack and maintain internal infrastructures. For this reason societal evolution involves the emergence of societal systems that have progressively increasing environmental and spatial control capabilities.

Material technics and societal technics

Human societies maintain and reproduce themselves through processing and converting information, resources and energy from their environments. They are complex cybernetic systems with feedback loops that take in inputs from the biosphere and from other societal systems, and convert these inputs into the material and societal outputs necessary for the system's maintenance, self-stabilization and reproduction.

Sociocultural systems use two types of interrelated technics (methods of applied learning) to equilibrate with their environments. Material technics are primarily concerned with attaining environmental control: the processing of energy and natural resources. Societal technics are primarily concerned with maintaining social control: the processing of

information and the organization, regulation and reproduction of the societal system's world-view and social structures.

Societies are viable to the extent that their material technics enable them to physically manipulate and spatially organize their environments. Societies have longevity to the extent that their societal technics enable them to preserve internal and external equilibrium. Material technics tend to be connected to positive feedback processes (growth and change), while societal technics tend to be connected to negative feedback processes (equilibration).

Societies are stabilized through system components such as cultural values and social institutions. An example of negative feedback is the use of social and economic rewards and punishments to reinforce a societal system and minimize deviations. Material and societal technics normally combine to promote systemic self-stabilization. When a system cannot control or adjust to internal or external changes, it must change its structure: increasing imbalances between positive feedback and negative feedback will result in either systemic transformation or collapse.

Worldviews organize social structures

Because humans interpret reality through culture, societal systems are unified and organized around worldviews, which are symbolic interpretations of reality that explain the place of humans in the world. Worldviews and cultures (learned traditions of thought and behavior) provide meanings and symbolic tools for organizing the social institutions that in turn organize and regulate group and individual behaviors.

A worldview reflects a society's level of technological and social development and its relationship with its environment. Societal evolution involves the emergence of new world-views (new paradigms) with the capacity to organize more complex structures and processes. Different world-views organize (pattern) different types of societies, creating societal systems with congruent views, values, social institutions and economic processes. Societies that are at a similar stage of development have a similar type of worldview and similar social structures. This is because only one major pattern is functional at each developmental stage.

Because the stages of societal development can be clearly defined, some scientists are developing mathematical models of societal evolution. For example, Jurgen Kluver and Jorn Schmidt believe that "[W]e can characterize each social system by the number of dimensions [of the social space of interactions]; in particular we see from the theory of social differentiation that early tribe societies are one-dimensional systems, class societies form two-dimensional systems because both segmentary and stratificatory differentiation constitute these societies and that modern societies can be described as a three-dimensional space of interactions. It is worthwhile to note that the theory of social differentiation, if reformulated in geometrical terms, postulates an unfolding of dimensions as a fundamental feature of social evolution." (Kluver & Schmidt, 1999)

Worldview and culture are not the same. Societies must take on the basic orientation and structural pattern that is appropriate to their evolutionary level of development in the same way that all children must progress through the same physical and psychological stages of development. However, since societies develop as separate systems, each develops its own culture. For example, while all agrarian societies have theocratic worldviews that organize centralized, caste-based social structures (kingdoms), different agrarian societies may have different religions and different caste structures. Culture provides the direction and symbolic tools that organize and coordinate social institutions. Institutions organize and regulate group and individual behaviors. These social behaviors in turn condition individual psychological structures.

The major historical stages of societal evolution

Human societies have evolved from simple societies to complex civilizations through distinct stages (historical ”ages”). The need for environmental relevance causes similar types of societies to emerge and endure at each stage of historical development in different parts of the world. Their congruent and stable patterns constitute system attractors. For example, similar conditions and stages of development created the long-lasting agrarian kingdoms of Egypt, China, and Central America. (While most societies clearly fit into one or another type of societal system, hybrid structures and transitional structures also exist. Current examples are agrarian societies that are in the process of industrialization such as Saudi Arabia.)

Historical ages can be classified in many different ways, e.g. by shifts in material technologies (e.g. Bronze Age, Iron Age, etc.), or by the emergence of new political systems. Because Alastair Taylor’s model uses a systems approach, it defines historical stages in terms of systemic changes—the evolution of new societal systems with congruent worldviews, cultures, institutions, economic processes and technologies. This approach provides us with five major historical stages: the Old Stone Age; the New Stone Age; the Agrarian Age; our current Industrial Age; and the emerging Information (or Integral) Age.

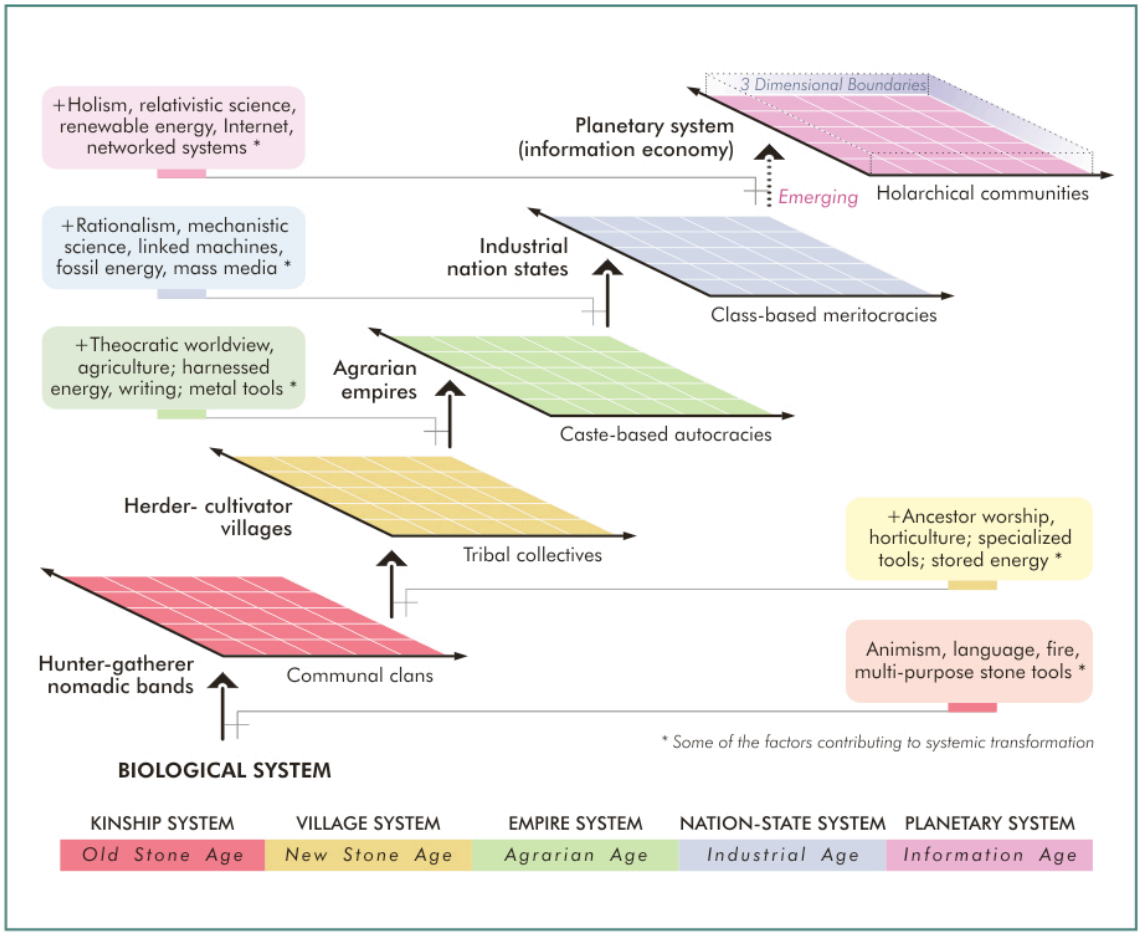

Figure 4: The Evolution of Societal Systems

Since these developmental stages/Ages are organized by their worldviews, Alastair Taylor called them Mythos I (the animistic world of hunter-gatherer societies); Mythos II (the ancestor-worshiping world of herder-cultivator societies); Theos (the theocratic world of agrarian civilizations); Logos (the rationalist world of industrial civilizations); and Holos (the holistic world of the emerging planetary civilization).

It is important to remember that the term "evolution" simply refers to increasing structural complexification—it is not a value judgment. Every type of societal system has its own advantages and disadvantages. For example, in Stone Age societies, people had a strong sense of belonging both to nature and their communities; in Agrarian Age civilizations people had strong faith, strong families and a strong sense of responsibility; and the Industrial Age provides many people in the world with better health, higher standards of living and more opportunities for personal growth than ever before. One of the challenges today is to "include and transcend" all the different types of human societies—to create a peaceful, cooperative and diverse world that preserves and develops all the best qualities of every stage of human development.

Societal form and function

Living systems can only survive if they have functional structures that enable them to maintain and reproduce themselves in their environments. The structures of all societies are isomorphic because they must all meet similar individual and societal needs. Although every society is culturally distinct, all societies are organized around the same set of key social institutions. This basic structure is called the Universal Culture Pattern (UCP). Anthropologists and sociologists generally agree that all societies have five basic institutions: family (to raise children and care for dependents); economy (to produce and distribute goods); government (to coordinate community affairs and organize defense); education (to pass on knowledge to new generations); and religion (to explain the unknown) (Brinkerhoff et al., 1997). In our (BEST Futures) model, we define the UCP in terms of the essential functions that every societal system must perform: providing meaning, communication, regulation, education, biological and social reproduction, economic production, and environmental control.

Universal Culture Pattern	Institutions	Mythos ◯	Theos △	Logos ▦	Holos ∞
	World view *orientation*	Animism *belonging*	Faith *obeying*	Logic *acquiring*	Holism *integrating*
	Culture *aesthetics*	Relationships *harmony*	Responsibilities *position*	Rights *achievement*	Interdependence *connectivity*
	Government *regulatory form*	Elders *customs*	Absolutist *decrees*	Constitutional *laws*	Consensual *self-regulating*
	Organization *basis*	Communal *kinship*	Autocracy *caste*	Meritocracy *class*	Holarchy *community*
	Economy *structure*	Foraging/horticultural *autonomous*	Agricultural *centralized*	Industrial *pluralist*	Information *distributed*
	Education	Tribal traditions	Caste traditions	Public education	Self-directed
	Technology *paradigm*	Human energy *magical*	Harnessed energy *religious*	Linked machines *mechanistic science*	Networked systems *relativistic science*

Figure 5: The Evolution of the Universal Cultural Pattern

Individuals learn their fundamental views of reality and standards of conduct from their society's UCP. For example, children are socially integrated (conditioned) through learning language, values, and skills from their families and peers. As they mature, they develop autonomy and reciprocal abilities to influence social behaviors, institutions and their wider culture.

All of the institutional sub-systems that make up a societal system's Universal Cultural Pattern are interconnected and interacting. Although there is a systemic bias towards congruence, some of the segments of the UCP may change more rapidly than others. If not rebalanced, disequilibria may lead to conceptual and societal breakdown and revolution. For example, new ideas or technologies may cause people to question existing social values or structures. Social revolutions are frequently the result of a growing gap between expectations and reality.

Societal evolution

New material and societal technologies develop in response to human needs for increased meaning and improved living standards as well as to societal needs for increased environmental control. The process of increasing environmental and spatial control can be seen in the progression from Stone Age spears to Industrial Age satellites. Over time, the development of new material and societal technologies leads to the emergence of increasingly complex societal systems that are able to process more and better energy, resources and information. Societal evolution involves the congruent transformation of societal worldviews, social structures and economic processes.

Societies change due to both internal and external factors. Constructive change can come in the form of new ideas and technologies or the discovery of new resources. Destructive change can come in the form of internal dissension, external attack, and/or the loss or increasing scarcity of resources. The ability of a society to manage both constructive and destructive change depends both on the relevance of its societal and material technics, and on its internal coherence and functionality.

By itself the introduction of a new technology will not cause the evolutionary transformation of a societal system. Alastair Taylor's model suggests that societal quantization cannot occur unless a number of congruent paradigm-changing developments are present and interacting. These are: increased external awareness (new technology/science); increased energy (increased energy use and production); increased external feedback (more environmental control); increased connectivity (population growth/urbanization); increased complexity (more complex institutions); increased internal awareness (more information systems); increased internal feedback (more societal feedback and control); more complex aesthetics (new modes of expression); more complex worldview (more functional view of reality).

Societal systems quantize (undergo qualitative and quantitative transformation) in three holarchical stages: 1) A paradigm-changing societal or material technic emerges which supports one or more quantizing factors. 2) The presence of a quantizing factor supports and accelerates the quantization of one or more segments (institutions/institutional groupings) of a societal system's Universal Culture Pattern. 3) The quantization of a societal institution supports and accelerates the quantization of the entire societal system.

The emergence of paradigm-changing technics (technics that support a more complex, open and conscious system) begins a process of transformation marked by creativity, tension between forces supporting and resisting change, systemic incongruence and instability. This dynamic process can progress, stagnate or regress.

Lance Gunderson and C.S. Holling have developed a panarchy model that helps to explain the dynamics of societal change and evolution (Gunderson and Holling, 2002*)*. Ecosystems and societal systems are panarchies that are composed of hierarchically organized levels. While higher levels are larger and more stable, lower levels change more quickly and are more innovative. A system's adaptive cycle is shaped by three properties: its wealth determines its potential for change; its internal connectedness determines its sensitivity to perturbations; and its adaptive capacity determines its ability to manage unexpected shocks.

There are four phases to an ecological adaptive cycle. 1) Exploitation: e.g. a young and diverse forest increases capital, connectedness and stability. 2) Conservation: connectedness and vulnerability increases in a mature climax forest. 3) Release: a crisis (e.g. fire, wind, drought or disease) overwhelms the system, returning nutrients and seeds to the soil. 4) Reorganization: a new ecosystem emerges, starting the cycle again. During adaptive cycles systems can add new abilities or lose abilities.

The adaptive cycles of societies are similar to those of ecological systems. 1) Exploitation: the new societal system is able to use its superior social and material technologies to expand throughout its environmental niche. 2) Conservation: rigidity and vulnerability increase as populations rise, the system becomes more complex and bureaucratic, and resources become scarcer. 3) Release: internal and/or external crises (ecological, economic and/or political) overwhelm the system, both destroying and releasing social and economic resources. 4) Reorganization: a new societal system emerges and the cycle starts over.

For example, populations declined and technologies were forgotten after the fall of the Western Roman Empire. Although parts of Europe regressed to the Stone Age, all knowledge was not lost. In the Middle Ages civilization in Europe was reorganized on Greco-Roman foundations. The ability of ecosystems and societal systems to use past genetic and cultural memories to recover from a collapse and adapt to new conditions is termed the springboard effect.

The rate of quantitative and qualitative change tends to accelerate over time. For example, population growth has accelerated as more complex societal systems have evolved better environmental control capabilities (more food, less disease, etc.). Increasing populations in turn contribute to accelerating technological and societal change.

SUPPORTING THE EVOLUTION OF A SUSTAINABLE GLOBAL SYSTEM

Flipping the paradigm: from consumer to conserver values

Most people assume that evolution is the result of genetic mutations that produce individuals with superior survival traits. A process of natural selection then occurs because these exceptional individuals are able to out-compete other members of their own species and other species in the struggle to find food, survive predation, and reproduce. This assumption leads to theories that selfish and competitive behaviors are the main forces driving evolution, and that all living beings are engaged in a constant battle for domination.

In reality, the evolutionary process always involves both individual and group selection. Since the survival of a species depends on group fitness, competition between individuals usually occurs within a wider framework of group (and ecosystem) cooperation. Michael Cohen points out that the core principles of healthy, sustainable ecosystems are mutual support and reciprocity, no greed, no waste, and increasing diversity (Cohen, 1997). Evidence of these principles is everywhere. Flowering plants and pollinators co-evolved; the well-being of an ant colony is more important than the life of a single ant; salmon kill themselves in the effort to reproduce themselves; the males of many species of wild cattle will risk their lives protecting their herds. Humans are no different from other species: most people are willing to make sacrifices for their children, community or faith. In times of war entire societies are asked to subordinate their personal desires to the needs of their nations. In the long history of humanity, the extreme individualism of our consumer culture is an aberration.

While competition is a natural aspect of being human—for example we love competitive sports and games—cooperation is also a natural part of our makeup. No human family, organization or society could exist without cooperation. Every house, street and machine we see is the product of a cooperative effort. Without the love and care of our parents and the support of our societies, none of us would be alive. In reality all of us combine private enterprise and socialism in our daily lives—almost all of our relationships with our families and friends are based on giving and sharing, while almost all of our relationships with strangers are based on selling or exchanging. No one charges their children for breakfast, lunch and dinner; the most die-hard capitalists save up their wealth so that they can give it away to their children when they pass on.

A mistake of socialism has been to assume (or pretend) that people are not motivated by personal interest and competition. *What's in it for me* is almost always a factor in people's decision making. Even when people are doing things for love, they usually want to receive love or at least appreciation in return. At the same time, a mistake of capitalism has been to ignore the fact that most people value their families and social relationships more than money, and instead assume that people are primarily motivated by materialism and narrow self-interest.

Developing a sustainable global economy is not about replacing capitalism with socialism. Traditional, industrial capitalist and socialist models are neither useful nor relevant. We do not need to choose between competition and cooperation, but we do need to determine their appropriate relationship. The problem isn't that the economy values competition, but that it values competition over cooperation. A family where competition is more important than cooperation is a dysfunctional, unhealthy family. A football game where competition and winning is more important than having fun and playing fair is no longer a game but a fight. The problem with the global system is not that competition exists, but that national and corporate interests are valued more highly than our collective survival.

Changing global values from consumerism to conservation is possible because history shows that the vast majority of people are willing to make sacrifices to defend their families and communities from a common danger. However, in order to create a sustainable system we will have to flip the dominant paradigm from cooperation within competition, to competition within cooperation. This will mean putting elected governments in charge of economic policies instead of allowing corporate interests to determine government policies. We can then create a conserver economy where the role of businesses is primarily to provide services rather than to sell disposable products.

The requirements and design of a sustainable societal system

Sustainability is not just a good idea, but a necessity. The global economy will not exist in the future unless it operates within the Earth's carrying capacity. These limits—our planet's annual production of environmental goods and services—define the physical parameters of a sustainable global system. In nature and society, function and form are closely related.

The rationalist worldview of the present Industrial Age is dysfunctional because it supports the exploitation of human and natural environments. It sees reality as being composed of unconnected objects that exist solely for human use. This mechanistic paradigm facilitates the development of centralized social structures that support political and economic expansion without regard for either human or ecological well-being (Eisler, 2007).

As a consequence we will only be able to create a sustainable system if we replace the current mechanistic worldview with an ecologically relevant worldview that recognizes the interdependence of all life on Earth. Because a society's view of reality creates a coherent framework for organizing and coordinating social organizations and daily activities, the development and spread of a systems-based (holistic) paradigm is the key to the constructive transformation of the global economy.

Although it is impossible to predict the exact design of a future civilization, we can determine the functional requirements of a viable societal system and from these determine its basic structural requirements. A future civilization will only exist if it is

sustainable, and it will only be sustainable if it is able to meet essential human and biophysical needs for health and wholeness (Taylor and Taylor, 2007b). This means that it must be able to limit the consumption of scarce resources, share these resources more equitably among individuals and regions and ensure that the essential needs of other species are also met. A sustainable system will also need to greatly reduce resource consumption and pollution while simultaneously supporting economic growth. In order to meet these requirements, new institutions are needed that promote conservation over consumption, cooperation over competition, peace over war. These new social structures are now beginning to develop with the assistance of systems-based views, values and technologies.

One of the most important new and still emerging properties of the Information Age is system self-awareness—the ability of individuals and organizations to understand how the whole societal system functions. The combination of system theories with system-based technologies (e.g. the Internet) allows for a qualitative leap in the ability of individuals and communities to access, create and share knowledge. The emergence of system self-awareness has enormous implications. At the same time as millions of people are becoming aware of the need for transformative change, it is becoming increasingly possible for individuals and communities to autonomously interact with the global network and to acquire and develop the consciousness and tools they need to organize and govern their own activities.

The advantage of centralized, hierarchical structures is strength and the ability to impose order, but this comes at the cost of flexibility and efficiency. As systems become increasingly centralized and stratified they become less efficient due to the rising costs of distribution, communication, coordination and control. In order for a sustainable global economy to be much more efficient than the industrial economy, it will have to have a relatively egalitarian distribution of power, information and resources.

These requirements suggest that it will not be possible to create a sustainable societal system without making a major shift away from centralized, bureaucratic organizations towards more decentralized and self-regulating communities. The shift from a primarily centralized societal system to a primarily decentralized system is the shift from structures that support a deadening process of domination and exploitation to structures that support a flourishing process of environmental and social sustainability. It is the shift from partial democracy to participatory democracy.

However, a decentralized societal network will only function if every part at every level has access to the knowledge and skills needed to appropriately interact with the larger system, to self-regulate and self-organize. The combination of an ecological worldview and systems-based technologies has the potential to empower people with the theoretical and practical tools required to control their own lives, communities and natural environments (FutureGenerations, 2008).

An appropriately decentralized network can improve efficiency by giving all its parts the ability to respond flexibly and autonomously to local conditions. The need for energy and

resources can be reduced by having most social and environmental needs met at the local level with local resources. Jeff Vail suggests that it is possible to reduce consumption while improving the quality of life by following three design principles: decentralized production and control; open access to essential knowledge and environmental and cultural relevance (Vail, 2007).

The practical structure for a decentralized system is a network of relatively self-sufficient communities that are integrated into wider regional and global networks through the Internet and holarchical social structures (Vail, 2006). Like some modern European villages, *rurban* communities have the potential to provide the best of rural and urban life. They can be created either through the green redevelopment of existing urban areas (Levenston, 2008), or through creating highly connected and interactive networks of sustainable rural communities.

A new system attractor

As environmental, economic and social crises multiply, they will threaten our standards of living first, and then our very survival. Sooner or later everyone — families, communities, businesses and governments—will be forced to act. The question then is not whether we should act, but when we will act. Will we act while constructive change is still possible? Or will we deny the reality of the dangers and avoid acting until the problems become unmanageable and disaster becomes inevitable? The survival of life on Earth is not a problem for someone else in some other place at some other time—it is a problem for each of us right now. It is not only a global issue, but also a personal and local issue.

The coming decades will not only be a time of great crises, but also a time of great opportunities. For the first time in history tens of millions of people are working for constructive change. The strengths of this movement are that it is enormous and diverse, organic and self-organizing (Hawken, 2007). It is composed of many of the brightest, most creative and most courageous people on the planet. It brings together modern science, ancient wisdom, love and faith. It is driven by both the need for humanity to survive and the desire for a better future. But the global movement has serious weaknesses. It is largely uncoordinated and still lacks the political and economic power to prevent the destruction of nature and civilization. Our task is to give it the tools it needs to successfully transform the world.

The survival of our species is now at stake. This threat has the potential to unite humanity around a common task—developing a sustainable culture and economy. Our challenge is to clearly explain the global emergency and provide alternative pathways to a viable future.

Donella Meadows pointed out that the quickest way to transform a social system is to change the dominant paradigm (Meadows, 1997). Since worldviews and their congruent

cultures and social structures form the strange attractors that organize societal systems, paradigm change involves the formation of a new societal strange attractor.

Vladimir Dimitrov, Robert Woog and Lesley Kuhn-White have described how we can support the emergence of a new type of societal system: "What we can do is seed positive values (that is, values in harmony with ongoing human understanding of better societal life, such as collaboration, justice, fairness, equity, caring for Nature, love, etc.) into the social space where these processes evolve, and then let them go. The divergence will take place in a space impregnated with values reflecting human visions of a better life; wherever a new trajectory passes, it will "absorb" the seeded values. The exact path does not matter (moreover, in social complexity we are unable to predict the exact path); what matters is the ambience through which social processes flow….

"What has to happen in practice is to *pass over the barrier*, although it seems to be high, of the basin of the old attractor into some 'neutral zone' as a transient state towards the basin of a newly emerging attractor. Being in the neutral zone, social trajectories become ready to be involved in another pattern formation; what sort of pattern depends on the nature of the new strange attractor. The divergence syndrome will start to 'breathe' in harmony with the social values embedded in its emergence." (Dimitrov et al., 1996)

Once we recognize that a systems-based world-view is the key to the organization of a sustainable society, we can help develop congruent social structures and technologies. Because the current global system is becoming more and more dysfunctional, its ability to maintain congruence is weakening. For this reason the emergence of a positive new system attractor should permit rapid transformation to occur through a process in which resources are increasingly drawn away from the existing system and reorganized into more viable structures.

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