Systems Tools for Institutional Transformation

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Abstract

The current world/national economy is in increasing trouble. There have been times of major social and institutional change, like 1500, 1776, and 1900, when changes in social ideas and new technologies have driven institutional transformations; this type of major change is called a "paradigm shift."

General Systems Theory is an invented language based on biological organismic behavior that offers an expanding comprehensive logic of scientific analysis for problem solving and large scale design. The need is to transcend the narrow focus of linear thinking dominant since Decartes that has led to recurring and growing difficulties with all of society's major institutions.

New systems thinking offers a platform for viewing social systems as dynamic rather than static structures, such as functional medicine, and Stafford Beer's Viable System Model.

Second Paper: "Viable Urban Settlements": A systems model of an evolving metropolitan community grounded in an international network of real time information flows offers an alternative future of de-emphasizing the potential for harm by the global/national megathreats. The challenge is to create transitional strategies that weave together and converge into a more viable geopolitical economic system.

Keywords: institutional transformation, urban, systems

Overview

Chardin: "the problem is complexification, the solution is sophistication"

As the world grows increasingly complex and dangerous, the language of general systems theory offers the potential to create workable institutions with instantaneous communication that disappear many problems created by archaic annual information structures.

Management Scientist Stafford Beer (British/Welsh/Canadian) gave a lunch talk called "Health & Quiet Breathing" at the Hospital Centre in London which is recorded in *Platform for Change*: "If you were starting from scratch, knowing the current state of the art,….do you think you would come up with a system remotely resembling the one we have today ? We have an organization frozen in the past; we have institutionalized a set of historical accidents. The health service should be redesigned in terms of information about healthiness, and see the health service as an indicator of societal health."

Given the ability to use computers to gather and analyze data, how could health care, and other public, private and social institutions' information be designed so as to minimize the need for personal and institutional conflict?

Megathreat Problems with the Current System

Post World War II, Western governments were obsessed with the threat of global communism, an ideological battle between Adam Smith's free market, nationally-subsidized economies and the command/control centralized planning fiasco of Stalin's draconian applications of Karl Marx. U.S. President Reagan succeeded in escalating the arms race to the point that the inefficient Soviet system overspent itself into oblivion, symbolized by the 1989 fall of the Berlin Wall.

Internationally, the outrageous 9/11 assault on the U.S. psyche by a small group of dedicated radical Muslim fundamentalists has led an incompetent President Bush ("W") to embroil the single superpower in a war in Iraq that has created a deteriorating lose-lose situation, as well as enormous U.S. domestic fear, paranoia (unjustified fear), governmental repression and catastrophic budget problems.

Environmental insensitivity by an irresponsible capitalist economic philosophy has led to increasing evidence of global warming, as well as deforestation, soil depletion, air pollution (even in windswept Honolulu), and major concerns about local water quality worldwide.

Dependence on the internal combustion engine automobile has led to a transit structure that is increasingly polluting, stressful, and a liability to the effectiveness of local economies; the problem is not your car or my car, it is everyone else's. General Motors loss for 2005 was $10.6 billion; remember when what was good for General Motors was good for the USA?

China's quarter of the planet's population aspires to have the same technological privileges as the U.S., accelerating pollution and stress.

Renegade nations like North Korea and Iran appear willing to back up their threat of using weapons of mass destruction.

The international criminal element grows unabated, dominating the post-Soviet Russia, to the point where organized crime seems to be able to do whatever they want. Internet makes national police powers obsolete, chaotic, unresponsive, ineffective.

The U.S. domestic economy is going down a rat hole: record U.S. trade deficits and budget deficits, indebtedness to the European Union and China, disappearing middle class. The spendthrift Republican administration recently had the Republican-dominated Congress raise the cumulative debt ceiling to $9 trillion on the estimated $10 trillion economy.

The Republicans and the Democrats no longer can represent the issues facing the United States: they are still locked in the same debate as they were 50 years ago. Big Labor represents fewer workers, as the AFL-CIO is disintegrating. California movie star Arnold Schwarzenegger has found it isn't that easy to blow up the boxes. And the past two national administrations have turned fiscal responsibility on its head: Clinton was the most fiscally responsible President in history, not only balancing the budget but creating a consistent surplus; and W Bush, the Andover cheerleader has mercilessly assaulted future generations with debt.

Crisis in physics-based western science: data overload, information not useful, knowledge a question, and wisdom sorely missing.

Social Change

The economists' theoretical solution to social problems is "technological innovation." The 1989 collapse of the Berlin Wall was a real event that symbolized the end of the repressive power of the Soviet system. The emergence of the affordable personal computer and the Internet has led to tremendous social change, and the potential to improve interpersonal communication.

One of the many questions emerging is: what is the role of the public sector? Concepts like public utilities were invented to cross over between public monopolies and private sector rampant irresponsibility, but increasingly the government has become involved in attempting to control economic and social options. Republicans and Libertarians argue that the government should be "less" involved, but that is confusing because they want the government involved in their personal agendas, on their side.

If, as Thomas Jefferson argued two centuries ago, government is best which governs least, then we need to develop a new set of social structures, to re-define what we mean by "government's responsibility" in a post-computer reality.

I am arguing in this paper that we need a shift in theoretical focus from an emphasis on national and state governments to the neighborhood/city/region. The structure should focus on decentralization, responsible personal autonomy and flexible adaptability. That means a focus on organization, management, communication, community, decision taking skills, and working within the limits of the natural environment.

Further, I am arguing that General Systems Theory changes the scientific method, that divide and conquer in science has outlived its usefulness, that Biology-oriented science is the future. As Debora Hammond points out, "the scientific enterprise lacks an integrative framework to put the pieces back together again," while systems thinking offers "a new rationale for scientific unity in a theoretical and experimental synthesis that cuts across the fields of biology, chemistry, physics, mathematics and philosophy."

Paragons of Paradigm Shift

In terms of time periods, examples of scientific and technologically-driven social change include:
From 1500, Copernicus, Columbus, Galileo, the Caxton-Gutenberg printing press
From 1776, Adam Smith (economics), Jefferson (government), Antoine Lavoisier (empirical science)
From 1900, Edison, Ford and Einstein
From 2000, the personal computer and General Systems Theory

Paradigm Shift from Kuhn

Thomas Kuhn, in *The Structure of Scientific Revolutions*, writes that the term "paradigm" describes the set of characteristics that

"Defines a science: No other criteria so clearly proclaims a field a science as a paradigm which is able to guide a whole group's research. It ends the need for constant reiteration of the fundamentals…

Theoretical and methodological beliefs which permit selection, evaluation and criticism of projects…

Object for further articulation and specification under new or more stringent conditions…

Confidence to encourage scientists to undertake more precise esoteric and consuming sorts of work.

"Aristotle's *Physica*, Ptolemy's *Almagest*, Newton's *Principia* and *Opticks*, Franklin's *Electricity*, Lavoisier's *Chemistry*, and Lyell's *Geology* – these and many other works served for a time implicitly to define the legitimate problems and methods of a research field for succeeding generations of practitioners. They were able to do so because they shared two essential characteristics: Their achievement was sufficiently unprecedented to attract an enduring group of adherents away from competing modes of scientific activity. Simultaneously, it was sufficiently open-minded to leave all sorts of problems for the redefined group of practitioners to resolve."

Science in Transition

For the purposes of this paper, please think about this section in the present by substituting the word "economics" where you see the historical concepts for astronomy in the late 15th Century and physics in the early 20th:

"Copernicus complained that in his day astronomers were 'so inconsistent in these [astronomical] investigations … that they cannot even explain or observe the constant length of the seasonal year.' 'With them,' he concluded, 'it is as though an artist were to gather the hands, feet, head and other members for his images from diverse models, each part excellently drawn, but not related to a single body, and since they in no way match each other, the result would be monster rather than man.'

"Einstein, restricted by current usage to less florid language, wrote only, 'it was as if the ground had been pulled out from under one, with no firm foundation to be seen anywhere, upon which one could have built.' And Wolfgang Pauli, in the months before Heisenberg's paper on matrix mechanics pointed the way to a new quantum theory, wrote to a friend, 'At the moment physics is again terribly confused. In any case, it is too difficult for me, and I wish I had been a movie comedian or something of the sort and had never heard of physics.' That testimony is particularly impressive if contrasted with Pauli's words less than five months later. 'Heisenberg's type of mechanics has again given me hope and joy in life. To be sure it does not supply the solution to the riddle, but I believe it is again possible to march forward.'"

Historical Example: Dynamics for Change

As an example of a stage of paradigm shift from the American historical period of 1801 to 1816, about the actual cobbling together of the new nation by Presidents Thomas Jefferson and James Madison from historian Garry Wills new book, *Henry Adams and the Making of America: Jefferson & Adams (1801-1816).* Wills writes from the perspective of John Adams's great-grandson, Henry Adams, the Harvard historian who took ten years to 1880 to write a nine volume analysis of Jefferson's and Madison's administrations.

This is on the philosophical battle that Jefferson had about his commitment to decentralization versus his needs as the national executive. The irony here is that Jefferson did what he accused his friend/enemy/friend John Adams/The Federalists of wanting to do:

"The Federalists hoped for little from change, and clung to a belief that stability must rest on privilege. That the privilege was often illusory just made them dishonest as well as ineffectual.

The [Jeffersonians] by contrast were optimistic about change, hopeful about the capacity of the American people...

The simplistic view of Federalists and [Jeffersonians] is that one stood for centralization of authority and power, and the other for decentralization. But reality cannot be sorted neatly into such nice compartments. The center and the periphery must always interact. In fact, they are defined only by their relationship to each other - the center is central to what, the periphery is peripheral to what? Federalists refused to recognize this reality, or to do so with consistency. They wanted to protect, and therefore to contract, their hold on ancient values. They were not static (no one can be). They were centripetal/inward moving, [Jeffersonians] were centrifugal, expanding out toward new constituents, new spaces, new opportunities. It was optimistic that it could do so and retain its identity.

But optimism is a force for change, and change alters identity. A centrifugal process must generate ever new energies at the center to radiate outward to the periphery - otherwise, expansion becomes mere accretion of disjunct parts. Power must permeate growth. The branch flourishes only when connected with the life of the trunk. That is why the [Jeffersonians] rhetoric condemning power could not survive the requirements of expansion. That does not mean - as some say Henry Adams means - that [Jeffersonians] became Federalists once they achieved power. That is what John Taylor of Caroline claimed, and Henry Adams considers him a prisoner of the past, an anachronism, an irrelevance. Henry Adams believes that the [Jeffersonians] transcended both parties, and party ideology itself, to become that most American of things - pragmatic. Geography made them do it. Henry Adams is right to say that Jefferson represents the best of the American people, since they are a pragmatic people. "A people which had in 1787 been indifferent or hostile to roads, banks, funded debt, and nationality, had become in 1815 habituated to ideas and machinery of the sort on a great scale." That is what Henry Adams meant by calling Jefferson a subject for comedy. Jefferson kept failing to be as idealistic and single-minded, as ideological and pure, as he thought he should be or would be - "and a good thing, too," as the British say.

General Systems Theory

GST as a new way to do Science

My formal introduction to General Systems Theory was John Van Gigch's graduate course at California State University – Sacramento in 1975. I was working in the California legislature as a consultant on mental health, health and welfare policy, and I had just put together a bunch of new ideas about how to improve information flows in social institutions in California. In my paper for the class, "Action in Time for Change", I concluded by stating that the systems approach is replacing the scientific method.

Huh?

I mean the analytic method of defining a problem is by building a box around it, disassembling the parts, dissecting each element, and then drawing final conclusions. It doesn't work for studying living things, like people and organizational behavior. Instead of breaking situations down so much that they lose their life, investigation needs to integrate and evolve with new information over time.

The technocratic focus has produced many wonderful gadgets and widgets, so many that social beings are polluting the ecosystem, locally and globally. We humans are continuing to trash our poor planet. We have overwhelmed many of the natural defenses, and the evidence for nuclear holocaust or global warming is quite threatening to our prospects for the future of life for our species.

Traditionally, social science has attempted to become more respectable by emulating the investigative methods of physics – the linear, causality model, with the result of ignoring the tangential consequences of intended stimulus within the experimental design. Economists even have a name for these ignored consequences: neighborhood effects. Things like pollution, poverty, and depletion of declining scarce resources are defined as outside the box of analysis and therefore irrelevant to the discussion.

The problem with the scientific method is that it to often ignores away the real issues at hand.

As an alternative, General Systems Theory follows a biological model of a system retaining its adaptive viability in a dynamic, fast changing environment.

General Systems Theory encourages the thinker to broaden rather than narrow their scope, to expand outside the box. In particular, for social science, to figure out strategies to improve future options, and move beyond the status quo.

Theory of History of a Good Idea

Almost impossible to articulate (Systems: Von Bertalanffy's, Wiener's)
Crazy
Fringe
Radical (Systems: environmentalism: Rachel Carson's Silent Spring, Paul Ehrlich's Population Bomb)
New Idea is glamorized by the media (Systems: 1970 Report of the Club of Rome)
Serious enough threat to be attacked by the establishment (Systems: 1970s)
Liberal, too good to be true
Moderate (where I believe Systems is now)
The Establishment
Conservative, the boring status quo
The enemy that the next stage must challenge to defeat
Only History

What is General Systems Theory?

OK, just so you understand, THIS is the most important section of this paper. After this section, the paper shifts to politics and economics, so please understand that those are examples of applying general systems theory, but they are mere examples. The main tool for institutional transformation is this new systems language which has a bio-logic orientation, rather than a mechanistic perspective.

From Decartes to now, western science has been dominated by an analytical method that emphasizes reductionism and dissection: divide something into static units, and then try to explain what happens.

Systems Tools for Institutional Transformation

The following is a composite of quotes by the founders of the systems language, Ludwig von Bertalanffy, Kenneth Boulding, James Grier Miller, Anatol Rapoport, and Ralph Gerard, from Debora Hammond's book/Ph.D. dissertation, The Science of Synthesis: Exploring the Social Implications of General Systems Theory.

Starting with a story from Miller that is not in Hammond's book, about the genesis of the systems movement. According to Boulding, in 1954, at the Center for Behavioral Sciences at Stanford University, four Center fellows – Von Bertalanffy (biology), Boulding (economics), Gerard (psychology), and Rapaport (mathematics) – were having a discussion. Another Center fellow walked in and asked: "What is going on here?" and Boulding answered, "We are angered about the state of the human condition, and ask What can we do – what can science – do about improving the human condition?"

"Oh!" their visitor replied, "That is not my field."

The four scientists felt that their visitor's statement reflected the fragmented disciplines of science that have little concern for doing anything practical about the fate of humanity. So, they asked themselves, "What would happen if science would be redefined by crossing disciplinary boundaries and forge a general theory that would bring us together in the service of humanity?"

Basically we are looking at a new scientific method, open, natural expansion of consciousness from specific to general, a union of analytic and wholistic, dynamic rather than static, looking for useful patterns. This means broadening the scope of inquiry to include all relevant factors, grounding technical rationality in the larger social and cultural context.

Boulding thinks of systems as a way of looking at things, a mode of inquiry rather than a rigid model of nature; there is a deep tension between the perception of the real world as utterly diverse and private, and the rage of order that we have that drives us to a passionate desire to experience the world as a unity. It is an impetus to continually extend the scope of inquiry, to foster a more expansive conception of knowledge. Gerard sees knowledge as progressing from observational to taxonomic to structural to dynamic to holistic formulations.

For von Bertalanffy, systems means an organismic approach complementary rather than antagonistic to the classical analytical approach; necessary to understand not only the parts but also the relations that exist between them. Growth is one of the fundamental problems in biology. The organism is never in a state of equilibrium, and maintains itself in a nonequilibrium state by taking in a continuous supply of energy and exchanging components with its environment. Von Bertalanffy points out John Dewey's emphasis on including the environment in any study of the organism.

Noting Thomas Kuhn's model of scientific revolutions, von Bertalanffy sees General Systems Theory as a new paradigm that is being elaborated, to some extent mathematically in terms of nonlinear differential equations, but also in terms of verbal formulations, since there are clearly aspects of reality to which the language of mathematics does not apply. The most significant aspect of this new paradigm, in his eyes, is that it offers a new world outlook or philosophy…

Von Bertalanffy's emphasis is on the need for a conceptual framework that transcends the mechanistic foundation of classical science in order to address the more complex phenomena that characterize the biological, behavioral, and social sciences. He cites Warren Weaver's distinction between classical physics, which deals with simple systems,

which is rarely more than two dimensional linear causality; and the new science of systems, which deals with organized complexity.

With von Bertalanffy, these concepts provide a foundation for interdisciplinary synthesis and contribute to the unification and integration of science within a broader framework than the reduction of all sciences to the mechanistic conceptions of physics. Further, it facilitates a more integrated approach to education that includes ethical values and the development of the personality.

Norbert Wiener describes cybernetics as a dramatic departure from the Newtonian world view and the basis for a new theory of scientific method. As with von Bertalanffy's open-system concept, the starting point for cybernetics grows from the apparent contradiction between the 2nd law of thermodynamics and the evidence of evolution. Information is not subject to the laws of conservation and can accumulate and grow over time, thus accounting for the triumph of evolution over entropy.

Von Bertalanffy is concerned about the nature of living processes to develop increasingly complex forms, in opposition to the second law of thermodynamics which implies that physical interactions should proceed toward the least-ordered state, characterized by maximum entropy, minimization of differences, and equilibrium. In stark contrast, the evolutionary phenomena of life manifest increasingly complex and highly ordered forms, decreasing entropy, and greater heterogeneity. Bertalanffy pointed out that the second law of thermodynamics applies only to closed systems, which had been the primary focus of physics. Far from contradicting the principle of thermodynamics, he points out the phenomena of life requires an expansion of traditional thermodynamics, of which closed systems are only a special and very limited case.

Von Bertalanffy identifies these processes of differentiation in living systems: 1) progressive integration, as the parts become more dependent on the whole; 2) progressive differentiation, as the parts become more specialized; 3) progressive mechanization, meaning the loss of equipotentiality as the parts become fixed to a single function; and 4) increasing centralization, as certain parts gain predominance over others (such as the nucleus in the cell or the nervous system in higher animals).

While cybernetics emphasizes feedback as the primary mode of regulation, von Bertalanffy suggests that is one of many principles that apply to systems in general, and that there are other kinds of regulation that are inherent in the system itself and not dependent on input from the environment….The concepts of equilibrium and homeostasis cannot account for the phenomena of change, differentiation, evolution, adaptation, emergence, creativity, and self-realization characteristic of living systems and human beings.

Boulding sprightly points out the meek will indeed inherit the earth because they are more adaptable; General Systems Theory should enable us to see the world of human ideas as an ecosystem, fostering immense variety, and not as an organism demanding subordination to a central authority; it is of immense importance to look at the earth as a total system in which only a tolerant ecological view can save us. Von Bertalanffy hopes this approach would foster grass-roots involvement in global, participatory democracy.

Of the major schools of thought within systems theory, my focus is organizational design, behavior and management:

Psychiatrist Miller asks Can the scientific method solve the larger, more pervasive questions about man as well as the smaller more particular ones? Is the tool with which man has won his victories over the physical world applicable to uncovering the laws which govern man's conduct, the deepest causes of our strife and our harmony?

For Rapoport, the mathematician interested in mental health, the systems approach puts the psyche back in psychology when it was in danger of being sacrificed in the interest of conferring scientific respectability on the study of human behavior. Von Bertalanffy quotes Arthur Koestler: for the anthropomorphic view of the rat, American psychology has traded in a rattomorphic view of man.

Boulding describes the idea of freedom within order, a pluralistic conception of the universe that would support many centers of power. The objective is to preserve democracy through more effective social-feedback mechanisms and the development of skills in democratic social management among the general populace.

Information is cumulative and capable of continual growth and expansion. For Boulding systems involves information, know-how, knowledge and learning – all of which have strong elements of indeterminacy in them. Since information is the only thing capable of evolution, it provides the key to evolutionary structure.

With self-consciousness, the evolutionary process becomes at least in part teleological [future oriented], directed by an image of the future in the minds of active participants who are capable of affecting the system. There are the enigmas of circular causality, which underscores the complex and paradoxical nature of the relationship between part and whole, granting a degree of relative autonomy to each level of organization.

To which Stafford Beer and I argue that the goal is to drive down organizational decisions to lowest level so that the people directly affected are the ones who make the decisions.

Applying General Systems Theory

The power of applying General Systems Theory (GST) lies in the conceiver's ability to look around boundaries and bridge gaps between neighboring entities – to see a bigger picture over a period of time. While General Systems Theory is frequently applied to the study of industrial production and other large scale technological processes, the basic "systems model" comes from the biological sciences (although the engineers say they developed their version independently). In biology, boundaries and gaps always change over time and so offer a more dynamic context.

To apply General Systems Theory,

- identify something you want to study, focusing on a particular problem, issue or item, and call it a "system"
- create your own visual map of the factors or actors who impact on the particular area of interest
- write out your map, with the problem in the center, identifying as many factors/actors as you can
- identify factors that make up the climate of your picture, which describes the system's environment
- look at how the different system factors interact with each other and parts of their environment over time

The key change of systems thinking is to use a biological model, like a living cell or even a human body, when building a model of anything else. Probably not the box of the engineer's closed system. The traditional model of the clocklike machine of the world of physics that has been seen as the definition of scientific discussion for the past few hundred years must be viewed as a static special case of a dynamic open system.

Some things are fairly static in life, like our skeletons, and we need social structures which are stable. But most of our organizational models have been dominated by 200 year old information systems that are slow moving, with only annual increments of change. General Systems Theory is about how to look at or for states of change. This requires more than analysis; this calls for synthesis:

- How do the key factors/actors in the system normally interact with each other?
- What are key actors' range of irregular behaviors?
- What cost to the system does the problem create?
- What happens just before the problem?
- How does the problem get dealt with?
- Is problem resolution possible, or is there a place where the problem normally gets hidden until it blows up again?
- Is it possible to indirectly change the environment so that the problem disappears?

The preliminary answers to these questions lead the investigator to a range of options for changing the system and its environment so that the problem may be impacted. Applying General Systems Theory is the studied art of actually being involved in a particular system, making an impact, and then dealing with the consequences. The advantage of GST over conventional analysis is that the observer broadens her or his scope of the problem initially, and then sees more of the wide range of factors with potential impact on the problem, and views change over time.

For a system to survive, it must complete and repeat certain cycles; continuance is the ultimate test of system viability. From a General Systems Theory perspective, ALL systems are organic and must follow the laws of biology, even machine parts suffer from long term aging. Death and possible renewal are necessary for life.

This GST approach to problem solving encourages and allows different individuals to speak as equals from their own inherent biases and limitations. People are basically positive if given the opportunity, capable of being creative, need some structures and socially-defined limits, and most will buy into the social mores of the time and context (including class and gender specifics). Von Bertalanffy aligned himself with the gestalt and humanistic traditions, which are rooted in a developmental view of the personality, emphasizing the processes of individuation, emergence, differentiation, growth and learning. Boulding was trying to tie together economic man, biological man, sociological man, psychological man, and perhaps even religious man, and bring the fragmented back together again.

People on the same planet, with similar concerns and problems, needs and desires, speak of survival, security, belongingness, friendship and self-actualization, according to psychologist Abraham Maslow. If, as his colleague Carl Rogers argues, people are basically positive, then it is only rhetoric and bad manners that hold together the world arms race that the U.S. military-industrial complex underwrites, continue to spoil our water, soil and air, misinform the public about carcinogenic processed food, sustain giant bureaucracies of millions of tiny boxes of power struggles, revere status-oriented academia, and nurture an international economy which would be delighted if half of us went to war tomorrow.

Teilhard de Chardin was a French Jesuit priest-paleontologist who was exiled to China for seeing life as greater than the Catholic Church. Chardin wrote a book called The Phenomenon of Man to describe our worldwide social awareness as something magnificent and precious – what Chardin calls "the noosphere". Located conceptually between the atmosphere and the biosphere, this noosphere idea seems to include all the writing, speaking, thinking, feeling and subconscious awareness happening on the planet. As an idea, it seems to give people a context for talking about human problems: what are the major interactors in the problem? How does change in the environment around the actors influence the problem? What would be positive change?

Criteria for Evaluating Social Science Tools

From *Tools for Conviviality* by Ivan Illich:

There are two ranges in the growth of tools: the range within which machines are used to extend human capability and the range in which they are used to contract, eliminate, or replace human functions. In the first, people as individuals can exercise authority on their own behalf and therefore assume responsibility. In the second, the machine takes over – first reducing the range of choice and motivation in both the operator and the client, and second imposing its own logic and demands on both. Survival depends on establishing procedures which permit ordinary people to recognize these ranges and to opt for survival in freedom, to evaluate the structure built into tools and institutions so they can exclude those which by their structure are destructive, and control those which are useful. Exclusion of the maligning tool and control of the expedient tool are the two major priorities for politics today.

If a just society is one in which liberty for one person is constrained only by the demands created by equal liberty for another, then we need to have institutions which promote a delicate balance between what people can do for themselves and what tools at the service of anonymous institutions can do for them. In order to achieve this, natural and social science need to be used to create tools, utilities and rules available to everyone, thus permitting individuals and transient associations to constantly recreate their mutual relationships and their environment with unenvisaged freedom and self-expression.

Examples of tools that move society in that direction

- *problem oriented medical record*: in the early 1970s, a physician in rural Vermont named Larry Weed revolutionized pre-computer medical practice by proposing organizing the medical record as though each person is unique, and the record should help solve the patient's presenting problems, rather than being organized to the convenience of the boxes inside the hospital's organization chart.
- *case management*: during the 20th Century the field of social work grew to try to accommodate the cracks and failures of the profit-driven industrial health care delivery monster; people are relentlessly ground up by our modern institutions, and there is little give for real human beings; to be able to assist individuals in gaining maximum control and fulfillment, or at least survive, social workers developed the concept of the case management process to help keep track of where someone seems to be headed to work things into a better place; when Ron Dellums, a social worker from Berkeley, was elected to the U.S. Congress, his case management approach to constituent problems was so much more useful that it is now standard procedure in all congressional offices.

- *integrative or functional medicine*: looking at the whole body, lifestyle and nutrition, Integrative or Functional Medicine involves understanding the stages of disease, looking at prevention and treatment of complex, chronic disease. It is an integrative, science-based health care approach that treats illness and promotes wellness by focusing assessment on the biochemically unique aspects of each patient, and then individually tailoring interventions to restore physiological, psychological and structural balance.

There are seven basic principles underlying the functional medicine approach:

- Science-based medicine that connects the emerging research base to clinical practice.
- Biochemical individuality. Each person is genetically and environmentally unique, which affects how she or he expresses both health and disease.
- Patient-centered care (rather than disease-centered) means that the person is the focus of care, not the diagnosis.
- Dynamic balance describes the ever-changing relationship between internal (mind, body, and spirit) and external (physical and social environment) factors that affect total functioning.
- Web-like interconnections among the body's physiological processes also affect every aspect of personal functionality.
- Health is a positive vitality. What is the person's range of feeling really well, full of vitality and life.
- Promotion of organ reserve. Heart, lungs and glands and everything else in the body can achieve greater stamina, better recovery from illness, and a longer "health span," not just a longer "life span."

Using these principles, functional medicine practitioners focus on understanding the fundamental physiological processes, the environmental inputs (diet, exercise, psychosocial forces, toxics and traumas), and the genetic predispositions that influence every patient's experience of health and disease.

- *historical institutional uses of systems theory*: the most famous systems analysis disaster is the U.S. Department of Defense analysis that led to the U.S. involvement in Vietnam in the 1960s. The greatest known success was when W. Edwards Deming, the American efficiency expert, was hired by the Japanese national association of scientists and engineers in 1951 to transform the Japanese economy. Deming brought the Japanese economy into its modern success using the systems approach to bust out old stereotypes: his Quality Circles invited workers from adjacent work units to challenge and even criticize each others products and work interfaces. Change from within brought the Japanese economy from despair of defeat from World War II to being the dominant economy besides the U.S. Deming is the other American who has influenced modern Japan as much as Douglas MacArthur (who designed the Japanese constitution).

Adaptive Organizational Behavior

Current social structures are static. Budgets are annual, corporations report quarterly – from when a year was considered to be a short period of organizational time.

Now we have instantaneous communication to a fault. We are being overwhelmed with media that is noise and junk.

The challenge is to design a dynamic information structure that encourages a real time present future focus.

Jane Jacobs, in *The Nature of Economies* (1999) uses a conversation among a small group of friends to explain this concept:

"The essence of dynamic stability is constant self-correction," said Hiram, the ecologist. "What's your definition, Armbruster?" (the intellectual).

Dynamic is from Greek for 'power' or 'strength'; it carries a sense of motion. Stability is from a Latin root meaning 'to stand,' and when it's coupled with dynamic, it carries a connotation of resisting overthrow or collapse."

"Energetic steadiness," said Murray, the economist.

"Before you go any further," said Armbruster, "just what kinds of dynamic entities are you referring to?"

"Every kind of system that is neither inert nor disintegrated. This includes all living systems: ecosystems, organisms, cells composing organisms, microorganisms. It also includes many inanimate systems: rivers, the atmosphere, the crust of the earth. Human settlements, business enterprises, economies, governments, nations, civilizations – they're all dynamically stable systems. Stability implies its opposite, instability. All dynamic systems are in danger of succumbing to instability, which is why they need constant self-correction. If and when a dynamic system decisively loses stability, it either collapses into inertia or disintegrates. Then eventually maybe something else dynamically stable engulfs it, or something new organizes itself from the pieces."

"Much the same as saying all things alive are in peril of death," put in Murray.

"No dynamically stable system lasts forever," said Hiram. "But the wonder is that such vulnerable systems endure at all, succeed each other, and even flourish for their time under the sun. Dynamic systems have resources and methods for evading collapse. Of course luck plays a part, but even when luck favors them, dynamic systems must continually correct themselves with timeliness and accuracy. Resources and methods for doing this fall into four categories, of which – "

"Only four!" exclaimed Kate, the ethologist/animal behaviorist. I'd have supposed dozens for economies alone; and in the rest of nature – what, millions? Trillions?

"Actually, four are quite a lot," replied Hiram. "Nature is prodigal with details but parsimonious with principles. I'll sketch out the categories in this order: bifurcations; positive-feedback loops; negative-feedback controls; and emergency adaptations."

A bifurcation is literally a fork in the road, where a new direction must be taken. Mathematicians call the same kinds of events discontinuities. Here's the correction principle: A system's instabilities of some sort can have become so serious that for it to continue operating as it has been is not a practical option. It must make a radical change, travel into new territory. Jacobs describes the emergence of air-breathing vertebrates from an ancestry of marine vertebrates. Mine is when a dinosaur/lizard built wings and flew to evolve to a bird. The discussion here is about decisive evolutionary change.

Stafford Beer: Copernican Scientific Revolutionary of Social Organization

A paradigm shift is a transformation in social consciousness based on a body of ideas providing a context to see the world in such a new way that it is a new world.

Before Copernicus: God above, Earth below, humans have a special relationship with God.
Copernicus: Sun is center of only our little solar system. If God is no longer above, where is human in the grand scheme of things?

Before Lavoisier: Science involved reading Aristotle's definitions of air, earth, fire and water.
Lavoisier: named hydrogen and oxygen as distinct gases, presented chemistry based on the oxygen theory of combustion (and respiration and fermentation) into carbon dioxide, introduced the two letter chemistry symbols, introduced balanced chemical equations to explain weight differences, rejected Aristotle's 4 elements for 33 (of which 31 are still considered elements), published the definitive textbook on Chemistry in 1789 which introduced all of these concepts to the emerging European academic and scientific community, and served as the secretary of the committee which invented the metric system – defining calorie and laying the foundation for the analysis of thermodynamics.

Before Darwin: Human is top of the evolutionary chain, created in God's image.
Darwin: Natural Selection leads to species specialization, humans lose preeminence among species.

Before Stafford Beer: Organizations thought of in terms of static organization charts with hierarchical bureaucracies, many layers of administration, TOP down decision taking, with built-in confusions of communication and control that lead to built-in conflicts.
Stafford Beer: All organizations that continue to exist have a part that does something in the world, and a second part that looks at how the environment is changing and what the organization should do in the future. The Viable System Model identifies the necessary and sufficient information flow that an organization needs to adapt over time; the model can be used to help an existing organization identify areas where communication is breaking down, and design new communication structures to accomplish new goals; all workers share access to manager's reports, which are designed in a way that empowers all to participate in debate about what the numbers mean, what the policy options are, and what direction the organization should point new efforts towards. It shifts the focus of organizational power down from "the Boss" to the operations level, with the emphasis of management shifted to being in service to operations.

Beer's Concern about Timely Organizational Response

The time-lags in the managerial context are too long. Firms are in one of several organizational system modes: sustained activity, growth, retrenchment, crisis, moribund, death-wish or aggression. The firm remains locked in one mode because it believes that it cannot readily change course – and therefore it disregards its opportunities of doing so. Perhaps this is partly due to systems of annual budgeting. In nature the viable system does not make this mistake; it is conditioned by evolution to be 'quick to the draw' where a change of mode is concerned. In management, the inertia is very high (unlike nature). When it comes to government, the inertia is so high as almost to deny the mechanisms for adaptation enjoyed as a right of any viable system. The reason for this in large-scale enterprise is the belief of all concerned in inertia itself. Opportunism is a dirty word, it betokens irresponsible action. The viable system in nature seizes its opportunities.

Companies and nations have failed in this rapid switching. Artificially contrived viable systems do not pay sufficient attention to the immediacy of response, nor in general to the instabilities of (worse) the rock-hard overstabilities engendered by differential time-lags inside the informational circuit.

Stafford Beer's Viable System Model (VSM) for Managers

The evolutionary change is a new way to look at organizations: as an adaptable organism. Every living, surviving entity has a management structure, which is mapped in the Viable System Model as Systems 1-2-3-4-5:

Start out with something that does something in the real world, and call it System 1.

System 1 extracts some inputs from its Environment, processes them, and sends outputs back to the Environment. It has a management information structure, and a manager, who makes decisions and has responsibility to keep this System 1 alive in a changing environment. With the environment's enormous and exploding complexity, the manager must use information to adapt the process to remain viable.

System 2 is the coordination function with other System 1s (mostly on the squiggly lines between their operations). System 2 is to prevent oscillation, so that there is a minimum of backlog and the need for storage space, and to specifically maintain a positive attitude about the exchange of information within the organization but outside the rigidly defined lines of communication established for management in System 3. System 2 is routine – messages are received from System 1 or System 3 that something needs to go smoothly, and they figure out a convention for doing it. Examples range from personnel policies and the annual budget process, to planning cycles, frequency of scheduled meetings, and rules for common purchasing.

System 3 is middle management, to coordinate the use of Technology A ("Here and Now"), the processes used to do something in System 1s, looking for synergy between System 1s. System 3 communicates on three channels: resource bargain (two-way), command (one way) and System 3* audit (mopping up excess variety by delving into operations to ask specific questions). System 3's job is to make sure System 1 is succeeding, whatever it may take. An organization is increasingly centralized and authoritarian in proportion to the quantity of decisions made about "Here and Now" in System 3 rather than System 1. Fewer decisions reflect a corresponding increase in decentralization. An important, in fact decisive, condition for maintaining a low frequency of decision-making via System 3 is a well-developed System 2. Units within System 1 can only attain a satisfactory ability to select courses of action and make decisions, if System 2 is well-developed and attitudes to lateral contacts within the organization are positive.

System 4 is about finding Technology B ("Change and the Future"), identifies needs and potential for change, whatever could replace Technology A.

System 5 mediates between System 3 ("Here and Now") and System 4 ("Change and the Future").

Hands On: actually building a Quantified Flow Chart that is a Graphic Model of System 1 processes: a trained interdisciplinary team that includes insiders creates graphic quantified flow charts of what is actually happening now. Most management information systems try to monitor too many items, so that their human regulators are overwhelmed.

The cybernetic approach determines to isolate whatever is important to the manager to know at any given moment, which requires real time technology.

The mapping of the organizations on to the VSM retains all the necessary complexity of viability with all the possible simplicity of a basic diagram. It offers operational realities that lead to key conclusions agreed to by the work team, who identifies which major flows and which potential bottlenecks are to be monitored. There are usually ten to twenty at each level of recursion, although some may be so sophisticated that data collection methods must be custom invented.

Thus it is that even financially trained people on boards may be observed scribbling little charts on their scrap pad: "It went up, it went further down, it leveled out, it is going up again". This is the sort of impression that has managerial impact. Certainly a numerical statement presented to a greater number of significant figures than could be measured in a national physical laboratory will not have so potent an effect. We readily perceive relative size, relative slope, relative color, and relative movement, whereas tabulations have to be disentangled from their level of arithmetical abstraction into these forms.

The magic number is 7 (+/- 2): indices need to be either aggregated or sampled to make sure that there isn't too much information, so that the manager can focus on key values.

Observations:
All decisions should be made at the lowest possible level of the organization. It is there that the alternatives and the consequences can best be evaluated.

Most organizations' managers get so caught in Technology A ("what we do better than anybody else") that they do not recognize the need for System 4, so they collapse System 3-4-5, and focus on System 2, and become efficient dinosaurs.

A fundamental concept of the Viable System Model is the idea of recursion, of cells living within a dynamic environment. The idea is to realize that each System 5 lives as a System 1 management structure within a larger environment, and simultaneously the original System 1 is also a System 5 for a smaller but still vital part of the universe.

This recursion concept transcends the whole political question about creating social change versus defending the status quo: at the System 1-2-3 level, the manager is looking for improvements, making sure everyone knows what to do and is doing it right, about being "efficient"; and at the System 3-4-5 level, the manager is looking at major structural adaptation to an already changed environment, about realizing that what is happening isn't nearly good enough, and major changes must be made, so that the organization can become "effective."

Stafford is empirically-oriented, and builds a lot of ideas from Ross Ashby's notion of requisite variety, which challenges a manager to match complex variety, to gain some control over information flow to improve decisions. Most management strategies either reduce the information complexity coming from the environment (planning, structural change such as divisions or specialization, or operational refinement) or amplify the manager's variety (augmentation such as bringing in experts or consultants, structural like diversify, acquire or reorganize, or improve information flow).

The primary goal of the information model is to be able to identify incipient instability so that the manager can adjust the process to adapt to changing reality in the environment. Current corporate decision making is based on the previous quarter, and government decisions are based on the previous year – which will rarely help the manager in adapting to FUTURE changes in the environment.

- Instead of having a time lag of even a month, in which case it is too late to do anything to intervene in time, what is happening NOW? If it was happening yesterday, and is probably happening still now, is not so much of a disaster (or triumph) yet but of a rocking-of-the-boat (incipient instability), and if we can detect it at once, then we may be able to restore the equilibrium.
- Which leads to the concept of management that has power of information to manage: do something now so that the future will be different from the future that otherwise would have been, a working definition of planning. By establishing long term normative planning goals, short term strategic goals can be defined, to guide actual tactical actions. But if information is lagged, then the future is foisted upon us, because it has already happened by the time we realize it.
- Real time information gives the manager the power to once again manage in the short term: it was once possible to observe activities under command, dislike the outcomes, and issue new orders instantly. In this way, managers quelled incipient instability. The inability to do this today is an artifact of our immensely cluttered, bureaucratic and inept systems – computerized though they may be. Consider the absurdity of a government's employing an army of econometricians in order to forecast (from lagged data) where we already are. And because the forecasts are often wrong, we decide our plans as proceeding from an initial position that we never occupied in the first place.
- A properly designed cybernetic system does not over-react, because it has properly calculated feedback functions that smooth irregularities and impose delays that are systemically appropriate. The present instant-response system, which has not been properly designed (nor designed at all), is as over-reactive as could possibly be.

The final introductory comment about the Viable System Model is to explore a term that Stafford invented: algedonic. He put two Greek words together that mean pleasure/pain. It is intended to be a measure of satisfaction, on the most crude level: Yes or No, on a scale of one to ten; add it up among a group of people, and get a measure; then do it a while later and see if their satisfaction level has gone up or down. It cuts through all the specifics, and just asks the global question of evaluating the System 1 in its environment.

[That is an effort to synthesize Stafford Beer's *The Brain of the Firm*, *The Heart of Enterprise*, *Platform for Change* (with reader's guide by this author), *Diagnosing the System for Organizations*, and the wonderful compilation edited by Raul Espejo and Roger Harnden: *The Viable System Model: Interpretations and Applications of Stafford Beer's VSM,* especially Stafford's "National Government: disseminated regulation in real time, or 'How to run a country'".]

Using VSM in Developing Organizational Competence in a Business

This is from a report by a Swedish paper making company with 8,000 employees, in Espejo and Harnden's *The Viable System Model: Interpretations and Applications of Stafford Beer's VSM:*

Each manager of an organizational unit receives a large quantity of information. This forms the basis for a large variety of alternative modes of action. Naturally, no manager can systematically evaluate every theoretical alternative. Experience and subjective evaluation act as a filter to determine the alternatives selected for final consideration. Consequently, a great majority of decisions are simple and self-evident for an

experienced manager, who is therefore able to spend more time on dealing with the few difficult decisions, which often tend to be those related to changes in the demands made by the surrounding world.

Inner stability can be achieved through feedback within the unit. Alternative modes of action and stimuli for change are received from outside. A large number of channels are required, supplying a considerable flow of information, to meet demands related to stability and integration within an organization. These channels of information must flow between manager and employee as well as between individual employees, inside and outside the unit. It is important to develop and support lateral contacts, both inside and outside the organization.

VSM Experience so far by the Swedish Paper Company

Have we been able to achieve our objectives through this long process? The answer is still uncertain. We started by talking of 3-5 years to make noticeable progress. After roughly three years we knew that five years would be required to change the culture of the Group. However, some preliminary conclusions can be stated now.

1. We are profitable: that really is the "acid test".
2. Everyone who requires specific information for his/her work is entitled to get it. This is crucial to our efficiency.
3. Stafford Beer's model as applied by us has helped in several ways. Foremost, top management has felt itself completely confident that the message is good and consistent. There is a new consciousness of the importance of systematic information flow.
4. It is important to recognize that the standard model for our organization (chain of command decision orders and follow-up accountability) remains valid. Traditionally, only the channels of communication which enable directives/orders are described, which is the equivalent to System 3. The new approach means that we consciously complement our model with our personal experience of what we all know happens in an organization. Reports are not sent only to the manager – they are also sent to the next manager, and to adjacent departments. Plans and information are spread through the organization by word of mouth, as well as the written word. By bringing this to everyone's attention (especially System 2), we can all make a conscious effort to develop this necessary aspect of our work.
5. All groups given new autonomy are first happy, then troubled. They cut themselves off from the world for a while when they try to establish their own identity and their own work rules. After one or two years they are ready to cooperate with the outside world again.
6. It is difficult to make middle management understand that it is to their advantage to delegate authority. They feel sometimes that their power base is threatened.
7. It takes an extra effort to make profit centers realize that it is to their own advantage to cooperate with other profit centers to gain synergistic effects. Centrally we assist in creating 'network' groups between key professionals.
8. The model has not, however, become part of every manager's daily language, although quite a few often think in terms of the systems of the model. It is notable that engineers especially find the model interesting: their technical background in regulatory systems makes it easier for them to understand.
9. Some union people also accept the model easily. Skilled workers are proud professionals used to solving their own problems.

10. When introduced to the model people start asking 'where am I?' It requires a lot of effort to make people understand that they have to work within more than one system.
11. We stress very carefully that decentralization does not mean independence. It means that more people have to take interdependence into account on their own. The basic concepts, objectives and rules are to be followed.
12. We also stress carefully the nature and the significance of our control system. However laudable autonomy might be, it has to be embedded in some overall cohesive context for the corporate identity to emerge. As one of our managers put it: Trust in people is all very well, but some control mechanism is necessary.
13. Finally, and perhaps most important, we can see how a new generation of middle managers is taking on new tasks and creating new opportunities. They are not waiting for their 'marching orders.'

Practical Political Challenges

So, given all this theory, what practical directions are potentially available to the State of California?

- create safe, viable systems
- high and medium density housing close to adequate public transit to minimize local traffic problems/needs
- decriminalize society: main sources of arrest: drugs/alcohol and automobile accidents
- transcend financial fraud: go from a scarcity philosophy to an abundance philosophy
- less children, as a personal decision
- less hectic workplace: think smarter
- not the volume of work/communication/data but superior decision tools that give organizations greater ability to accommodate need and simultaneously promote organizational flexibility to adapt to other dynamic organizations as well as a fast changing world environment

Pro-active Institutional Tools

- State/national identification (social security number, electronic eye print, identity theft protections)
- global voluntary database for public policy analysis and to create a history for the future
- social service planning, management and program evaluation; see Action in Time for Change, 1976
- single payer health care: only the U.S. has unsuccessfully stuck with massive failed experiments with the HMO (health maintenance organizations), further complicated by the tragic MediCare prescription drug financing scam; by comparison, Germany's health system was set up by Bismark in 1870, survived losing two world wars, and the health professionals, the consumers, the employers and the elected officials are all satisfied; see "Systemic Trauma: The Troubled Prospects for Managed Care in California and the U.S." in the ISSS 1996 Proceedings, Louisville
- building a policy forecasting computer model for statewide analysis; see "The Computerized Community & Can We Measure Optimal Community?" 1995 Amsterdam ISSS Proceedings
- converting to a regional form of local government based on a unit of 10,000 people, instead of counties, and then define geographic regions in terms of blocks

of 100 and 10,000 people in a specific demographic, so that when it is necessary and appropriate, all of the representatives for a given problem area can focus; design the information structure so the computer matrix does all the difficult coordination, making it convenient for people to work together.

- Integrate the California state master plan for higher education into a single governing structure for the University of California, the California State University and College system, and the Community College system, eventually consolidating decision making, administration, governance and financing, with UC being forced to give up some of its privilege, to better distribute resources by giving more to Community Colleges, which have the most direct local contact. Debora Hammond responds: "I had some ideas along these lines, as the new master plan was being drawn up. Would make much more sense to organize the educational system around a regional network model, with the research universities serving as resources for the state university and community college system, instead of a tiered structure (that puts the leadership of the CSU, for example, in Long Beach, which means I have to travel south if I want to be a part of system-wide initiatives). Far more logical would be to have the UCs as resources for the region - networked with the State University and Community College, and even more fully with the public school system, which would allow for the coordination of various service learning/community-based research projects across the educational levels."
- New state constitution based on grass roots communication

Part 2: Viable Urban Settlements follows.