PROCEEDINGS

RUSSELL L. ACKOFF and THE ADVENT OF SYSTEMS THINKING

A Conference to Celebrate the Work of
Russell L. Ackoff
on his
80th Birthday
and
Developments in Systems Theory and Practice

March 4-6, 1999

Sponsored by:

The College of Commerce and Finance
Villanova University
Villanova, PA 19085

Program Committee

Matthew J. Liberatore, Conference Chair

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David N. Nawrocki

Systems Thinking and Information Systems Practice

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Idealized design

William Roth

Conference Coordinator

Helen A. Tursi

Special Issue Co-Editors

Systems Practice and Action Research (SPAR)

Margaret Nicholson, Kent Myers

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RUSSELL L. ACKOFF CONFERENCE SCHEDULE

March 4 –6,

THURSDAY, MARCH 4, 1999

7:00 – 8:00 PM ***REGISTRATION***

COCKTAIL RECEPTION & HORS D'OEUVRES
Villanova Room, Connelly Center

8:00 PM ***CONFERENCE OPENING***

Welcome & Objectives: Thomas F. Monahan, Dean,
College of Commerce and Finance, Villanova University

Opening Remarks*:* John R. Johannes, Vice President of Academic Affairs
Villanova University.

8:15 PM ***KEYNOTE ADDRESS*:**

Vincent P. Barabba, General Manager, Corporate Strategy and Knowledge Development, General Motors Corporation

"The Market-based Adaptive Enterprise: Listening, Learning, and Leading through Systems Thinking: An Appreciation of Russell L. Ackoff"

FRIDAY, MARCH 5, 1999

7:30 – 8:00 AM ***REGISTRATION - CONTINENTAL BREAKFAST***
Connelly Center Lower Lobby

8:00 AM **IDEALIZED DESIGN VIDEO - Cinema**
"*IDEO – the Deep Dive"* – featured on "Nightline"

8:30 – 8:45 AM ***WELCOME AND AGENDA***
Connelly Center Cinema

Matthew J. Liberatore, Associate Dean,
Villanova University.

8:45 – 9:15 AM ***"On Passing Through 80"***

Russell L. Ackoff, Chairman, INTERACT

9:15 –10:45 AM **SESSION I**

Business Applications of Systems I
Moderator: James Klingler, Villanova University
Connelly Center Cinema

1. "*Systems Thinking and Management Epistemology: Second Thoughts on the Historical Hegemony of Positivism."*
Omid Nodoushani, University of New Haven.

2. *"Changelessness, and other Impediments to Systems Change"*,
David Hawk, University of Helsinki

3. "*Systems Theory and Financial Markets."*
George Philippatos, University of Tennessee David Nawrocki,
Villanova University

OR

Social Systems Sciences - Applications I
Moderator: Joan Weiner, Drexel University
Radnor-St. Davids Room

1. *"Looking at Leadership from a Systems Perspective*",
Erwin Rausch, Didactic Systems, Inc.

2. *"A Theory of Resonance: Intentional Emergence and the Management of Loosely Coupled System"*, Larry Hirschhorn and Flavio Vasconcelos,
Center for Applied Research.

3. *"Adaptation Revisited."*, Wladimir Sachs, Sachsofone Associates, Inc.

10:45 – 11:00 AM **COFFEE BREAK**
Connelly Center Lower Lobby

11:00–12:30 PM **SESSION II***

Business Applications of Systems II - Economics and Finance
Moderator: George Philippatos, University of Tennessee
Connelly Center Cinema

1.*"Pentagon Capitalism and the Killing of the Red Queen: How the US lost the Coevolutionary Arms Race between Firms, Markets, and Technology."* Rodrick Wallace, New York Psychiatric Institute.

2. *"A Consideration of Market Dynamics."* - William Harding, University of Mary Hardin-Baylor.

3. "Coherent Market Theory and Nonlinear Capital Asset Pricing Model." - Tonis Vaga, Windermere Information Technology Systems.

OR

Idealized Design I: Bringing the Process into Perspective
Moderator: William Roth, Allentown College
Radnor-St. Davids Room

12:30 – 1:30 PM **LUNCH** Villanova Room, Connelly Center

1:30 – 3:00 PM **SESSION III***

Idealized Design II - Defining New Opportunities
Moderator: William Roth, Allentown College

Communications Facilitator: Kenny Myers
Devon Room

Systems Training/Educator Facilitator: Bill Roth
Radnor-St. Davids Room

Industry/Government Consultants: Jim Leemann
Rosemont Room

OR

Business Applications of Systems III

Moderator: Mohammad Najdawi, Villanova University
Cinema

1. *"Structural Process Improvement at the Naval Inventory Control Point."*, Gary Burchill, Center for Quality Management.

2. *"Studying the Sense & Respond Model for Designing Adaptive Enterprises and the Influence of Russell Ackoff's System of Thinking."* David Ing, IBM, Advanced Business Institute.

3. *"Implementation of Learning & Adaptation at General Motors*." Wendy Coles, General Motors Corporation.

3:00 – 3:15 PM **AFTERNOON BREAK**
Connelly Center Lower Lobby

3:15 – 5:00 PM **SESSION IV***

Idealized Design III - Integration on a Global Scale

Moderator: William Roth, Allentown College
Radnor-St. Davids Room

Social Systems Sciences II - Applications

Moderator: Jaime Jimenez, National Autonomous University of Mexico
Cinema

1. *"Managing Complexity Through Participation: The Case of Air Quality in Santiago de Chile.*" - Alfredo del Valle, Innovative Development Institute.

2. *"Community Development Through Participative Planning*." - Jaime Jimenez and Juan C. Escalante, National Autonomous University of Mexico

3. *"Large Scale Corruption: Definition, Causes, and Cures*", Raul Carvajal, Universidad Nacional de Mexico

5:00 PM **Shuttle Service to Radnor Hotel**

6:15 PM **Shuttle Service to Villanova University**

6:30 PM **COCKTAILS - Villanova Room**

7:30 PM **DINNER -** Villanova Room

8:30 PM **RUSSELL L. ACKOFF BIRTHDAY CELEBRATION**

Master of Ceremonies: Vincent Barabba, General Motors

Opening Remarks: Jamshid Gharajedaghi, President & CEO, INTERACT

SATURDAY, MARCH 6, 1999

8:00 - 8:30 AM ***CONTINENTAL BREAKFAST***
Connelly Center Lower Lobby

8:30 – 10:00 AM **SESSION V – Panel**
Cinema

Panel participants will include several representatives from IT Intensive Firms

INFORMATION TECHNOLOGY AND SYSTEMS INTEGRATION

Moderator: Sasan Rahmatian, California State University, Fresno

10:00 – 10:15 AM **COFFEE BREAK**
Connelly Center Lower Lobby

10:15 – 11:45 AM **SESSION VI -Cinema**

Future of Systems in Education and Practice
Moderator: Thomas F. Monahan, Dean, Villanova University

Concluding Remarks: Russell L. Ackoff, Chairman, INTERACT

11:45 AM **CONFERENCE CONCLUSION**

POST CONFERENCE PROGRAM

"Catching Up" (12:00-3:00PM)

Stay and enjoy the company of colleagues and friends at this informal session. Lunch and Refreshments will be served.

Radnor-St. Davids Room

PREFACE

The purpose of this Conference is to bring together former students, associates and others interested in Systems Thinking to recognize and celebrate the contributions of Professor Russell L. Ackoff and to explore developments in Systems Theory and Practice in the areas of teaching, consulting and research.

The program features an Idealized Design Track chaired by professor William Roth of Allentown College, a Business Applications Track chaired by Professor David Nawrocki of Villanova University, and a panel on Systems Thinking and Information Systems Practice chaired by professor Sasan Rahmatian of California State University at Fresno.

ACKNOWLEDGEMENTS

Several people have contributed to the success of this conference, especially David Nawrocki and Helen Tursi of the College of Commerce and Finance, and Terry Sousa, Events Director for the Connelly Center, Villanova University.

I would also like to thank Dean Thomas F. Monahan of the College of Commerce and Finance for having the vision to see the importance of Systems Thinking in business practice and for initiating the idea of Villanova's organizing and holding this conference.

In addition, the assistance of Mrs. Chris Nawrocki, students Angela Capron and Regina Latella during the registration process is greatly appreciated.

The Market-Based Adaptive Enterprise: Listening, Learning, and Leading Through Systems Thinking

An Appreciation of Russell L. Ackoff

Address
by
Vincent P. Barabba

General Manager,
Corporate Strategy and Knowledge Development
General Motors Corporation

I am really pleased to be the speaker this evening. In fact, I have been looking forward to it ever since Dean Monahan and I discussed the possibility several months ago. That's because we are marking two very different types of milestones this evening.

The first type of milestone, of course, is Russ Ackoff's eightieth birthday – a landmark I would not have missed for anything, since I consider Russ to be one of my best teachers, even though I never took a class from him – and, most of all, he is my good friend.

The second type of milestone is Villanova's initiative to develop a new systems thinking-based approach to the business school curriculum, which we will be discussing over the next two days. I believe this initiative has the potential of becoming a turning point type of milestone in business school curriculum. If you are successful, I believe other business schools – and companies – will take note and, if they're smart, will adapt (they'll say reinvent) much of what you are developing here to their own institutions.

I should also comment about the subtitle of the presentation – An Appreciation of Russell L. Ackoff. Let me at the outset make it clear that I borrowed that term from another person whom I admire greatly – C. West Churchman. He used the phrase as the title of a paper he gave at the First Edgar Arthur Singer, Jr., Lecture at the Busch Center at the Wharton School in 1981. In that paper he said, "I have selected the title of this chapter rather carefully. An appreciation of someone's lifetime work is not just an evaluation; it is also a process of adding to and adjusting the results of that lifetime of creation of ideas and a system of philosophy. As Singer would put it, an appreciation 'sweeps in' new ideas and corrections for the system."

I chose not to make that phrase the title of this presentation, because I found myself humbled by the comparison between this evening's comments addressing how I've applied what I've learned from Russ Ackoff, and Churchman's contribution of new ideas and corrections based on what he learned from Singer. Still, I will do my best this evening to describe what I've learned from Russ over the years, and how that learning has and is continuing to influence General Motors.

We have been doing a lot of work in systems thinking at General Motors as we've attempted to develop a new business design. This business design should better prepare us for a world of greater complexity compounded by an increasing rate of change. Russ has been traveling with us on this journey, and he has been instrumental in exposing us to new perspectives, opportunities, and solutions. Those of you who know Russ well are aware that candor and directness are two of his hallmarks. During a recent project review at GM, he gave us one of the highest compliments I've ever heard him utter, when he said – in that inimitable deadpan style of his – "Well, it's clear you haven't become orthodox in following what I have recommended, but you have at least demonstrated that you understand and are adapting the concepts to your situation."

Now the reason we interpreted Russ comments to be a compliment is that, as many of you know, throughout his career Russ himself has rarely been viewed as one to follow the orthodox way of doing things.

But working with General Motors wasn't the first time Russ found himself discussing orthodoxy in Detroit. Back in 1949, as an assistant professor of philosophy at Wayne University (now Wayne State University), Russ challenged the traditional manner in which philosophy was being taught. As Russ said at the time, "In common language it's a question of whether philosophy can bake bread or can't. Our interest is toward a philosophy of science that is applied to the everyday needs of people, and theirs is reflective. We think it should be useful."

The Detroit Times of February 26, 1949 described the controversy this way: "It was the first time that the philosophy department, traditionally regarded as a cloistered, theoretical body, was causing the big excitement on the campus."

By forcefully stating his beliefs, Russ has helped -- wherever people would listen -- initiate change. A hallmark of his next 50 years.

This evening, I want to present a view of the future that hopefully will cause some excitement on this campus over the next two days. This vision incorporates much of Russ Ackoff's thinking with lessons learned from an analysis of past business models – especially the famous Alfred Sloan model that led to General Motors unrivaled growth for more than forty years, but then proved invalid for a changing business. It is also tempered by insightful discussions with Peter Drucker regarding his experiences at GM and his unique insight into why we did some of the things we did, as well as what he thinks of our ideas for the future.

The vision I'll share describes an idealized state of a learning organization in which all decisions are driven by systems thinking. I call it "the market-based adaptive enterprise." In the spirit of clarity, for which our honoree is well known, let me explain why these specific words have been chosen:

- Market is where the exchange of goods and services takes place and where relationships are or, are not, formed. It is where ideas meet their ultimate test: will *they* be accepted?

- To say market-*based* as opposed to driven or oriented is to emphasize the fact that the relationship between customer, community and enterprise can be best managed by an open and continual dialogue in which each party learns from the other.

- Adaptive signifies that we accept the fact that our ability to predict the future has been drastically reduced, requiring that we learn how to anticipate change and be prepared to respond to it or, when possible, cause the change to be in our favor.

- Enterprise is chosen over company or corporation because the boundaries that separate the company from its customers, community and competitors are becoming less clear. We must think of all the elements that surround how we do our business as an integrated set of interacting parts – a system which will create greater value than the sum of its parts.

No organization that I know of has yet achieved the vision that we will discuss this evening, but many are moving in that direction, already using some of the tools and approaches that it encompasses Hopefully, this vision will provide a springboard for new questions and ideas over the next two days.

Let me begin with a look at how one non-business enterprise came to re-invent itself several times over the past sixty years. That institution is the U.S. Army. I want to share an analysis that John Smale, former chairman of Procter & Gamble and General Motors, uses to explain why great companies so often lose their leadership and fail to regain it. As a veteran of WW II, as well hundreds of major corporate encounters, Russ should appreciate this comparison.

The year was 1943 and the United States Army had yet to be tested in combat against the Germans. When the confrontation finally came at the Kasserine Pass in western Tunisia, the Americans broke and fled. The commander-in-chief of the Allied Forces, Dwight D. Eisenhower, immediately authorized General George Patton to shake up the American field command. The first commander Patton relieved was the general who had been in charge at the Kasserine Pass. He also happened to be the general who Eisenhower himself had rated as his best commander after Patton.

Given the conditions, Eisenhower had no qualms about demoting his old friend, nor did his boss, General George Marshall, or the man on the spot, Patton. Boldness and swiftness were understood to be the order of the day. The stakes were nothing less than survival.

Less than two years after the debacle at the Kasserine Pass, the American army was respected universally as one of the most powerful and effective military organizations ever amassed.

Another twenty years later, however, that same army was suffering from what the historian Neil Sheehan calls "the disease of victory." The junior officers who had begun their careers under the Marshalls, Eisenhowers and Pattons had become so accustomed to victory and dominance that they felt little need to question the enterprise's view of the world or its doctrine, structure or culture.

The operational model was often referred to as the "three M's" – men, money, and material – and it was assumed that the U.S. Army would never lack any of them. This army could not even contemplate defeat.

Jump forward ten years and that same peerless army was in the throes of unprecedented criticism and doubt from within and without as the world witnessed the evacuation of Saigon. The Army's leaders were shocked and demoralized. The "impossible" had occurred.

Now, jump forward another fifteen years, and that army had in a sense gone full circle. Officers who had started their careers under the commanders of the Fifties and Sixties had seen and learned the lessons of complacency and arrogance firsthand. And they applied those lessons when their turn came at the reins of leadership. The U.S. Army went into Operation Desert Storm a far wiser, more flexible, and more open-minded enterprise than it had been when it entered Vietnam.

The point of this story is that all organizations – even business schools and corporations – go through similar cycles. Success breeds failure unless the organization is willing and able to anticipate and adapt to change – which, as we all know, is much easier said than done. And, it is even more difficult for organizations than individuals. This whole phenomenon was captured quite well by Ian Mitroff in the title of one of his many insightful books, *We're So Big And Powerful Nothing Bad Can Happen To Us.*

Anticipating and adapting to change is the mindset of the market-based adaptive enterprise. The key elements of this mindset are systems thinking and the continuous application – rather than mere gathering and storage – of useful knowledge.

If the mindset is focused on systems thinking and knowledge use, the heart of the market-based enterprise is an open decision support system that pumps a free flow of knowledge – not just data – among employees and across functions in the support of a full range of decision processes.

Its nervous system is a network of market-based decisions that encourage and reward the sharing and application of knowledge. The development, sharing, and application of knowledge in turn becomes the enterprise's core competency – the essence for which it is most admired. This knowledge advantage – not physical resources – is what gives the enterprise a competitive edge in the market place.

Now, if the rest of you did not pick up on it, I know Russ recognized that this description of the ideal enterprise was couched in the language of the organismic systems age and not the language of the mechanistic industrial age.

The key to the successful and continuous development, sharing, and application of such knowledge is a systems approach to the enterprise itself. In this systems approach, the parts by themselves are meaningless – indeed, they cannot provide value – outside their interaction with all the others. In a systems approach old concepts like knowledge management and data warehousing -- based on "inventorying" what is known are replaced by decision support systems that pump a free flow of contextual knowledge and understanding – not just data – into a series of networked dialogues that take place continuously across the functions within the firm, as well as between the enterprise and its extended alliances which includes the ultimate consumers of its products and services.

Management's role in this enterprise has never been better described nor more succinctly articulated than by Russ, "...management should be directed at the interactions of the parts and not the actions of the parts taken separately."

Remarkably, this is not yet the way most managers view themselves, despite all that has been written on the subject. Even those managers who think they have done major reengineering still have not eradicated all vestiges of the traditional "silo thinking," in which the parts are assumed to function separately most of the time.

One "silo" – or group of people – determines what it thinks customers want; another group designs the product; other separate groups handle the engineering, manufacturing, and promotion; and still other groups sell and service the product and determine the terms of trade. Unfortunately, too few of these people talk to each other in a systematic way. And, the fault for this lack of communication has less to do with individual employees than with the silo thinking and structure of most organizations and the way their work processes link – or fail to link – the people together.

My favorite story about the silo problem took place during my senior year as an undergraduate student. One of my professors had developed a business simulation in which teams of students competed in making and selling a product. This particular year, instead of assigning students to teams at random, the professor organized us according to major. This led to strikingly different outcomes.

The marketing majors spent most of their time and money on sales and promotion. They acquired an impressive share of the total market, but at high cost, and were bankrupt before the game ended.

The accounting majors aimed at maximizing profits by minimizing investments in products and promotion. With no new products and only meager promotion of existing ones, the eyeshade brigade lost market share and slipped by degrees into bankruptcy.

The production majors spent all their money on product development and manufacturing processes. They ended up with great products at the right prices, but with no money to tell customers about them, they too went out of business.

To the consternation of all concerned, the personnel majors won. The marketing majors ran out of money, the accountants ran out of products, and the production majors ran out of customers. The personnel types occupied themselves with endless changes to the organization chart. Having spent no money, they simply ran out of time and won the game by default.

Unfortunately, our governmental, educational and commercial enterprises too often act like we did as undergraduates in that class, and direct their attention to the actions of the individual parts, rather than to the interactions of those parts.

And that leads me to my next point -- the ideal market-based adaptive enterprise is best defined not by its structure but by the following characteristics. Characteristics which are formed by management's continuous pursuit of a dynamic balance among the parts as it explores ways to create value for the enterprise, its consumers, and the communities in which it operates:

- First, an unambiguous sense of direction permeates the organization. The mission of the enterprise is known and understood by everyone – it is the universal premise behind all decisions and tasks, and it is focused on finding better ways to gain, develop, and -- most importantly -- keep them.

- Second, strategic and operational plans reinforce each other. There are no downstream disconnects between activities.

- Third, decision-makers understand how their roles contribute to the total enterprise, and their accountability is clear – all the arrows are aligned.

- Fourth, there are no simplistic ideas about how customers or competitors will respond to the actions of the enterprise: planning and execution recognize the full complexity and uncertainty of the market.

- Fifth, there is empowerment throughout the enterprise. Direction and accountability are clear, but there is no micro-management from above.

- Sixth, conflict and differences of opinion are not suppressed. When they surface, they are channeled into a process that seeks a consensus decision. That is complete agreement -- not necessarily in principle, but definitely in action.

- Seventh, the interaction of market knowledge with creative product and marketing ideas results in a steady stream of innovative and customer-satisfying products and services that leverage the capabilities and resources of the enterprise.

- Eighth, existing and retired employees of the extended enterprise are the most effective recruiters of new employees.

- Ninth, other enterprises want to do business with you.

- Tenth, when employees are asked, "If the enterprise was a school, would you pay tuition for your children to attend?" The answer is an enthusiastic "yes."

Again, the heart of this market-based enterprise is an open decision support system that pumps a free flow of knowledge, which is then shared across functions by individual employees who use common business processes. The network of market-based decisions that takes place in this atmosphere of shared knowledge is what gives the enterprise its competitive edge in all the critical actions of the enterprise.

The operating principles of this idealized market-based enterprise are called "the three Ls" – Listen, Learn, and Lead. Many companies, of course, already do this to varying degrees.

In the vision I am describing, the enterprise does all three consistently and simultaneously – and definitely not in any prescribed sequence. It could start off by listening to internal and external voices; learning from these voices as well as from observing and analyzing the impact of its own decisions on the marketplace and on its own organizational competencies; and leading by making decisions that are at the forefront of its industry – decisions that force the competition to respond. This, of course, is sometimes referred to as Ready, Aim, Fire.

But the enterprise could also start by leading, then listening, and then learning – sometimes referred to as Fire, Ready, Aim.

Now a lot of us had fun when Tom Peters used this sequence in his book *In Search of Excellence*. He pointed out that the "Ready! Aim! Fire!" sequence only applies to certain targets and certain weapons. In the case of traditional field artillery, the sequence is actually "Fire! Ready! Aim!" The forward observer calling in the fire first calculates the approximate location of the target and then calls in a marking round. He observes where this round hits and then adjusts the fire. Usually, at least one more round is fired before the target is locked in, and only then does he give the command, "Fire for effect!"

Recognizing the need to make adjustments after initial action is another hallmark of the market-based adaptive enterprise – and it is, of course, at the heart of the three Ls. The market-based adaptive enterprise determines where it wants to be before it acts, and it is always adjusting its route along the journey – as necessary. As Russ also likes to point out, the idea of "knowing what you want to be before you act" runs contrary to the sequential way of thinking. For most of us, the natural impulse is to start crawling and then walk and then fine tune our direction as we get up to running speed. That is why defining a vision is so difficult for many leaders and companies today who are already running at full speed just to stay in the race.

But sometimes you have to think backward, not sequentially, when it comes to problem solving. This is one of Russ' extremely subtle, yet powerful, concepts we have made good use of at GM. Children understand how to do this intuitively – when you give a child a maze, they naturally go from the exit to the entrance. Why? Because it is always easier to solve a problem if you think about it backwards.

Consider this math problem that Russ frequently describes: How many matches must be played in a tennis tournament that has 64 contestants? Well, through brute force you can add 32 matches in the first round, plus 16 in the second, plus 8, then 4, then 2 and finally 1 – to arrive at the correct answer of 63 matches. However, if you could just think about the problem backwards, it becomes a much simpler problem. How many *losers* do you need to establish the winner? This way, the answer is obviously 63. The not-so- simple challenge is to be able to think about the problem backwards.

The way to do this is to put yourself mentally in what Russ calls the idealized design – or put another way, where do you want to be *today*? Then look back to the actual reality. Just as in the child's maze, it is amazing how clear the path becomes. And yet, we are taught in our schools and from the management gurus that you must stand firmly where you are, clearly articulate where you want to be in the future, and then meticulously plan a journey to get there. I'm sure you'll agree from experience that organizations are quite skilled at articulating all of the significant obstacles on that journey. With this perspective, all you see is problems. If you can think about your strategic issues *backwards*, you will see the obvious solutions.

We are not as skilled at thinking backwards as we would like to be when it comes to corporate strategy at GM, but we have had some recent successes in articulating a clear idealized design, then thinking about it backwards. Using this approach, a complex organization quickly found the obvious solution they wanted to implement.

Many management theorists now tout the idea that one of the key functions of leadership is to provide a vision that the organization can accept and follow. Actually, I believe this idea is incomplete, and – if taken too seriously and literally – it is downright dangerous in its implication that one person at the top has the vision to guide the organization to the Promised Land. The Chinese philosopher Lao Tzu said it well more than two millennia ago: "To lead the people, walk behind them."

In that vein, it is interesting to note that Peter Drucker as early as 1949 in his book, *The New Society,* pointed out that subordinates were beginning to show signs of possessing more knowledge than their superiors. [He must have been reading the Detroit Times reports about Russ and his superiors in the Philosophy Department at Wayne University.] Only now are some managers coming to realize the implications of that observation as the knowledge economy has come into being.

The role of leadership in the market-based adaptive enterprise is not to impose a vision or the leader's own "voice," but to draw out the very best of the many visions and voices within the enterprise. This is particularly true in complex, multi-divisional companies. Inevitably, the enterprise has many competing voices. It is from this rich and sometimes discordant diversity of sounds that the truly wise leader must orchestrate a harmonious "voice of the enterprise" which overarches all the competing voices.

This, of course, is also more easily said than done. It requires a fundamental change in how we develop and focus our attention and resources on processes that facilitate the sharing and use of knowledge. We must stop continuously restructuring the organization into new silos, which tend to store knowledge in functional pockets to be used as power that generates heat, and not understanding that generates insight and enlightenment.

If all those who directly or indirectly have been my teachers have taught me anything, it's that we need to take a systemic approach to using, not owning, knowledge as a basis for solving problems. Because as Churchman said, "The value of knowledge is in its use, not its collection."

That value is further enhanced when we can share and develop cross-functional knowledge across the enterprise. Rather than trying to control and "manage" knowledge, we need decision-making processes that acknowledge and make use of both the deep knowledge of individual functions and the broad knowledge that can be generated across functions.

The idea of connecting people in large organizations through networks is gaining momentum. In an August 1998 *Business Week* article, Nellie Andreeva discussed the fact that in a large organization, if you can link the right well-connected people, you can easily create what she calls a "small world" out of a large one.

And in a 1996 *Harvard Business Review* article, James Brian Quinn and his colleagues talked about "spider webs" – self-organizing networks that bring people together to solve a problem and then disband once the job is done.

At GM, we are developing such a network. The critical design concept is that breadth without depth is useless, and depth without breadth is paralyzing. It's of little value to design a system that creates one at the expense of the other. We are learning to tap our most valuable, and sometimes least accessed, resource – the "data base" held in the minds of our experienced and imaginative employees and external associates. We're getting better at creating the smaller individual networks.

The networks within functional activities, such as marketing, engineering and finance are already well established. The newest entries to the network are more specialized – for example, market information, decision support, learning and adaptation, and strategy and knowledge development.

But the most significant challenge still remains -- how to connect the individual networks and activities that exist within the enterprise. One possibility is to connect them directly. The resulting picture, as you can imagine, looks a lot like spaghetti.

Fortunately, we're evolving towards what appears to be a better approach. We call it the Knowledge Network. All the individual activities and local networks connect through the equivalent of a Wide Area Network, with nodes for the elements of the system. Each of the functions and services maintains the in-depth understanding of what it is held accountable for accomplishing.

The fact that it is connected by its node to the network allows those who need a specific portion of that deep knowledge to access what they need for cross-functional analysis. The design provides both the breadth and depth that we identified as crucial to using our knowledge to deliver the greatest value.

The Knowledge Network is not a centralized electronic knowledge depository. Instead, it helps create a networked infrastructure that improves the quality of cross-functional decisions at the enterprise level, without giving up the benefits of strong functional management and information systems. From an organizational standpoint, this should make us stronger. An enterprise is better off as its individual members increase their understanding of what is known about what they do. But when we connect these knowledgeable individuals, a powerful base of shared knowledge systemically enhances the organization's ability to create value over time.

To the extent that someone in finance becomes more knowledgeable, the enterprise as a whole will be more skillful in obtaining capital and hedging its commitments against interest and currency rate changes.

To the extent that individual product designers are more knowledgeable about new developments in materials and technology, the new products that emerge from the development pipeline will better represent the leading edge.

Although the Knowledge Network exists in a very formative stage, the real challenge for us is to effectively use information, rather than just collecting it. We need to develop processes for sharing what we know with the entire enterprise, and using what we know already to make decisions and solve messy problems. In effect, we have to make sure we really are using the knowledge network and not creating spaghetti.

At GM, we employ several processes to accomplish this task. One of these approaches is called Dialogue Decision Process (DDP), which involves a series of structured dialogues between two groups.

The first group in the DDP consists of people who have the authority to allocate resources – people, capital, material, time, and equipment. The second group is a team of cross-functional leaders and specialists directly involved with the issue at hand. They represent such functions as design, engineering, manufacturing, marketing, and so forth. The two groups share their learning through four sequential structured stages of the process: framing the problem; developing alternatives; conducting analysis; and establishing connections. In this final stage, the groups reach a consensus. As Russ puts it, "Consensus is agreement not in principle but in practice." The decision agreed to through the DDP is real and will be implemented because everyone involved, despite their different views, is committed to action.

This vision of the market-based adaptive enterprise does not mean the death of all functional structures as we have known them. The jury is still out as to whether the horizontal organization will prevail. Organization by function did not happen by chance, and it has not persisted over the decades – despite its shortcomings – because of mindless inertia. It persists because each of the functions provides a space in which the core capabilities of the organization can develop and flourish. These functions encourage and nurture the specialized expertise that all enterprises require.

The real challenge for leaders is to retain the benefits of the functional organization while lessening or eliminating its deficiencies – that is, getting the specialized knowledge out of the silos so that it can be shared by all concerned. Silos are much better at designing information systems that serve their own needs than designing systems that circulate information to other areas. If we recognize that information is a valuable asset, then we should not be surprised when people want to possess and control it.

Among the ancient Mayas, the priesthood controlled information about the changing seasons. They alone knew when it was time to plant and to harvest. Controlling this information gave them control over the agrarian society in which they lived. Most corporations, too, have information priesthoods, and their control of vital information gives them status and organizational power. It is not surprising, then, that information handlers often feel threatened when their leaders go looking for ways to free-up the movement of information within the enterprise.

Leadership must drive the information priests from the temple, so to speak. Information professionals have an important and honorable place in the enterprise, but they cannot be allowed to stand between other employees and the accumulated information and knowledge of the organization. There can be no keepers of enterprise information. There can only be stewards. Information stewards act as facilitators and coaches for others in finding and using the right information and in the development of enterprise knowledge. They must walk that delicate balance of being passionate in their

desire to make sure that people not only get what they ask for, but that they also know what is available that they should have asked for -- but did not. That means the stewards must be sufficiently engaged in the decision process to be able to know what is needed, but not to be seen as passionately captured by a single point of view. As such, they should be seen as trusted caretakers of the central nervous system of the market-based adaptive enterprise.

It is interesting that the phrase “knowledge is power,” often attributed to Sir Francis Bacon, is usually used in the sense that by controlling knowledge, one also controls power. Bacon, however, used the concept of power in a very different way. In a statement on the relationship of knowledge of God to God's power, he actually said, "For Knowledge itself is Power." His remark reflected the sixteenth century view that knowledge is the power through which humankind could create a better life here on earth. For Bacon and his contemporaries, knowledge was a resource that made it possible for other good things to happen.

The same could be said in the idealized enterprise I’ve described.

Now that I’ve described my vision, let’s look at this concept of the market-based adaptive enterprise model in the context of real world forces and changes. Or, to paraphrase what Russ said fifty years ago, let’s see if this concept “can bake bread.”

I’ll begin with a look at how General Motors emerged at the beginning of this century from a loose conglomerate headed for bankruptcy into the world’s largest corporation only to find itself again in peril – a history similar to that of the U.S. Army going back to the Kasserine Pass.

General Motors was created through the acquisition of vehicle assemblers and component manufacturers – 25 companies purchased between 1908-1910, 14 more between 1916 and 1920. Peter Drucker refers to it as the first Keiretzu – the Japanese term for a network of suppliers controlled by the same organization. When GM was created, these business units were left largely to operate on their own, making financial targets, accountability, and measurement impossible. In 1920, with the U.S. economy in recession, this near anarchy came home to roost and the company found itself on the verge of bankruptcy. The management team was replaced and the Board of Directors appointed a non-executive Chairman.

Alfred Sloan (whose own company, Hyatt Roller Bearing, had been acquired by GM more to bring Sloan’s leadership skills into the fold than for the value of Hyatt itself) was named GM President in 1923. At the same time, he introduced his new paradigm for automotive design, production, and marketing (“a car for every purse and purpose”), and he brought order to the loose amalgam of business units through a system of policy groups and committees. These were headed by corporate officers, with representatives from all the business units. They served as forums for debate and decision making to ensure individual business unit targets and performance stayed in line with the corporate strategy.

Sloan's organizational model of "decentralized operations and responsibilities with coordinated control" soon became the paradigm for all corporations, as noted in Peter Drucker's landmark book, *The Concept of the Corporation*. It worked so well for General Motors that it went unchanged for more than 60 years – even though the competitive world itself had changed dramatically. GM, like the U.S. Army in the 1960s, suffered from "the disease of victory." The leaders who had begun their careers under Sloan and Kettering had become so accustomed to victory and dominance that they saw little need to question the enterprise's view of the world or its doctrine, structure or culture. Although the signals of difficulty were there to see, they were ignored for a very long time.

For many years, GM had been the fastest, most innovative, and most efficient manufacturer and marketer in the world, but by the early 1990s it had lost ground on all these measures as technology, competition, and consumer needs and desires all kept changing at an ever-accelerating pace. The success of Sloan's model had itself created inertia and resistance to learning within the organization.

Ironically, Alfred Sloan himself recognized that attaining leadership is simpler than maintaining it. He wrote the following in his classic book, *My Years with General Motors*: "The perpetuation of an unusual success or the maintenance of an unusually high standard of leadership in any industry is sometimes more difficult than the attainment of that success or leadership in the first place. This is the greatest challenge to be met by the leader in any industry."

As part of the framework for GM's analysis of its own history and of other companies that have attained industry leadership, lost it, and then rebounded (e.g., Coca-Cola, General Electric, Disney), we developed a matrix for charting the strategic direction of both companies and businesses.

Envision, if you will, the classic 2 X 2 matrix. On the vertical dimension we consider the quality of the firm – on the lower end we have those firms that are doing OK. On the upper end we have those firms that are great. The horizontal dimension deals with the industry of the business that you're in. On the left side is an OK industry, on the far right is a great industry – that is, there is growth, high margins, stable competition.

So with the matrix clearly in mind, you can envision that at its peak, General Motors was in the upper right quadrant (where all companies want to be) – a "great" company in a "great" business. By the early 1990s, however, GM was widely viewed to be in the lower left quadrant (where no company wants to be) – an "okay" company in an "okay" business.

Companies that reach the upper right quadrant and then stay there are those that have managed to adapt to the changes around them, rather than merely trying to improve the company itself without moving it into new business.

We have found that this chart sparks a lot of self-examination whenever we share it with other companies and with business professors and students. I suggest it might be very interesting and insightful to ask where the College of Commerce and Finance would be on this chart today and where you want it to be tomorrow – which in turn can spark a very useful "thinking backward" dialogue around the question of how to make it happen. It might even raise the question if your current name is the right name for what you decide to become. The matrix has certainly helped us think about who and where we are and where we need to go.

The Alfred Sloan business model was predicated on efficient mass production and distribution points as the keys to success. The company's production and marketing paradigm – predictable and constant volume at a fixed network of manufacturing plants and distribution points – assumed that customers would be so attracted to GM's products that they would conform to the way the company itself chose to do business. In an industry typified by predictable competition and huge capital investment, the idea of the company changing its system to conform more to the customer's personal convenience was not given much consideration.

Sloan's General Motors was typical of what has since been called the "make-and-sell" business paradigm. An analogy of how this paradigm works is the railroad. A costly infrastructure is put in place and the customer must get to the closest point in the infrastructure (the train station) and then get off at the point of the infrastructure that is closest to his or her destination. The advantage to the customer in this model is the reduction in cost of getting from fixed point A to fixed point B. The disadvantage is if they want to travel somewhere other than from point A to point B.

At the opposite end of the "make-and-sell" paradigm is the "sense-and-respond" paradigm, where the company is structured and focused according to the customer's needs and desires rather than the requirements of the company's own infrastructure. Speed, agility, and innovation are the hallmarks of this business design. An analogy is the taxi, as opposed to the railroad: the customer calls the taxi company and is picked up at the exact time and location he or she desires and then taken directly to the place where he or she wants to go. The advantage is that you get to leave from where you want and arrive where you want to go. The disadvantage is the increased cost. Consumers make these trade-offs every day.

GM and other large companies are moving from "make-and-sell" toward "sense-and respond." In most businesses, this transition is not a matter of following one model or the other. Rather, it is a matter of incorporating *both* frameworks into the enterprise. The scope of each depends on the business' unique customers and their concerns. Some customers may still be best served under the make-and-sell model, while others will demand the flexibility and customization allowed by the sense-and-respond model, and will be willing to pay more for that added value.

The processes and systems required to support each model are also very different, adding another challenge for the company. For example, a consolidated global purchasing function, with the economies of large volumes and long-term contracts, works well for the make-and-sell organization but could, if it did not adapt, inhibit the flexibility required by the sense-and-respond organization.

Those companies that successfully make the transformation from "okay-to-great" and "make-and-sell" to "sense-and-respond" are above all else learning organizations. Shareholder value is created by out-smarting the competition as you satisfy the customer. Leadership and vision – rather than technology, capital, and fixed assets – are the real discriminators of success. Leaders themselves become students as well as teachers.

The life expectancy of business models continues to diminish as the pace of change in the world economy accelerates. The decision-making process and all that goes into it – including imagination and data – are more crucial than ever. The voice of the customer must be balanced with the voice of the public and the voice of internal stakeholders (i.e., employees, investors, dealers, etc.).

And the voices sometimes conflict. For example, individual automotive customers may not want to pay extra money for emissions equipment, but the same individuals, represented by the "voice of the public," insist that manufacturers install such equipment.

The decision-making process must take all of these voices into consideration. It must also recognize that none of the voices is constant. Issues and concerns are always changing, which makes environmental scanning and the capturing and sharing of learnings critical. Clearly understanding external trends in lifestyle as well as economics and values is also more crucial than ever – and, again, all of these are constantly changing at an accelerating pace, underscoring the fact that knowledge is now the real basis of competition.

In the case of General Motors, strategy development is assigned to those who will implement the strategy rather than to a single "planning" staff. People responsible for executing the strategy are also responsible for capturing, sharing, and managing the knowledge that is the basis for the strategy. We've established General Motors University, which is being used not only to capture and share learnings, but to drive cultural change through the organization, transforming it from an "organization focused on what it knows" to an "organization focused on learning," with leaders functioning as students as well as teachers rather than as "bosses." In the General Motors University framework, strategy development and leadership development go hand in hand.

The bottom line is that General Motors leadership today realizes that success is a journey, not a destination -- a journey of constant learning and change.

Our transformation from a "knowing organization" to an "organization committed to learning" is far from complete, but the results so far have been encouraging. The

challenge now is to maintain that focus as the pace of change and the pressures to balance the different voices of the customer, the public, and internal stakeholders become more complex.

The essence of an organization focused on learning is, of course, its people. But how do you assure that you have the right kind of people to lead all the others in this dynamic model? It is actually a new paradigm of leadership. Traditionally, business leaders have been identified and nurtured based on how they perform in a "make-and-sell" environment. Their individual skills, insight, and vision regarding the business are the most prominent traits that cause them to be identified and nurtured as potential leaders.

In the market-based adaptive enterprise, however, the more intangible qualities of leadership are more important than traditional skills. People skills are what leadership is all about in this model. The role of the leader is to get people to share their knowledge and create the synergy that comes from sharing, with the goal of moving the enterprise forward.

The first step is finding people who are bright and ambitious and also have a level of natural leadership ability. The next step is to assure these people remain sensitive to the importance of relationships among people in the organization. These relationships are what drive – or, if not nurtured and cultivated, actually stifle – the organization's knowledge and power. This includes external relationships as well as relationships among the people in the organization itself – particularly relationships with customers. In the market-based adaptive enterprise, it also includes relationships with the suppliers and distributors of our extended enterprise.

I personally believe you cannot teach people to be leaders, but you can teach them to be better leaders. Leaders in this new environment must be given a broad variety of assignments in which their personal exposure and involvement in new relationships is viewed by management as more important than the actual tasks involved in their assignments.

In 1923, General Motors ran a series of advertisements highlighting the value that GM's unrivaled scope offered the customer. The theme was General Motors as a family of companies, but it was also – whether consciously or not – an early discussion of systems thinking in the industrial age. One of the ads asked the question, "But what does General Motors mean to me [the consumer]?"

The answer began with a description of four individual benefits:

- The purchasing power of a company of GM's size shows up in the price of your vehicle.

- The aggregate experience of GM' divisions was nearly four times greater than that of any other company.

- Because of GMAC, you were able to pay for a GM car out of income – just as you pay for a home.

- And innovation comes out of the largest automotive laboratories.

The advertisement then offered the following "bottom line" answer to its original question: "General Motors, the family, is more than the sum of its members, for it adds a contribution of its own to the contributions made by each individual company. And these united contributions, crystallized in added value, find their way to you."

As GM again strives to become a "quadrant #1 company," we believe the question asked in that ad is still relevant to how we design our business: "But what does General Motors mean to me [the consumer]?"

Although the question is the same, today's answer is at once both profoundly similar and dramatically different from the 1923 answer. It is similar because we can still develop a value proposition of consumer value in which what GM in total (the system) offers its customers is greater than the sum of the products and services of its individual business units.

It is different because of radical changes in consumer requirements and in the technologies and processes that define GM's individual parts and their interaction in the greater GM system.

In today's systemic age, the answer might sound something like this:

General Motors, the enterprise, offers you more than the sum of its parts because:

- By constantly monitoring the needs, behavior and satisfaction of millions of current and potential customers, we can anticipate the broadest range of your requirements and desires.

- Our full range of products and services, combined with our global team of people and technological assets, enables us to translate those requirements and desires into the precise combination of products and services that are most valuable to you and your household today. Additionally, based on these relationships, we will anticipate and develop products and services to meet your future requirements as your household needs change over time.

- Our purchasing power and capability allows us to acquire the right mix of components, at the best possible price. We can then provide the components and services you want – in a manner that allows you to configure them to meet your specific requirements at a price you can afford.

- Our global reach ensures that these services are designed, developed, and delivered to you when, where, and how you want them.

As Alfred Sloan observed in an address to his senior management team in 1926, "There is nothing that impedes progress; there is nothing that stops development; there is nothing that prevents us from going ahead the way we otherwise would than to be governed too much by precedent – that is, not to have an open mind."

That is the spirit behind the vision of the market-based adaptive enterprise. It is the spirit behind Russ Ackoff's career and teachings. And it is also the spirit that is required for Villanova's College of Commerce and Finance to transform itself into a model for others to follow.

ON PASSING THROUGH 80

Russell L. Ackoff

When one reaches 80 one is considered to be ripe and ready for picking. Picking usually consists of the pickers using the pickee as an excuse for a celebration in which the pickers expect the pickee to make a presentation that falls into one of several well-worn prototypes.

First, there is the maudlin, sentimental acknowledgment of all those who have provided support, assistance, and encouragement to the pickee. Such a presentation has virtually no interest to the pickers except for the anxious wait for mention of their names. Once mentioned, they lose interest in what follows. Those who are present but not mentioned, assume a permanent grudge against the pickee. Furthermore, even if I used all the space allotted to me to acknowledge indebtedness, I could only cover a small percentage of those that should be mentioned.

The second prototype is based on the false assumption that wisdom increases with age. The pickee is then expected to share with the pickers the bits of wisdom he or she may have accumulated . Unfortunately, my bag of wisbits is empty. Whatever I may have once possessed I have dissipated in my writings.

The third prototype is also based on a false assumption: that the clarity with which one can foresee the future increases with age. The fact is that whatever we can see clearly about the future we will take steps to prevent from happening. As Kenneth Boulding once said, if we saw tomorrow's newspaper today, tomorrow would never happen. Unfortunately, as you know, I have no interest in forecasting the future, only in creating it by acting appropriately in the present. I am a founding member of the Presentology Society.

The fourth and last prototype is autobiographical. But I have no interest in reconstructing the past as I would like it to have been. I leaned from it precisely because it wasn't what I expected, which also explains why I don't remember it. Furthermore, you cannot learn from my mistakes, only from your own. I want to encourage, not discourage, your making your own.

Now where do these self-indulgent reflections leave me? Not surprisingly, where I want to be: discussing the most important aspect of life: having *fun*. For me there has never been an amount of money that makes it worth doing something that is not fun. So I'm going to recall the principal sources of the fun that I have experienced.

First, the fun derived from denying the obvious and exploring the consequences of doing so. In most cases I have found the obvious to be wrong. The obvious, I discovered is not what needs no proof, but what people do not want to prove. I have been greatly influenced by Ambrose Bierce's definition of self-evident: "Evident to one's self and to nobody else." (1967, p. 289)

Here is a very small sample of the obvious things I have had great fun denying:

- *That improving the performance of the parts of a system taken separately will necessarily improve the performance of the whole.* False. In fact it can destroy an organization, as is apparent in an example I have used *ad nauseum:* installing a Rolls Royce engine in a Hundai can make it inoperable.This explains why benchmarking has almost always failed. Denial of this principle of performance

improvement led to a series of organizational designs intended to facilitate the management of interactions: the circular organization, the internal market economy, and the multidimensional organization.

Another example: that *problems are disciplinary in nature.* Effective research is not disciplinary, interdisciplinary, or multidisciplinary; it is transdisciplinary. Systems thinking is holistic, it attempts to derive understanding of parts from the behavior and properties of wholes rather than derive the behavior and properties of wholes from those of their parts. Disciplines are taken by science to represent different parts of the reality we experience. In effect, science assumes reality is structured and organized the way universities are. This is a double error. First, disciplines do not constitute different parts of reality; they are different aspects of reality, different points of view. Any part of reality can be viewed from any of these aspects. The whole can only be understood by viewing it from all the perspectives simultaneously. Secondly, the separation of our different points of view encourages looking for solutions to problems with the same point of view from which the problem was recognized. Paraphrasing Einstein: we cannot deal with problems as effectively as possible by employing the same point of view as was used in recognizing them. When we know how a system,works, how its parts are connected and interact to produce the behavior and properties of the whole, we can almost always find one or more points of view from which better solutions to the problem can be found than can be found from the point of view from which the problem was recognized. For example, we do not try to cure a headache by brain surgery, but by putting a pill in the stomach. We do this because we understand how the body, a biological system, works. When science divides reality up into disciplinary parts and deals with therm separately, it reveals a lack of understanding of reality as a whole, as a system.

Systems thinking not only erases the boundaries between the points of view that define the sciences and professions, it also erases the boundary between science and the humanities. Science, I believe, consists of the search for similarities among things that are apparently different; the humanities consists of the search for differences among things that are apparently similar. Science and the humanities are the head and tail of reality, viewable separately, but not separable. It is for this reason that I have come to refer to the study of systems as part of the *scianities.*

- A final example: that *the best thing that can be done to a problem is to solve it.* False. The best thing that can be done to a problem is to *dissolve* it, to redesign the entity that has it or its environment so as to eliminate the problem. Such a design incorporates common sense and scientific research, and increases our learning more than trial-and-error or scientific research alone can.

My second source of fun has been the revelation that most large social systems are pursuing objectives other than the ones they proclaim, and that the ones they pursue are wrong. They try to do the wrong thing righter and this makes what they do wronger. It is much better to do the right thing wrong than the wrong thing right because when errors are corrected it makes doing the wrong thing wronger, but the right thing righter.

A few examples.

- *The health care system of the United States is not a health care system; it is a sickness and disability care system.* These are not two aspects of the same thing, but two different things. Since the revenue generated by the current system derives from care of the sick and disabled the worst thing that can happen to it would be universal health coverage Conversion of the current system to a health care system would require a fundamental redesign.
- *The educational system is not dedicated to produce learning by students, but teaching by teachers, and teaching is a major obstruction to learning.* Witness the difference between the ease with which we learned our first language without having it taught to us, and the difficulty with which we did not learn a second language in school. Most of what we use as adults we learned once out of school, not in it, and what we learned in school we forget rapidly — fortunately. Most of it is either wrong or obsolete within a short time. Although we learn little of use by having it taught to us, we can learn a great deal by teaching others. It is always the teacher who learns most in a classroom.Schools are upside down. Students should be teaching, and teachers at all levels should learn no matter how much they resist doing so.

  A student once asked me in what year I had last taught a class on a subject that existed when I was a student. A great question. After some thought I told him 1951. "Boy," he said, "you must be a good learner. What a pity you can't teach as well as you can learn." He had it right.
- *The principal function of most corporations is not to maximize shareholder value, but to maximize the standard of living and quality of work life of those who manage the corporation.* Providing the shareholders with a return on their investments is a requirement, not an objective. As Peter Drucker observed, profit is to a corporation as oxygen is to a human being: necessary for existence, not the reason for it. A corporation that fails to provide an adequate return for their investment to its employees and customers is just as likely to fail as one that does not reward its shareholders adequately.

  The most valuable and least replaceable resource is time. Without the time of employees money can produce nothing. Employees have a much larger investment in most corporations than their shareholders. Corporations should be maximizing stakeholder, not shareholder, value - value to employees, customers, and shareholders.

My third source of fun derives from producing conceptual order where ambiguity and confusion prevail. Some examples:

* *Identifying and defining the hierarchy of mental content: which, in order of increasing value, are: data, information, knowledge, understanding, and wisdom.* However, the educational system and most managers allocate time to their acquisition that is inversely proportional to their importance. Few individuals, and fewer organizations know how to facilitate and accelerate learning - the acquisition of knowledge, let alone understanding and wisdom. It takes a support system to do so.

  All learning ultimately derives from mistakes. When we do something right we already know how to do it; the most we get out of it is confirmation of it.

Mistakes are of two types: commission (doing what should not have been done) and omission (not doing what should have been done). Errors of omission are generally much more serious than errors of commission, but errors of commission are the only ones picked up by most accounting systems. Then since mistakes are a no-no in most corporations, and the only mistakes identified and measured are ones involving doing something that should not have been done, the best strategy for managers is to do as little as possible. No wonder it prevails in American organizations.

* *Identifying and defining the three basic types of traditional management: the reactive or reactionary, the inactive or conservative, and the preactive or liberal.* Then showing that a fourth type, the interactive or radical, denies the assumptions common to the three traditional types, and therefore constitutes a radical transformation of the concept of management. The interactive manager plans backwards from where he wants to be ideally, right now, not forwards to where he wants to be in the future, or past.
  The interactive manager plans backwards because it reduces the number of alternative paths he must consider, and his destination is where he would like to be now. ideally, because if he did not know this, how could he possibly know where he will want to be at some other time?
* *Identifying and defining the ways we can control the future: vertical integration, horizontal integration, cooperation, incentives, and responsiveness.* These are seldom used well. Corporations tend to collect activities that they do not have the competence or even the inclination to run well. They also tend more to adversarial relationships with employees, to encourage competition between parts of the corporation and conflict with competitors. As Peter Drucker pointed out, there is more competition within corporations than between them, and it tends to be less ethical. In many cases managers unintentionally create incentives that result in activities diametrically opposed to their best interests - for example, rewarding themselves for short-term performance, ignoring the long-term or paying commission based on the amount of a sale rather than its profitability. This encourages the sale of underpriced, hence usually unprofitable, items.
  Few organizations are ready, willing, and able to change in response to unanticipated internal or external changes; they lack the responsiveness of a good driver of an automobile who gets to where he wants to go without forecasts of what he will encounter but the ability to cope with whatever occurs.

My fourth source of fun has been *the disclosure of intellectual con men* — for example, propagators of TQM, benchmarking, downsizing, process reengineering, and scenario planning. Management is incurably susceptible to panacea peddlers. They are rooted in the belief that there are simple, if not simple minded, solutions to even the most complex of problems. And they do not learn from bad experiences. Managers fail to diagnose the failures of the fads they adopt; they do not understand them. Most panaceas fail because they are applied antisystemically. They need not be, but to do otherwise requires an understanding of systems and the ability to think systemically. The perceived need to learn something new is inversely proportional to the rank of a manager.

Those at the top feel obliged to pretend to omniscience, and therefore refuse to learn anything new even if the cost of doing so is success.

Finally, my fifth source of fun has derived from *designing organizations that can avoid the kinds of traps I have described here.* For example, the designs of a democratic hierarchy, an internal market economy, a multidimensional organizational structure; and learning and adaptation support systems. But I have derived the most fun working with others on the design of Interact, the Social Systems Sciences Graduate Program at The Wharton School, and the Operations Research Graduate Programs at Case and Penn.

I am indebted to all who have made my "work" a continuous source of fun.

Systems Thinking and Management Epistemology:
Second Thoughts on the Historical Hegemony of Positivism

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Abstract: Epistemology, or the theory of knowledge, is concerned with the nature and scope of knowledge, its presuppositions and basis, and the general reliability of claims to knowledge. Since its birth, Social Systems Sciences (S3) has been critical of positivist epistemology in the discipline of management. The epistemological foundations of management theory have evolved with the development of three paradigms—the idea of social science, the unity of science movement, and the behavioral science revolution. Examining the epistemological foundations of management theory, this paper reflects on the role of positivism as a dominant ideological construct (or a grand-narrative) in management and organizational studies.

Introduction

Since the 1980s, there has been a growing sense of discontent with the dominant theory of knowledge in the discipline of management. It is evident, Joseph McGuire pointed out, that the record of management theory since the mid-1950s does not contain many startling theoretical breakthroughs or successful advances (McGuire, 1982: 31). The same sentiment was expressed by Thomas Cochran, who claimed that although more and more management theory has been clothed in the language of social psychology and mathematics, it has never succeeded in developing a comprehensive theory, nor progressed in fundamental understanding much beyond that put forth at the turn of the 20th century (Cochran, 1977: 486).

In the area of management education and learning, such a growing concern has led to West Churchman's and Ian Mitroff's commentary that other than the dominant positivism research methodology, there has never been any coherent or sound theory of knowledge in most schools of business administration (Mitroff and Churchman, 1992: 134). By the positivist research methodology, one usually refers to such procedures as those associated with inferential statistics, hypothesis testing, mathematical analysis, and experimental and quasi-experimental design (Lee, 1991: 342). The "good old" scientific research in management and organizational studies is characterized by careful sampling,

precise measurement, and sophisticated design and analysis in the test of hypotheses derived from tentative general laws (Behling, 1980: 483).

The search for a universal method which complies with transmuted general laws also rests on the belief that the human world can be studied in the same way as the natural world, thereby producing knowledge which is directly comparable to the natural sciences (Whitley, 1984b: 370). Nevertheless, characterizing management research as the application of scientific method to organizational problems no longer seems as straightforward and unproblematic as it once did (Whitley, 1984a: 775). Indeed, the positivist epistemology which has dominated the discipline of management is also responsible for a peculiar belief that reduces managerial and organizational knowledge to a "bag of tricks" and as an "instrument of technical control" (Gadalla and Cooper, 1978: 351).

But this dominant epistemology, Richard Marsden noted, deference to which is a rite of passage in North America, has established control over the production of knowledge. The simple, if unspoken, truth is that the positivist epistemology has functioned as a hegemonic approach within universities and maintained control over the professional associations devoted to generation of new knowledge (Marsden, 1993: 101). Since the positivist epistemology in the discipline of management has successfully established its paradigm, some organizational researchers propose that, like sociology, the discipline of management should be understood as both "a quasi-science and a quasi-humanities" (Zald, 1991: 165). As "a quasi-science and a quasi-humanities," as Mayer Zald has put it, management needs to combine a positivistic program of theoretical and empirical research with the enriching possibilities of the humanities (Zald, 1993: 516).

Whichever way we answer this suggestion, could orient the discipline of management (and systems thinking) toward a unique understanding of its own epistemology either as a continuation or a rupture with the dominant theory of knowledge. However, some researchers refuse to acknowledge that any attempt at promotion or coexistence with the positivist epistemology is also linked to an old question that refuses to die: to what extent can society be studied in the same way as Nature? Undoubtedly, this question is the primal problem of the philosophy and methodology of the social sciences (Bhaskar, 1978: 1).

Moreover, contrary to common opinion, in an influential account of scientific activity in our time, Thomas Kuhn argued that progress in the history of science has not been cumulative or built on advances, one on the top of another (Kuhn, 1962). The key in Kuhn's account is that of a "paradigm", or a set of assumptions, within which a group of scientists function during times of what he calls "normal science". During such a period, science develops along with the conventional opinion about the cumulative advancement of knowledge until the emergence of a period of "extraordinary science" or "crisis". Since every paradigm tends to define the world in limited ways, sooner or later, problems of a quite different order arise. It is during such a period of crisis that tearing down the established structure of assumptions which may have served well in the past becomes part of the scientific practice (Dando and Bennett, 1981: 95).

In this respect, some management researchers advocate an “epistemological break” with the dominant positivist research methodology and reject its agenda for construction and validation of theories by celebrating theoretical discontinuity in the field (Reed, 1993: 163). Nevertheless, in order to implement an epistemological break in management and organizational studies, we need to examine the epistemological foundations of management research methodology. Since the positivist management epistemology is a by-product of three different philosophical movements, this paper attempts to critically evaluate the contributions of each of these paradigms. An inquiry into the historical hegemony of positivism in management epistemology is not very far from the contributions of social systems sciences and its brand of experimental idealism. Indeed the democratization of philosophy and science, as put forward by Russell L. Ackoff, C. West Churchman (1949), and Thomas A. Cowan (1947), could only be accomplished by debunking positivism.

In a way deconstructing the epistemological foundations of management theory is beneficial to further development of systems thinking. Since various interpretations of systems approach by Ludwig von Bertalanffy and Herbert Simon are generally within the positivist paradigm through their search for "a unified science" (Mattessich 1982; Bello 1985; Zeleny 1979), this paper argues that systems thinking could benefit from debunking the epistemological foundations of positivism.

The Idea of Social Science

In 1784, at the height of the Age of Enlightenment, Immanuel Kant defined the meaning of the word that gave the age its name: “Have courage to use your own reason!—that is the motto of enlightenment” (Kant, 1963: 3). Pursuing the motto of enlightenment, from Edinburgh to Vienna, Philadelphia to Milan, Paris to Berlin, an impressive clan of radical intellectuals called *philosophes* (a French word that did not apply to Frenchmen alone) declared war on any kind of orthodoxy, and especially toward orthodox religion (Gay, 1966: 11). In their hostility to what they were pleased to call “superstition,” the *philosophes* wanted to rationalize the world by disenchanting humankind from metaphysics through the scientific revolution of their age (Gay, 1972: 65).

In so doing, from 1791 to 1794, a bewildering array of educational projects was presented to the revolutionary government of France which led to the creation of *Ecoles centrales*. The three guiding principles of the *Ecoles centrales* were as follows: first, the elimination of error by correlating more closely the meaning of words and the sensations which are their bases; second, the destruction of prejudices and superstition by the revelation of the physical and sensible order of the universe; and third, the creation of a moral and social order based upon a materialistic and utilitarian concept of man and society (Williams, 1953: 314).

The distinguishing feature of the new educational program lay in an epistemological liberalization in order to reconcile the freedom obtained through self-emancipation with the social rationality of science (Kaiser, 1981: 96). Contrary to the mainstream of

seventeenth century thought, which had identified science substantially with physics and mathematics, the philosophes promoted a sense-oriented observation approach for the pursuit of new knowledge (Moravia, 1980: 249). Bringing man/woman back from heaven to earth, they also viewed the living individual as an être sensible, an organic being made up of flesh, nerves, and muscles; possessing dynamic forces and impulses (Moravia, 1978: 58).

Such an epistemological liberalization, enabled the philosophes to pursue their war on superstition by advocating a materialistic, utilitarian, and sense-oriented concept of man. They also succeeded in linking morality and physique, a foundation on which the concept of ideology was given birth. It was Antoine Destutt de Tracy who declared that the pathos of the Enlightenment is retained in the "*Sciences des idées*," for all its incipient naturalism. Since naturalism refers to the claims that the methodology of the natural sciences can be applied to social issues, the philosophes proclaimed that human morality is anchored in nature (Lichtheim, 1965: 168).

Ideology, Destutt de Tracy announced in 1796, was a necessary neologism because metaphysics was too discredited. Ideology, and not religion, was the basis of morality which was only an application of the science of the Age of Enlightenment. In this respect, ideology was to be not only "positive" (meaning exact and scientific) but "useful" as well (Kennedy, 1979: 356). For the *philosophes* the word *idéologie*, as Joseph Schumpeter once noted, meant much the same thing as did the Scottish moral philosophy, or as our own social science, in the widest acceptance of the term which includes psychology (Schumpeter, 1949: 347).

The term "*science sociale*," already well established in France before the end of the 18th century, was also coined and given official sanction during the French Revolution. It was the marquis de Condorcet, the secretary of the *Académie des Sciences*, who pioneered a discussion on the necessity and possibility of bringing to social affairs the methods and techniques of the natural sciences as early as 1792 (Baker, 1964: 213). While John Stuart Mill began to use the term social science by 1833 (Burns, 1959: 431), the term had immigrated and then naturalized in the United States through Thomas Jefferson, largely due to his translation of the work of Destutt de Tracy as early as 1811 (Baker, 1964: 223).

Relying on the power of science, the *philosophes* aimed at conquering the realm of social behavior, to bind the broken elements of society through a single and potent science which would be the necessary vehicle of a rational social order. For that, the idea of social science incorporated two principles. First, as regards man/woman, we are made to accept the view that his/her motives can be described as either "material" or "ideal" and that the incentives on which everyday life is organized necessarily arise from the material incentives. Second, as regards society, a materialistic and utilitarian concept of man/woman propounds that social institutions are determined by the economic system (Polanyi 1947: 110).

To maintain the unity of these principles, two further meanings of the term "rational" are brought in so that the worldview of social science reinforces its own system of

rationality. With regards to "ends," a utilitarian value scale was postulated as rational; and with regards to "means," the testing scale for efficacy was applied by science. The first scale debunks rationality on the basis of the esthetic, the ethical, or the philosophical; the second made rationality the antithesis of magic, myth, or the metaphysical (Polanyi 1977: 15).

At the end of the 18th and to the middle of the 19th century, almost every member of the radical clan of intellectuals expected metaphysics (and consequently religion) to disappear in favor of science. The belief was based on the power of scientific reason due to its uncovering of the natural order. While the philosophes held that religion was associated with superstition, fetishism, unprovable beliefs, and a form of fear which was used as protection against other fears, science results in rationalization. Rationalization, the substitution of a technical order for a natural order, was believed to be capable of imposing organizational structures that could replace the ties of primordial relations, and through which humankind had arisen from its "childhood" (Bell, 1977: 422).

At the same time, such a transition from "childhood" to the "maturity" of humankind was responsible for defining the enlightenment's concept of modernity. Since 476 A. D., when Cassiodorus for the first time made the distinction between the ancients (antiqui) and the moderns (moderni), there existed a dialectical relationship between the masters and the imitators in which to be modern meant to renew and to emulate the culture of antiquitas (ancients) (Schabert, 1979: 125). The idea of modernity promulgated by the philosophes was very different from Cassidorean concept. Reversing the Cassiodorean perspective, the moderns of the Age of Enlightenment labeled the knowledge of the past a by-product of humankind's childhood, due to a revision in the meaning of the word revolution. The older sense of the word revolution since antiquity was cyclical, a continuous sequence of ebb and flow, a kind of circulation and return, or a repetition. During the 18th century, the word revolution came to denote a breach of continuity or a secular change of real magnitude, a radical significant change, which was taken from a scientific term in astronomy and geometry (Cohen, 1976: 258).

In fact, the great *Encyclopédie* of Diderot and d'Alembert contains a notable entry on revolution because the philosophes concept of modernity is closely linked to their reversal of the meaning of the word revolution. During the Age of Enlightenment, the very idea of putting an *Encyclopédie* together, was a by-product of such a reversal in the meaning of modernity and revolution. The importance of the *Encyclopédie* in the 18th century were twofold: in the first place, it was a vehicle for the most advanced ideas of the Age of Enlightenment; and, in a more general sense, was the theory of intellectual progress—the belief that knowledge itself was a liberating force and could promote the happiness of the human race (Cobban, 1969: 275).

The heritage that the philosophes left behind was too large and much too open to radically opposing interpretations by latecomers. No wonder that it was August Comte who popularized the idea of social science through his infamous work on positivism as early as 1822 (Iggers, 1959: 434). His notion of positivism preserved the theme of progress and modernity as advocated by the philosophes, but it was also he who undercut

the radicalism with which the Age of Enlightenment was associated. Making an important distinction between the polity and the philosophy of positivism, he stated that polity had been grounded on the Christian principle of love, while philosophy (and its principle of progress) remained pious to the heritage that the *philosophes* left behind (Comte, 1975: 355).

The essential attributes of the philosophy of positivism were summed up by Comte as the following: first, an orientation to reality and utility through which positivism rejects any speculative endeavors in philosophy; second, an adherence to the 18th century meaning of the term positive which denoted a search for precision and exactness in scientific endeavors; third, an organic tendency along with a relativist outlook in thinking which emphasized the constructivist nature of philosophy accompanied with a rejection of absolutist principles of metaphysics (Giddens, 1978: 240).

For the founding father of sociology, there was no need to apply the philosophy of positivism to business and public administration fields, because Henri Saint-Simon (who was Comte's mentor) had already taken care of that challenge. Although there were no large organizations and no institutionalized management during his life time, Saint-Simon anticipated the development of administrative science and managerial tasks (Drucker, 1977: 15). In a word, Saint-Simon's views on management could be summarized as the call for the rationalization of industry. Rationalization, in its broadest sense, aimed at the elimination of errors in judgment due to the faulty knowledge of market conditions. Instead, rationalization represented the idea of an enlightened administration embracing the entire industry in its relation to the national economy (Mason, 1931: 642).

The rationalization of industry would also create an industrial society, a regime in which technical knowledge should be applied to social affairs in a methodical and systematic way. Hence, within the industrial society, the technicien (technician), or trained expert in the applied sciences, would operate based on the technocratic mode of thinking—that is, the ends become simply efficiency of production, programming, and getting things done (Bell, 1971: 126). In so doing, technocratic mode of thinking represented the evolution of knowledge based on a secular progression. Evolving from the theological to the metaphysical stages, the positive stage represented a passage deep-rooted in the Enlightenment's aversion for the role of metaphysics (and religion) in modern society. Applying the term as a general sociological category, secularization was thus defined as a process of decline in religious activities, beliefs, ways of thinking, and institutions that occurs primarily in connection with the rise of modern scientific rationality.

The Unity of Science Movement

The Enlightenment's struggle against metaphysics was pretty much exhausted by the middle of the 19th century. The rise of well grounded philosophical systems through the works of Hegel, Nietzsche, and Weber, along with exposure to the raw materialism of Feuerbach, Marx, and Engels, once more revived the place of metaphysics within the discourse of the humanities as well as the social sciences. The *philosophes*'s cause

seemed to be lost until the rise of the unity of science movement, as put forth by the members of *Der Wiener Kreis*.

The members of the Vienna Circle saw themselves as the enthusiastic progenitors of a new enlightenment which campaigned for the elimination of metaphysics through the logical foundations of science. In this respect, the word science was used in its broadest sense, including all theoretical knowledge, no matter whether in the field of natural sciences or in the field of the social sciences and the humanities, and no matter whether it is knowledge found by the application of social scientific procedures, or knowledge based on common sense in everyday life (Carnap, 1938: 45).

No wonder that the Circle's rise to prominence, as one of the most interesting phenomenon in European philosophy, granted the unity of science movement a trademark which has not left them since. We shall employ the term logical positivism, remarked their trailblazers in the United States, because it is precisely the union of empiricism with a sound theory of logic which differentiates logical positivism from the older positivism of August Comte (Blumberg and Feigel, 1931: 282).
Coming together as an informal group to discuss philosophy of science in 1907, the founding fathers of the Circle hoped to give an account of science which could extend the work of Ernst Mach in scientific logic and theory of knowledge (Mach, 1914). "The real master and the spiritual ancestor" of the unity of science movement, Mach was particularly influential because of his proposition in favor of the possibility of the unification of science (Frank, 1970: 239). Indeed, the missionary spirit of the Circle was due to such an interpretation of positivism, in which the struggle against metaphysics meant the elimination of all sentences that were not reducible to sentences containing only perception terms as predicates (Passmore, 1943: 66).

In 1922, with the arrival of Moritz Schlick, the informal group had given way to the Vienna Circle which met regularly from 1923 to 1936. The group was dissolved in the late 1930s, yet their worldview began to spread around the world, and particularly in the United States. Since then, in dealing with a genealogy of the Vienna Circle's worldview, a common error is to investigate the work of Ludwig Wittgenstein as the original source for an understanding of logical positivism (Clegg, 1983: 125). Not only did he refuse to meet the members of the Vienna Circle and turned down their invitation to attend the Circle's meetings, but the only time that Moritz Schlick was able to convince him to reconsider, Wittgenstein insisted on reading poetry to the group, especially the poems of Rabindranath Tagore! (Janik and Toulmin, 1973: 215).

In fact, as Rudolf Carnap once acknowledged, Wittgenstein was almost "a religious prophet or a seer" to the members of the Vienna Circle (Carnap, 1963: 25). Rather, "the big locomotive" of logical positivism's train was none other than Otto Neurath! As the author of the Vienna Circle's manifesto (in collaboration with Hans Hahn and Carnap who edited the text), Neurath also invented the Circle's name. The obvious organizational driving force behind the movement, he was certainly the most influential theorist of logical positivism. His stimulating leadership was instrumental in popularizing the Vienna Circle's worldview, it was also he who had a specialized

knowledge of the social sciences and many of his writings were devoted to questions concerning theory and methodology of the social sciences (Hempel, 1969: 164).

The entrance of the Vienna Circle in the world of science was through a manifesto entitled "The Scientific Conception of the World". The manifesto began with an alarming note concerning the revival of metaphysical and theological thought. But, the spirit of enlightenment and anti-metaphysical factual research was growing stronger as well. The challenge, the manifesto added, was in becoming conscious of the spirit of a scientific conception of the world. The goal ahead for the scientific conception of the world was in the rise of a unified science, and the method of this meta-science was logical analysis. For that, the manifesto characterized the scientific worldview essentially by two features. First, it is empiricist and positivist—meaning knowledge exists only from experience and rests on what is immediately given. Second, the scientific worldview is marked by application of a certain method—namely logical analysis (Neurath, 1973a: 309).

To pursue the spirit of anti-metaphysics, Neurath shed more light on the philosophy of the Vienna Circle through his thesis on physicalism. Repeating the call for a unified science of sciences, since all our knowledge is controlled by sense organs, Neurath concluded that unified science is physics in its largest aspect, a tissue of laws expressing space-time linkage or what is called physicalism. Rejecting a dualist conception of science which divides all knowledge into the natural sciences as opposed to the intellectual or moral sciences, physicalism views such separation as untenable which, in the last analysis, can be traced back to an unwillingness of man/woman to give up entirely his/her special position as part of a celestial kingdom (Neurath, 1931: 622).

Hence, the terms "unified science" and "unity of science" were Neurath's solution for pushing the agenda of anti-metaphysics by synthesizing two divergent intellectual currents. First, the empirical work of scientists who are often antagonistic to logical constructions of a priori rationalism bred by philosophico-religious systems. Second, the logical analysis that is linked with the foundations of physics to which neither the French Encyclopedists nor Comte had any access (Neurath, 1938a: 8). The main element of unity of science would be in unification of scientific language through the possibility of reducing all scientific terms to well-known terms of our language of daily life by means of observation-statements, on which we must base all further scientific discussions (Neurath, 1946: 499).

The path to such a unification of scientific language lay in the origins of physicalist jargon. Since words derive their meaning not from the actions or objects that they denote, but from the historical context of discourse in which they are used, Neurath aimed at the construction of a unique "language game" concerning scientific methodology. Specified by rules of intelligibility embedded in the institutional context in which the language is employed, scientific knowledge should be grounded in the stylized vocabularies and protocols of communication that comprise language games. What is originally given to us is our ordinary natural language with a stock of imprecise and unanalyzed terms. There is also the physicalistic language of advanced science which we

can construct that is free from metaphysical elements from the start. The unification of scientific language, thereby, requires one to combine terms of ordinary language with terms of the language of advanced science, since in practice the two overlap.

Consequently, in scientific treatise concerned with the unified science only a "slang" comprising words of both languages will serve. Since no tabula rasa exists, there is no way of taking conclusively established pure protocol sentences as the starting point of the sciences (Neurath, 1959a: 201). Only a synthesis of these two languages would lead the unified science to observation statements, and if formulated carefully, these may be called "protocol statements." Since we are like sailors who must rebuild their ship on the open sea, never able to dismantle it in dry-rock and to reconstruct it there out of the best materials, the unified science requires that we constantly avoid terms that cannot be tested through spatio-temporal observations or behavioristic descriptions (Neurath, 1939: 4-5).

To avoid the hunting-spears of dangerous terms, Neurath suggested an "*Index Verborum Prohibitorum*". The major contribution of such an "index of forbidden words" is in eliminating the emotional, concealing, confusing, and metaphysical terms such as "norm", "transcendental", "categorical imperative", "intuition", and many others which would have to be put on the index unless they were reduced through formal definitions to protocol sentences (Neurath, 1941: 132).
Once the purification of unifying scientific language was accomplished, unified science could pave the path for successful cooperation of scientific specialists in the most diverse fields. Unlike metaphysical terms which divide the social sciences and the natural sciences, logically purified scientific terms can only unite. United by a unified language, the unity of science movement thus forms a kind of worker's republic of letters, no matter how much else may divide them as men/women (Neurath, 1987a: 23).

The combination of a unifying language with an "index of forbidden words" could enable the unity of science movement to make predictions about the behavior of machines, animals, stones, human beings, and society. Not only would the unified language safeguard the scientific method in general, it is also possible to state the extent to which predictions about society can be successfully made. The fruitfulness of such behavioralism was in employing spatio-temporal terms subject to the laws of physics, capable of establishing new correlations, and leading to successful predictions (Neurath, 1959b: 293). As a result, anyone concerned with behavior while employing the language of unified science may be called a "behavioralist." As a researcher employing the unified science methodology, a behavioralist makes predictions just like a physicist. In a behavioralist scientific methodology each statement that does not fit without contradiction into the total structure of laws must disappear; each statement that does not rely on formulations that relate to data is empty and metaphysical. Put simply, within such a methodology, statements are only means to predictions, meanwhile predictions must be tested by what is actually observable (Neurath, 1973b: 326).

In a way, Neuarth was proposing a research procedure in which scientific inquiry begins with a logically grounded theoretical proposition (the so-called major premise), relies on

some facts or initial conditions (the so-called minor premise), then concludes by predictions about what should be observed, and finally the tests or compares to what is actually being observed. In this method of inquiry the central place belongs to the role of logic and not experimentation. Allegedly, the history of the theory of relativity shows that Mach brought down the theory of absolute space by penetrating logical analysis and not by experimentation, and that is how his treatment of the problem of inertia greatly facilitated Einstein's achievements (Neurath, 1987a: 10). However, the challenge was how to collect various statements concerning the logic of science, including all the cross connections between the given disciplines, since a great many special disciplines overlap with one another (Neurath, 1938b: 243). The response was by a new call for encyclopedism, aiming at a synthesis of various scientific activities, such as observation, experimentation, and reasoning, and how together these could help to evolve science (Neurath, 1938a: 2).

That would also introduce a revision within the established institutions of higher education in terms of research inquiry, and particularly in the United States. In the United States' institutions of higher education, Neurath noted, each single department offering graduate work is as a rule destined for a more or less specialized theoretical or practical aim; therefore, if a logician gives a lecture in logic as a member of a department of philosophy he/she has in general a different contact with the students than if he/she were to give lectures in logic as a member of a department of mathematics. Against this type of organization for research, the unity of science movement proposed a return to a medieval tradition dating back to the encyclopedical ideal of the scholastic period. In the old continental tradition of "Philosophische Fakultäten," it is assumed that lessons in logic are given for all students, for historians in the same way as for mathematicians or pure philosophers because every "Fakultät" (not synonymous with the American usage of the term faculty) is an encyclopedist who teaches very different subjects throughout his/her entire career (Neurath, 1938c: 486).

Grounded in logical analysis and supported by physicalism, the universal methodologist (or meta-scientist) should dictate the nature of scientific inquiry in various disciplines, so that the elimination of metaphysics and the purification of language could be accomplished. In economics, for example, such a universal methodology would dictate the course of scientific inquiry in the same way as sociology, psychology, marketing, or management, by relying on the contributions of the unified science—that is, the logico-scientific analysis rather than an historical explanation (Neurath, 1987b: 68).

The rise of such a universal methodology, according to Neurath, was also related to what he called the planning revolution because a new administered society was on the rise. While planning was almost universal, as a war measure or as an anti-slum medicine prescribed by economists, it also manifested a major characteristic of the new patterns in society (Neurath, 1942a: 281). Since planning was gradually introduced during the first World War, as "war economy" taught us, even a rather fragmentary planning was sufficient to overcome unemployment and the international destruction of goods (Neurath, 1942b: 23). From historical examples dating back to the French Revolution, one could learn that a transformation of the traditional "market economy" into a kind of

"administration economy" seemed to be likely and existed with the coming of an administered society (Neurath, 1943: 149).

Obviously, Neurath's assertions generated serious concerns with regard to the implications of the unity of science movement for a democratic society. The movement for the unification of the sciences, Horace Kallen noted, arises in a context of other unification movements. It is one trend among many others covering certain events between 1939 and 1945: the rise of monopolies, cartels, and trusts, the centralization of government along with the emergence of totalitarian regimes, the expansion of religious confederations, and the tendency toward unionization among the arts, all of which are manipulating the climate of opinion in free societies (Kallen, 1946a: 493).
In conjunction with the larger socio-economic and political forces at work, the unity of science movement succeeded in reinvoking an old passion for unity. Yet, the passion for unity, a word which has a spiritual implication in whatever form being used, attaches nobility and reverence to the One, and vulgarity and misprision to the Many. Not only philosophers, but businesspersons, men and women of the church, men and women of the state and scientists have been, and continue to be, zealous against the Many (Kallen, 1940: 81).

For that, Kallen was seriously concerned about the rise of an epistemological tyranny in science, and the possibility of a totalitarian system in society. Moreover, for the program of unification to be successful, it needs to assign or impose invariant meaning to the multiple-intentioned term "science"; it has to select, fix, and insulate against change, by imposing one language as against many others and with the assistance of one exclusive logic pattern for any and all arrangements of its terms (Kallen, 1946a: 494). This unified science (or meta-science) also requires custodians, and these custodians need more than academic coercive power to accomplish their purpose similar to the scholastics of the Middle Ages (Kallen, 1940: 91).

Although Neurath denied these charges (Neurath, 1946: 496), the most consistent and persistent American opponent of the totalitarian mentality in the 1940s, Kallen insisted that at best the unity of science movement could become an apologist for those academic scientists and institutions in need of financial support by the "war industries" (Kallen 1946b: 517). As strange as Kallen's charges may appear, we need to remember that Neurath, with his strong socio-political interests, was particularly insistent that the Vienna Circle should act in the manner of a political party, setting out to destroy traditional metaphysics, which he saw as an instrument of social and political reaction (Passmore, 1967: 52).

The Behavioral Science Revolution

Soon, the views of logical positivists converged closely with the rise of the behavioral science revolution (Giddens, 1978: 278). The advice to scientists (and social scientists in particular) that recommended they put all claims in testable form, by making sure that their concepts be reducible to common sense physicalist terms, made logical positivism the relevant predecessor of the behavioral sciences (Scriven, 1969: 198).

In an interesting way, the connection between logical positivism and the behavioral science revolution also goes back to the unique political developments in the United States and Europe. In post-WWII Germany for example, the rise of a new left intellectual movement such as the Frankfurt School, seriously challenged the logical positivist's epistemological stance in the famous "*Methodenstreit*" debate (Schroyer, 1971-72: 317). Suddenly, the Vienna Circle's worldview seemed to have run "out of gas," especially while the reign of logical positivism was being handed to Sir Karl Popper. In general, the debate centered around the legitimacy of the separation of scientific knowledge and practical choices on both epistemological and social levels, thus questioning logical positivism's attack on metaphysics (Adorno et. al., 1976: xxv).

Moreover, during WWII, the connection between war and national science policy seemed logical. Wars both threaten and unite a nation, creating reasons for large-scale mobilization of talent and resources that tend to outweigh traditional resistance to centralized control of science. Whereas by the end of WWII, the geopolitics of friends and foes had to be redrawn, the Cold War began to dominate the human condition as early as 1947 and was largely in place by 1949. The Cold War had also opened up a hegemonic cultural discourse with an all-embracing influence over policy-makers as well as scientists. The most urgent goal for policy-makers of the Cold War era was to prevent the thermonuclear destruction of the world and to stop communism. An interventionist role for the federal government in scientific research thus was understood as a national security priority.

In 1950 Congress established the National Science Foundation. Since then, the purpose of this independent federal agency has been to develop a national science policy and to support basic scientific research and education. During the late 1940s and the 1950s, it was common to believe that the shift toward massive governmental and military research in America, would not only produce the necessary weapons, but simultaneously generate a flood of peace-time applications far surpassing in quantity what existing industrial laboratories could produce (Beer and Lewis, 1963: 779). No wonder that the same idea was applied to the social sciences as well. In 1946 Senator Fulbright of Arkansas, in a Senate debate on establishing the National Science Foundation, admitted that the misperception about the study of social sciences being confused with what politically some think of as socialism, was not the fault of the bill. Rather, as comments of other Senators during the 79th Congress showed, such a confusion was widespread. Only six years later, in a report written by the chairman of a House committee to investigate foundations, Representative Cox acknowledged that many of our citizens confuse the terms "social," as applied to the discipline of the social sciences, with the term socialism (Miller, 1955: 513).

In this respect, the behavioral science revolution began as an attempt toward the purification of scientific discourse from the remnants of Marxism during the Cold War. Or, as Bernard Berelson has put it, the term "behavioral sciences" came into currency in the United States in the early 1950s (Berelson, 1968: 42). Unlike the idea of social science during the Age of Enlightenment, or the unity of science movement in the 1920s,

the concept of behavioral science was an invention of the U. S. government, packaged for both domestic use and to be exported to the rest of the world, much as the "Forum Series" of "the Voice of America" attempted during the 1950s (Berelson, 1963: v). While the history of science contains instances of intellectual concepts becoming administratively institutionalized, the concept "behavioral sciences" represents the reverse—an administrative arrangement that became intellectually institutionalized (Berelson, 1968: 43).

In this vein, the Ford Foundation initiated a behavioral science program on an institutional scale. Existing by the charter that holds it "to receive and administer funds for scientific, educational and charitable purposes, all for the public welfare", in 1949 the Ford Foundation declared that "the critical problems of our contemporary democratic society make clear the great need for knowledge of the principles which govern human behavior." In so doing, five program areas were specified for action: the establishment of peace, the strengthening of democracy, the strengthening of economy, the advancement of education, and the increase and application of scientific knowledge of individual human behavior and human relations (FFBSD, 1953: 7).

Consequently, the Foundation's program in the behavioral sciences began in 1951 with the belief that a planned acceleration in the accumulation and use of knowledge of human behavior was both needed and possible. In the Foundation's vocabulary, the term "the behavioral sciences" was not equivalent to the usual definition of the social sciences, because the term as it was used did not coincide with the existing organization of academic fields (FFBSD, 1953: 13). Expecting to advance the behavioral sciences through concentration on scholars and institutions of higher education, the Foundation spent an initial lumpsum worth of $3,000.000 in the summer of 1950 and, in February 1953 the Trustees of the Foundation allocated a total of $7,201,300 among the ablest scholars and the most prestigious American institutions of higher education (FFBSD, 1953: 8).

In less than a decade, the Foundation's hope was transformed into reality. In February 1958, an influential memorandum by a group of distinguished citizens, printed in the antecedent of the now infamous The American Behavioral Scientist, called for a clear political linkage between the behavioral science revolution and the United States national security. Highlighting America's global hegemony in the advent of the Cold War, they suggested an assessment of every resource of physical, intellectual, and moral power. Of particular interest was the state of behavioral science and how it can improve international relations by enhancing the nation's intellectual and moral power. We must assume, the memorandum urged, the probability of a breakthrough in the control of the attitudes and beliefs of human beings through exceptionally effective educational techniques. Such accomplishments in behavioral science could be a weapon of great power in communist hands, unless comparable advances in the West produce effective countermeasures (Bauer et. al., 1958: 8).

The call for mobilizing behavioral sciences as an effective weapon, soon inspired the President's Science Advisory Committee to come up with a plan for strengthening

behavioral sciences. The support and use of modern science in the national interest, Jerome B. Wiesner (President's Special Assistant for Science and Technology) noted, was recognized as an important obligation of the federal government. In this respect, the general issues studied by behavioral scientists also were considered to be critically important to the American national welfare and security (Wiesner, 1962: 233). The impact of behavioral sciences on our society, Wiesner pointed, is far greater than most people realize because at a deeper level they are changing the conception of human nature, and fundamental ideas about human desires. Since behavioral scientists use methods common to all sciences (i. e., observation, instrumentation, experiments, statistical data and analysis, construction of models), general education in behavioral sciences should expose all students earlier and more effectively to the possibility of investigating behavioral phenomena by scientific techniques (Wiesner, 1962: 238).

To be considered as a part of the behavioral sciences, a field must satisfy two basic criteria: first, it must deal with human behavior; and second, it must study its subject matter in a scientific manner (Berelson, 1963: 3). At the center of behavioral sciences are the American versions of anthropology (minus archeology), sociology, psychology (minus physiological psychology), economics, political science, geography, psychiatry, linguistics, the behavioral aspects of biology, and various disciplines in business administration (Lorsch, 1979: 171). As for the discipline of management, it came under the control of behavioral science through the literature on organizational behavior, by proposing to investigate organizations as a fruitful place in which to study human behavior (Roethlisberger, 1964: 42).

Perhaps in no other area than management and business education, the behavioral science revolution has made such a profound impact. The ground-breaking report by Robert Gordon and James Howell (also sponsored by the Ford Foundation), dealt with the content of management education and essentially advised mimicking the epistemology of behavioral sciences (Gordon and Howell, 1959). In this respect, fundamental analytical tools came from the behavioral sciences, because the best solutions to any kind of business problem depended upon the effective application of such skills (Bach, 1958: 351). Or, to use the American Assembly of Collegiate Schools of Business's (AACSB) guideline, the foundational theory of knowledge for management education includes the following areas—accounting, behavioral science, economics, mathematics, and statistics (AACSB, 1994: 17).

Against Epistemological Tyranny

This essay attempted to reflect on the historical hegemony of a grand-narrative which has also acted as the dominant ideology within the discipline of management and systems thinking. Examining the positivist epistemology as a by-product of three evolutionary movements, this paper reflected on the birth of the idea of social science during the Age of Enlightenment, the unity of science movement through the contributions of the Vienna Circle, and the behavioral science revolution in the United States at the peak of the Cold War. In this respect, a critique of positivist epistemology as advocated by the social systems sciences (S3) literature has been grounded on unmasking the ideological

foundations of positivist epistemology.

Throughout the short history of positivist epistemology, research has been defined as the formal process of inquiry by an organized quest for principles, theory, or even "laws of nature" (Sprague and Sprague, 1976: 59). With the triumphant rise of the behavioral science revolution such an understanding of research has become entrenched within various business disciplines. Beginning in the 1980s, some management researchers began to question the hegemonic position of the positivist epistemology. There has been a definite shift from political economy toward the behavioral sciences, a critical researcher noted, to the extent that not only the underlying management theory but the dominant research methodology has been dictated by the concerns for random samplings and statistical methods as prescribed by logical positivism (McGuire, 1982: 33).

Indeed, nowadays the dominant positivist theory of knowledge in management and organization theory seems to be losing its pervasive promise. The rigid production techniques, action manuals, number crunching, and statistical random sampling are called into question, while an upsurge of various "soft theories" indicate an epistemological discontinuity is in motion. In fact, such a multiplicity of theories has been considered as the central theme of a postmodern theory of knowledge in the discipline of management (Daudi, 1990: 288). Still, some researchers argue that this state of multiplicity of epistemologies, by definition, is a state that signifies a field that is fragmented and that does not share the consensus characterizing more paradigmatically developed disciplines (Pfeffer, 1993: 608).

Since the early 1980s, in almost every other business discipline, the dominant positivist epistemology and its research methodology has also been seriously challenged. The current crisis of confidence in economic science, Phyllis Deane noted, seems to be related to a new orthodoxy which has ambitions to mimic the methods of natural sciences (Deane, 1983: 2). While during the late 1950s an increasing interest in behavioral disciplines imbued marketers with greater appreciation of the behavioralistic aspects of their discipline, today some marketing specialist lament that behavioralism affects the development of new ideas in marketing because who gets published, what gets published, and where it gets published often depends on this epistemology rather than the marketplace (Morris, 1996: 4). In accounting too, the notion of a positive accounting theory is also shown to be an illusion because research in the discipline, like any other scientific inquiry, cannot be value-free or socially neutral. Debunking the claim for methodological detachment, the critics added, the positivist epistemology has been unduly influenced by one particular viewpoint in economic thought (utility-based, marginalist economics) with the results that the discipline serves to bolster particular interest groups in society (Tinker, Merino, and Neimark, 1982: 167).

By now it is no secret that in every discipline, adherents to the status quo are often guilty of methodological ethnocentrism; that their research methodology is the most developed and most natural approach; that they share a kind of "end of history" assumption that their epistemology is the high point of cumulative wisdom and experience (Tinker and Lowe, 1982: 332). What seems to be new since the birth of the idea of social science,

through the unity of science movement, and now in the aftermath of the behavioral science revolution, is a spreading of an epistemological tyranny by invention of errors, distortion of science, and ruining philosophy; albeit by pioneering simplemindedness (Feyerabend, 1978: 205).

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CHANGELESSNESS, AND OTHER IMPEDIMENTS TO SYSTEMS PERFORMANCE[1]

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INTRODUCTION

In the paper is a concern for the decreasing capability of humans to appreciate that which they have an increasing ability to manipulate. Articulated in a 1970s U of Penn systems sciences dissertation[2], this was ascribed to a seriously limited capacity for context appreciation. This was proposed as a consequence of an historic emphasis on reductionistic ideas and analytical thoughts, not holistic ideals and systemic thinking. This was similar to the notion that humans become adept at achieving short-term results, but not at managing their longer-term consequences.

The systems science platform of the 1970s, especially the planks developed by the Ackoff/Ozbekhan/ Trist group at U of Penn, argued that appreciation of connections was a better route into context-sensitive systems than was traditional analysis of parts[3]. While there was ambiguity as to what this meant it was sufficiently attractive to encourage much fruitful research and several innovative dissertations.

Concern for context and how humans choose to understand or ignore it continues to be an important theme for systems science researchers. It has led to a series of

[1] An important precondition to classical knowing was the appearance of objectivity. The quest for this supported the idea that there need to be a constancy of what was known, i.e., to be scientific you needed to be able to ask the same question again and get the same response. This would be sufficient evidence that a researcher had "stood aside" from the researched situation. By inference, the distance between viewer and object was a quality where the greater the distance the greater the quality. This generated considerable "explicit" information about phenomena, but now the concern has moved to what David Bohm has called the "implicate order," especially of phenomena that are dynamic and nonlinear. He argues how these phenomena must be engaged. Additionally, under conditions of discontinuity and rapid change how helpful is it to repeatedly ask the same question?

[2] "Regulation of Environmental Deterioration," Hawk, D.L., Dissertation, Social Systems Sciences Program, University of Pennsylvania, 1979. The thesis was that environmental deterioration resulted from an inability to appreciate context. This was because social systems have become addicted to use of an analytic frame of partial thought. The most worrisome aspect of the resulting dilemma was that the same analytical model that had created the situation was now being used to resolve it. The situation was doubly damned by then being formalized and institutionalized via a legal system that was designed for stable environments. The recommendation from the work was to move from the "legal order" model, that values stability, to a negotiated order approach, that embraces dynamics.

[3] This notion was introduced in the 60s by Sir Geoffrey Vickers in his work as to why and how appreciative systems differ from rational and analytic constructs. While they can accommodate much more, they also require much more innovative management methods. West Churchman's work on *Design of Inquiring Systems* and the Systems Approach and its Enemies offered similar ideas.

interesting questions. Many agree that context is important, if for no other reason than to give meaning to discrete acts. The first question then becomes, why do most people still ignore context in their work? Why does the segmented route to partial analysis of part processes continue to define the mainstream? Why does it attract the major resources and the basis for most of what we consider to be innovative breakthroughs? And finally, why has systems terminology been so widely applied while the systems approach has itself been so widely avoided?

STRENGTH OF THE ANALYTIC PARADIGM

During the 1970s the systems sciences were gaining strength, applications and noteworthy results. By the mid-1980s, the early attempts to achieve a holistic systems science perspective in many areas has been largely suspended. Work had shifted to more clearly defined problems that could be addressed in what was seen to be a more productive manner via partial analysis of pre-reduced parts. The results were similar to those that had initiated general systems research several decades before.

During the 1990s concern returned to deeper relations between parts, between parts and their environments, and about systems instability. Questions regarding the meaning of analytic conclusions resurfaced. Signs of this were seen in a growing acceptance of Chaos Theory, an increased credibility for ventures like the Santa Fe Institute, and cross-disciplinary endeavors that generated highly innovative technology.

This should have provided credibility for a return to the systems science agenda of the 1970s. It did not. There was recognition that the analytic agenda was clearly insufficient to the needs facing society, but the response was an acceptance of systems' terminology and a rejection of systems perspectives and philosophies. Why? The reasons for this and the research to better understand and respond to it are at the center of current concerns in systems sciences, and in this paper.

The Trist, Ozbekhan and Ackoff depiction of our inhabiting richly connected situations that could better be managed as problematiques or messes seemed to gain ground against the analytic tradition of problems seeking solutions. But, somehow, this was not to be. In management, the ease of learning and teaching case-method approaches carried the day. The situation appeared to be changing, but somehow it was being transformed from a base camp of logical positivism into a Lewis Carroll world of Alice-in-Wonderland. The terminology of the systems approach was used more for its marketing appeal than as a means to access more meaningful research questions. The situation thus became even more "problematic" and "messy" that what was originally envisioned by the Ozbekhan and Ackoff articulations.

The Alice world now had dynamic terms for putting a new spin on static, and pretty boring, models. It could use change as the central concept in an argument for careful monitoring of the continuation of the traditional. It could use general systems terminology to argue for policies and practices that stand in opposition to systems thinking. The result is that systems concepts appeared to be used for temporarily shoring-up the tradition whose weaknesses had initiated the need for the systems approach. The irony is great. The need to find a way out is even greater.

The idea of contextual appreciation was a way to improve the seeing of systemic connections between things. Some things might thus be done better, while other things might simply be left undone. This has since been turned upside down by opponents to the

"systems agenda" via their use of the concepts to built a researchers' Alice-in-Wonderland Garden. Examining and dissecting context had become a means to conserve the traditional instead of modify it. Contextual appreciation was thus a trendy term for new ways to reduce and analyze context. As such it was not used to see the richness of connections that defines context.

Instead of understanding context, analysis dissects it. This allows humans to do things pretty well as they previously did. For example, instead of using context understanding to see the web of relationships between humans and their natural environment, analysis could be used to save parts of that environment from parts of what humans do. The Environment could thus be "protected" from the worst aspects of what humans did and presumably will continue to do. The term environment and the values demonstrated by a 20th Century environmentalist have come to rely heavily on the terminology of the systems approach, but not the framework. The emphasis should instead be on how to avoid approaches that allow old deeds to continue via new labels.

This requires a return to some historical moments where fateful choices were made around profound distinctions. These are profound because they continue to underlie human attitudes about reality and change. This may also explain why the systems approach has had such limited success in its battle with the analytic tradition. To illustrate what this means in some detail a research venture[4] that deals with problems of environmental protection is outlined in the next section. At its basis it encountered the problem of how to get a social system to move from a tradition that abhors change to one that can embrace it, as well as avoid using new terminology to hide the weaknesses in business-as-usual.

The same logic is used in the concluding section to suggest why there are weaknesses in all systems of thought, include the one we know as systems theory. A weakness is outlined there that comes from the reductionistic tradition, is a clear indicator of an anti-change attitude in science, and is endemic to the systems approach. While opposing the reductionistic tendencies of changelessness in science, systems theorists have themselves fallen prey to a trap they consul others to avoid. This concerns an almost blind faith in the dreams allowed by negative entropy. This added to the general societal bias that avoids questioning most traditions, is doubly troublesome. It encourages humans, including systems scientists to believe they can invent perpetual motion machinery and thus over-ride entropic processes. In a research endeavor outlined near the end of the paper it will be pointed out that this belief, and the systems of thought it fosters, was the single greatest obstacle to environmental appreciation and improvement, as it was formulated in some 1970s and again in the 1990s research venture.

CHANGE[5] AS KEY TO CONTEXTUAL APPRECIATION

[4] The venture was established to see if it was possible to change an industry without use of the state's mechanism of legal order to force the change. The philosophy behind this came from systems sciences work in the seventies that demonstrated how if the legal order mechanism was successfully used that the ideal would by definition be lost. Thus a means to induce change was needed that did not rely on exterior force but interior value shift. In some ways this is simply the age-old Faustian Problem; i.e., the long-term expenses of short-term avoidance of the characteristics of change. This was the good news.

[5] The concept of change, its clarification and its management, is critical to society. The concept is only being accepted as "difference-over-time." We need to find a way to expand this to accommodate what we have long accepted as "difference-in-time" with change, or "difference-over-time." Product design in society has

A clear and fateful choice was taken in 5th Century Greece[6] and China. The subject was the phenomena of change as it related to reality. The objective was to find a way for humans to deal with the relationship. The decision profoundly impacted how humans came to perceive, interpret and manage their separate and mutual realities. On one side was a deep faith in the security offered by a utopian state of "changelessness." Therein, reality was defined as that which did not change. Whatever appeared to change could be disregarded. Where change emerged, it could be assigned to an area of no/low importance. Changelessness, in policy and practice, could be a legitimate way of life. Where the forces of change were too great, changelessness could always shift a little bit, and become slightly mobile as a form of "stability." This fixed stability could even be allowed to move a bit more and expand to include the idea of "sustainable."

The alternative route was different in a profound sense. It was for whoever became intrigued by the aesthetics of change. Beliefs about it were held with similarly strong conviction, but as can been see, by far fewer people. Those embracing change defined reality as that which did change. Emphasis was with the beauty of that which was dynamic instead of the protection offered by what was static. The choice was between a changeless state and a state of change. At the most general level the debate dealt with how humans would negotiate with nature. At a more specific level the debate set the stage for how humans would confront themselves and each other.

Parmenides of Elea was the early proponent of reality as a "changelessness state." This was the same theme of Plato when he argued that the ideal that lay behind appearances was as fixed as it was unknowable. Heraclitus of Ephesus argued instead for reality as "a state of change, not a change of state." The two lived during the same era. They offered a clear choice to citizens of pre-500 BC Greece. Both of course presented strong evidence to support their logical framework. The basis of society's eventual choice was probably not on the evidence presented.

This 5th Century BC choice, as it occurred at about the same time, on both sides of the world, provided a fundamental distinction for paths to human development. It also implied very different rules of engagement regarding how humans would relate to other humans, their surroundings, and, ultimately, themselves. The choice taken was clearly on the side of social conservatism via the passion for changelessness. Platonic fixations and Aristotelian structures won. This is perhaps one of the most fundamental problems facing the now-fading 20th century. How the consequences of that choice conflict with contemporary reality may be the key dilemma of our age. If so, this provides a new way

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largely been limited to trading in difference-in-time issues. In fact, difference-over-time governs the success and failure of difference-in-time organization. In this way the contextual can be integrated into the phenomenal. In the past this was impossible. Some of the reasons are outlined in the Watzlawick, et.al. book on: *Change: Principles of Problem Formation and Problem Resolution*, New York: Norton Publishers, 1974.

[6] A basis for the frame of reference: This dichotomy presents one of the most fundamental of early human choices regarding societies and their structures. The choice was between Parmenides of Elea, who advocated that reality was changelessness, and Heraclitus of Ephesus, who argued for the reality in change. In the East the choice was between Confucius, who was essentially on the side of Parmenides, and Laotse, whose beliefs coincided with those of Heraclitus. This became a foundation of the belief systems for the design of human: systems of governance, concepts of law and formation of social institutions, and the built environment. Humans sided with Parmenides. This was perhaps a consequence of their wanting stability in the face of change. It will be argued that humans have paid a heavy price for their early luxury. This is seen in the design of the institutions and artifacts, including urban regions and the values behind the bodies that create and govern them.

to see and understand the difficulties in contemporary cultures, institutions, artifacts and ways of knowing. As such, it provides some clues as to how all of the above might be improved.

In summary, the changeless perspective assumed that whatever changed didn't exist or could be assumed to be unimportant to human affairs. This perspective was especially strong in classical physics until the late 19th century, and even prevailed in some aspects of early 20th century relativity theory. For example, Einstein was primarily responsible for the momentous break with Newtonian physics, but yet he showed a fondness for maintaining a connection to stability by arguing for the cosmological constant. This would allow there to be sufficient matter to keep the universe from infinite expansion. We see similar tendencies in most religions, legal systems, economic assumptions and other areas of social expectation that attempt to bind groups together. The change perspective assumed the existence of a quite different worldview. Phenomena that did not change were dead, or were negligible as compared to the dynamics that governed the human condition. The emergence and acceptance of the change perspective can be seen as a critical part of the development of much of contemporary science, e.g., modern biological science understanding beginning in the 1920s.

Each offered a different vision of reality, and different constructs and concepts for negotiating with it. Important to research outlined herein are the alternative consequences of each view. Each set out to know, make, maintain and negotiate with a very different set of conditions for the improvement of human well being. Each designed, fabricated and supported a very different social and physical environment. Each came to form a different relationship to a different view of nature. The choice made in 500 BC led to a fateful division on the pathway of human development. Changelessness was the apparent choice, leading to design of institutions and artifacts that are intended to deny the more dynamic forms of existence. Significant resources have clearly been invested in processes that resist change. The purpose here is to create a knowledge base for those that want to embrace change as a viable attitude and method to research.

There are three major issues in the choice concerning change that need to be understood, in order to shift the societal bias in what we do and why we do it. They are:

1. Being Seduced by Stability and Related Arguments for Changelessness
2. **Embracing the Systemic and Other Counter-Arguments for Change**
3. Researching the Distance Between Changelessness and Change

1. SEDUCED BY STABILITY AND RELATED ARGUMENTS FOR CHANGELESSNESS

> "Daring it is to investigate the unknown, even more so it is to question the known." [7]

The continuing bias towards achieving a changeless society is easy to see in societal institutions and their history. Governmental structures and the political institutions set up to promulgate them may seem to appear to be innovative and creative. They want to appear "progressive," or somehow associated with change, but where they suggest such luster they either loose it quickly or show signs early on that they did not

[7] Watslawick, et.al, ibid, p. xi.

really mean it in the first place. Recently established bodies, such as those for protecting the human environment from humans, or for recycling products, or for working towards a sustainable life, are recent examples of conservatism masking itself as innovation. These exemplify continuance of an attitude formalized in 500 BC Greece, and China, and that will undoubtedly carry over into the next millennium. Older institutions of modern society, such as its legal system, is approach to governance, and its belief in the role of marriage, may also qualify as instruments of changelessness.

It is now important to reconsider the 5th century decision for artificial stability as it has been used to create a platform. We need to experiment with a new human contract that could be more sensitive to the change processes that unfold regardless of human desires. This would involve fundamental research and experimentation. It would also need an integration of conceptual frameworks similar to that sought by the framers of general systems theory.

This would involve research defined as "a process to search again in order to see clearly for the first time." This would value different parts of the search process and would require a different approach to seemingly intractable problems of contemporary society. It would necessitate an interdisciplinary approach to contemporary problem resolution. It would require a new appreciation and understanding of change dynamics.

Maintaining non-change, even anti-change, characteristics in the face of ever-increasing forces of change has become too expensive for most societies. Even rich societies have found that the cost of traditional boundary maintenance is too great and the advantages too questionable. While still disallowed by the dictates of the current system biases, some very attractive methods are available. A few groups profit from the current discontinuities, but the majority of the world's population ends up with hopelessness to face unrelenting changes that are seen as beyond their means of control and understanding. They have been disabled. They cannot effectively respond to the dynamics in their own environments because the models they occupy stem from a rational scheme that doesn't exist because it continues to pretend existence of a changeless state. The expenses of maintaining the resulting mismatches are great.

It is critical to begin to work towards improvements in our vision, models and measures of the phenomena of the urban environment. This can improve our understanding of how science and technology can best aid in the management of environmental change dynamics. As more of the earth's population is drawn to the places that seem filled with environmental hope while they are managed as base-camps of industrial hopelessness an alternative is needed. Critical to this is new knowledge for realizing new potentiality. Perhaps it is time to start reinventing wheels and raising questions about other truisms.

2. EMBRACING THE SYSTEMIC AND RELATED ARGUMENTS FOR CHANGE

"Plus ca change, plus c'est la même chose." and how to get things to not remain the same, when they change.

As we approach the beginning of the 21st century a new mix of exciting social and technical possibilities are available for improving the qualities of the human condition.

These involve the means for rethinking social institutions (that govern and support social well-being), exciting ideas for rebuilding the made-environments (that provide the stage-set for human potentiality), and new models for redesigning technologies (that can enhance relations between humans, and between humans and their natural environments). Still lacking are models, methods and measures that allow integration and management of these resources.

In the 1950's, leading members from various disciplines argued for a need to integrate the significant scientific and technological resources that were just then seen as beginning to emerge. This was the beginning of what is now known as the "systems science approach."[8] The scientists posed a set of very challenging critics of the limitations of continuation of industrial based models for developing and using science and technology. They pointed to the need for and possibilities in a somewhat sketchy "post-industrial, bio-cybernetic era." The essence of their argument was that there was a clear need for a new set of ideals to drive knowledge creation. Basic to their agenda was an interdisciplinary research approach to achieving integrative and innovative ideals. Their work came from a new set of research ideals and called for a new set of methods. Their aim was to create new knowledge about how future human environments might be improved. The agenda was dismissed during the 1980s but in recent years their bio-physical-social proposals have been actively re-addressed by the work of a few scientists.

Many of the economic, political, scientific and technological elements necessary to experimentation with the systems science approach were lacking when it was first articulated. Some of the missing resources have since been developed. Still lacking is dependable knowledge of the principal processes behind change dynamics; processes that appear to be caught up in the unseen limits of known rational models. We should reconsider the current scientific-philosophical model of research in light of the trouble it is having with dynamic processes. Central to this work is the concept of change, how it is defined, modeled, measured and managed. Change tends to exist just outside the limits of unaided-rationality[9]. We need to carry out research that better serves human needs in their efforts to best realize the consider potentials that have become possible.

3. RESEARCHING CHANGE

> Goethe's greatest contribution to the discovery of the mind was that, more than anyone else, he showed how the mind can be understood only in terms of development. In Kant's conception of the mind…development has no place. He claimed to describe the human mind as it always is, has been, and will be. There is no inkling that it might change in the course of history, not to speak of biological evolution or the course of a person's life."[10]

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[8] This is exemplified by the sub-component of AAAS known as the General Systems Society. Their 1954 agenda began with concern for the growing complexity of societal problems, misallocation of limited resources and the lack of ecological understanding of human activities, and how most of these problems were the result of an overly reductionistic model of science that was bound to the tradition of disciplines. Related to this were the founders of early cybernetic thinking and the Macy Conference that involved some of the same people and concerns.

[9] Unaided rationality refers to the definable limits of any single approach to rationality, and suggests the greater potentials in being able to also accommodate the non-rational in any human situation. In this it is a more general and very different construct than Herbert Simon's "bounded rationality" in economic thinking.

[10] Kaufmann, Walter, *Discovering the Mind*, New York: McGraw-Hill Book Co., 1980, p. 25.

Research is needed to find new ideas and objectives for understanding the human condition. One obvious research location is where human potentiality, and associated problems, is seen in their greatest concentration – *the urban environment and the systems that produce it*. A focus could be to identify the key variables that govern the change dynamics of the urban environment. This problems and promises of this are great. This is problematical because it is the location of the most dense human activities and is very illustrative of the myriad of connections and disconnections that define the current human situation. It is promising for the same reason.

The urban environment most clearly demonstrates the negative aspects of the decision taken 2,500 years ago. The current urban condition is in fact more clearly understood via the contradictions that come out from trying to see cities as fortresses against change while the contents of these forts contain the dynamic phenomena of life. The difference must be reconciled, or paid for the cumulative mismatch. While the earlier choice seems to have been the least expensive in first cost, its consequences appear to hold a very high set of second costs. Even the maintenance costs are becoming very high. Selecting the change paradigm had problems but that route, by its nature would have required a continual reconciliation of life-cycle costs. The nature of the changeless path was to resist change until there was a crisis, thereby insuring the non-linear change process that was initially the greatest worry of those advocating changelessness.

The price that is being paid for continuing with the tradition of changeless continues to grow. There needs to be a better way to negotiate with the continually unfolding reality that we know to exist in spite of our best efforts at control. Costs have always been associated with this process, but, somehow, something is now different. The costs are beginning to rapidly escalate. The costs come from unresolved contradictions that accompanied the choice and growing maintenance problems. They are primarily carried by our context but seem recently to have surfaced internally to the human condition. It is time to examine the other side the twenty-five-hundred-year old choice dichotomy.

RESEARCH INTO CONTEXT APPRECIATION

Human beings have significant problems in being human. The difficulties are manifest in many ways but are clearly be seen in the way in which humans relate to each other and their surroundings. The potentials for improvements in these relations are very great, but so too are the difficulties in finding success. In part this is because of serious shortcomings in how humans conceptualize reality (i.e., as changelessness) and in part due to how material resources essential to human existence are conceptualized (i.e., as infinitely recyclable). Problems with humans relating to their environments begins with their attitudes towards themselves and their environments, especially as those two things relate to change and entropy.

This shows up most clearly in the entropy construct and how we choose to interpret it. Alternative interpretations of entropy are available. Just as with the concept of change, how a nation, group or individual chooses to interpret entropy provides an important clue to how they will manage their relations to their environments. The dominant attitude is that entropy doesn't matter, and where its influence cannot be avoided, the consequences can be recycled. This attitude stems from an interpretation of entropy from the ideas set by James Clerk Maxwell (1831-1879) and Ludwig Boltzmann

(1844-1906). Each, in a different way, felt that entropic processes might somehow be reversed, with the major reversal mechanism being human intellect. This homocentric scenario is similar to that found throughout industrialization.

This prevalent attitude towards entropy allows for belief in reversing it, known as negative entropy. This is overtly optimistic. It tends towards arrogance and is generally ignorant of evidence of change, decay, time, irreversibility and other realities of nature. Systems theorists are guilty of the same bias. They should be the first to experiment with alternative "attitudes" towards entropy, especially those coming from more holistic visions than what was offered by Bolztmann. This would allow appreciation of deeper interpretations of how humans relate to their environments. This would allow serious critic of utopian dreams associated with concepts of "recyclability" and "sustainability," and more recent requests to being sustainable. All these are simply revisitations and continuances of the2,500 year old decision for homocentric control by advocating changeless systems.

An endearing and enduring aspect of the systems approach is that it encourages one to see relations and connections to a larger system of order. It encourages a more holistic stance and innovative, alternative viewpoints. Early on, GST recognized the critical role of attitude in shaping and setting viewpoint. As was pointed out in the first section, attitude helps determine what we see and fail to see. In its favor, the systems' attitude has encouraged many researchers to stretch their thinking. This appears as fundamental and explains the innovative nature of doorways opened by systems thinkers into the arena of scientific discovery and innovation. None-the-less, the systems viewpoint has had its own flirtations with changelessness. An important symptom of this is seen in the early attitude of GST towards entropy where life-forces were felt to exhibit neg-entropy phenomena.

Believing that something is possible, as well as desirable, is a precursor to humans making investments to bring it about. For good as well as bad ends these beliefs can become a magnet for the enthusiasm and other resources needed to work towards accomplish. This generally beneficial process can sometimes be counter-productive, depending on the ideals. The changeless attitude in negative-entropy is one example.

Many researchers believe that the entropic processes can be negotiated with, and, where sufficient intellect is applied, even reversed. This has been a GST attitude since the 1950s, is consistent with the changelessness agenda of 500 BC, and supports the middle-ages religious belief that via information from God humans could create perpetual motion machines. In all three ways the significance of the 2nd Law of Thermodynamics could thereby be ignored and humans could continue to do pretty well whatever they wanted. If we now add the possibility to recycle things, if they can't be reversed, we have escaped all responsibilities.

How the systems perspective views these ideas is critical. Current indications are worrisome. Systems people somehow have developed attitudes similar to the reductionistic groups that they initially criticized. They had some trouble in the late 1960s in responding to the AAAS challenge of Garret Hardin when he criticized the fundamentalistic political-economic belief system of the day that felt Adam Smith's ideas were sacred. In 1968 he asked scientists to reconsider the environmental dilemmas that resulted from the individualistic, results-oriented focus of their individual activities. He

restated the challenge in 1998 where he argued why "Freedom in a commons brings ruin to all." (Hardin, 1998) As was reprinted in a recent issue of *Science*:

> "It is easy to call for interdisciplinary syntheses, but will anyone respond? Scientists know how to train the young in narrowly focused work; but how do you teach people to stitch together established specialties that perhaps should not have been separated in the first place? With Adam Smith's work as a model, I had assumed that the sum of separate ego-serving decisions would be the best possible one for the population as a whole. But presently I discovered that I agreed much more with William Forster Lloyd's conclusions, as given in his Oxford lectures on 1833. Citing what happened to pasturelands left open to many herds of cattle, Lloyd pointed out that, with a resource available to all, the greediest herdsmen would gain - for a while. But mutual ruin was just around the corner." (Ibid, 1998)

The essence of Hardin's recommendation was rethink underlying human assumptions while shifting towards a more interdisciplinary approach to human problems. Supportive of the systems agenda, Hardin felt we should look towards context and see the "underlying nature of things." Hardin's initial problem with the fate of the commons supports the concern with our current use of the entropy concept. This was consistent with the concerns of systems thinkers like A. Rapaport and K. Boulding. For example, Boulding proposed a model of human activities that would dampen the economic enthusiasm for competition and increase the concern for resources entering and exiting socio-economic systems. He argued how inputs could be seen in an alternative, more dynamic, system of value and how externalities of outputs should be factored in. This approach lost to the dream of negative entropy possibilities associated with resource recycled and even creation. The concept of sustainability seems to take us even further down the utopian dream world where under the banner of everything matters nothing in fact does matter.

One of the founding fathers of the General Systems Research Society, Gerard von Bertalanffy, appeared to accept the attitude that life was essentially in opposition to entropy. As mentioned before, others around him were not so convinced but the optimism was to great to be ignored. Boulding was concerned about negative entropy not because resources were infinite or finite, but because of the consequences of resource use. Recycling they only led to them being even more used (Laszlo, 1972). None-the-less the possibility of neg-entropy was widely adopted in the thinking of the Society's membership. Most of the second generation systems thinkers adopted this stance without thinking.

Most interesting science and technology development now takes place outside discrete disciplines via an interdisciplinary approach, but seldom by systems scientists. The prior comments may provide some hints as to why.

The idea, i.e., possibility, of negative entropy is a problem in several ways. These can be seen easily in specific research to deal with specific environmental problems. This author is involved with two such projects at this time. Both began with a criticism of the limits of the forced regulatory structure to get an industry to improve itself. Both required using a model of change dynamics. Both called for an appreciation of the situations of which they were a part, as well as a high level of innovation for redesigning them. The

idea of entropy was found to be a critical indicator of such appreciation. The idea of negative entropy was found to be a maor impediment to success. It provided an escape hatch to insure that the only approach that would get anyone to move would be forced regulation, although, of course, not very far.

THE ENERGY STAR APPROACH TO IMPROVING ENVIRONMENTAL APPRECIATION

In the Spring of 1996 a project was begun for the U.S. EPA. Within the Energy Star Program this work was to see if an industry could be changed without use of regulation to force it to change. I was asked to undertake this venture due to what I had proposed in the reports from the empirical part of my dissertation in systems theory for Russ Ackoff's program in the University of Pennsylvania. The project began with an alternative conceptualization of problems in the relationship between humans and their environments. Individuals and individual companies would be allowed to work towards what was in their own interests, not that of a governmental employee. The trouble came to be how their interests came to be defined, which was a problem once again of context appreciation. The impediment to change was, once again, found to be in interpretations of entropy.

The research question was: "Can an industry generate information and processes to improve the relations between its products and the larger environment, without being directed by regulatory efforts? The industry is the one that builds homes within the U.S. While often ignored, this industry's products directly account for about 30% of the energy consumed within the country, as well as a related proportion of materials, and of course result in a similar proportion of the nation's air and solid wastes pollution. Indirectly, via the location and situation of the products, it accounted for another 20% of the nation's pollution problems. As much of the industry and most of its consumers know, the industry's products are generally of low quality as measured against those of other industries. Its wastes are significantly higher.

It was considered technically feasible to cut energy use and pollution from the industry's products yet early studies pointed out that it was not politically nor economically feasible to use regulation to attain this objective. The industry lobbying group was one of the most powerful in the nation, accounting for almost $100 billion a year in indirect subsidy to the industry. A directive agenda had once been attempted via DOE energy "guidelines." This approach was stopped before it could get started due to political resistance. This brought the EPA to assume that the costs of enforcement would be prohibitive. Thus, an alternative approach had to be tried in order to achieve some of the Rio agreement objectives on Global Climate Change.

My work for the 1970s dissertation in systems sciences on alternative methods for regulating environmental deterioration was seen as attractive. In essence, it argued that a non-regulatory, non-directive approach to self-regulation of pollution externalities was in most cases more efficient, and in some cases the only possibility. The research found there to be no good and bad guys in the area, but a large amount of bad information (ignorance) and many bad feelings (hatreds and mistrust). To turn this around the normal policing function had to be turned into an information function that would not direct behavior but encourage the behaviors of learning and adaptation. The situation of

pollution could then be turned form a legal orders system to a negotiated order solution. This would require a new sense of context appreciation and people who were able to embrace change. This was the basis for the 1996 Energy Star Homes experiment.

The project has been moderately successful except for continuing attitude shortcomings. The objective is to get the industry to improve its quality by 30% more than what was proposed by a set of building regulations, without using the regulations. This means in essence about a 50% overall improvement in the industry. About three hundred producers are now taking part in achieving the much higher standards as required to receive the Energy Star label[11], and several thousand houses have been built, their is a lingering obstacle to even more significant change. It centers on the changeless paradigm and the negative entropy belief in perpetual motion machines as outlined above. It is very difficult to change the dominant attitude is that it doesn't matter what humans do with materials and energy, since people are so smart that they can override whatever difficulties that will arise later. Some of the new technologies in the area are clear representatives of mis-directed efforts to create perpetual motion machines. This includes: geo-thermal heat pumps, solar collectors and PV roofs, as they are now conceived and produced.

Most home producers and especially home consumers deeply feel that there are more than sufficient resources for making and operating infinite homes. Where shortages or problems with quality emerge, the solution lies with "recycling." Via the recycling argument "It just doesn't matter what is done or bought."

> *The biggest block to this non-governmental, no-cost project is to find ways to inform the public as to why what is produced and bought does matter. Only this will get this most conservative of industries to change. Recent discourse on sustainability only furthers the difficulties in achieving change. The Energy Star initiative continues. More work now needs to be done with the customers. Clarifying the entropy issue may be the most effective way to bring a new sense of appreciation into the situation. It can begin with a better understanding of the fundamental nature of the concept and how humans have articulated this nature in different ways for different purposes. The issues of entropy exposed earlier in this paper need to be examined at a deeper level in order to appreciate their fundamental importance to change.*

The Entropy Dilemma and its 19th Century Roots

The speculation of pre-19th century scientists converged in a 19th century articulation of the concepts of time, energy and materials, and how these relate to asymmetries in the environment. Two kinds of asymmetries were noted as important. The first was time itself. The second was with regard to things over time. William Thomson (1824 - 1907) dealt with the first in his elaboration of "the universal tendency of entropy to increase." (Thomson, 1852). Rudolf Clausius (1822-1888) brought meaningful technical articulation to the second asymmetry via his theory of the workings of the internal combustion engine. He in essence argued that the internal combustion engine can only "work" if there is a loss in order, defined as potential to do work, in its larger environment.

[11] The Energy Star label is the same as the one you will find on your computer under the screen saver option. 100% of the world's computer manufacturers are now enrolled in this program, that is voluntary.

From this point the scientific and technological argument turned to whether the entropy issue can be symmetrical or must be asymmetrical? Are natural processes reversible or not? Most areas of science have taken a decision about the debate. While the physical evidence has been on the side of absolute irreversibility there has long been a metaphysical faith that parts of the physical world eventually be found to exhibit a possibility for reversible ordering. Religions have always been steeped in the belief for this potential. Much credit for its emergence in science should be given to the work of Boltzmann. He turned the Second Law of Thermodynamics from its exceptionless nature into one that was statistical. The problem plaguing Boltzmann until his end was that if entropy is reversible, than why was entropy not higher in the past?

The debate continued through the work of Karl Popper (Popper, 1956) into the work of Davies, (Davies, 1974) to that of John Preskill, Kip Thorne and Stephen Hawking in 1998. The last three individuals are noteworthy scientists that illustrated their best thinking in a bet made relative to the validity of the entropy law within the total universe relative to separate behaviors they could study in various corners of the universe. This deals with the general acceptance that the law holds at the universe scale but may not need to in some isolated corners. Their wager had to do with where and when entropy held. More specifically, the discussion centered on what happens to information when it runs into the bottomless pits in the universe called back holes?

> *"Dr. Hawking and Dr. Thorne bet that the information - whether consisting of letters, numbers, the binary digits on a computer disk or even the arrangements of atoms in a rock - is gone forever. Dr. Preskill wagered that it could not possibly be."(New York Times, 1998) The essence of this argument gets to the fundamental differences between relativity and quantum mechanics. It seems that one will need to be modified to explain the entropy at black holes. If this argument sounds familiar it should. Its related to the argument as to whether or not the universe keeps expanding, or as Einstein felt, there was a cosmological constant of mass that would balance it out into the relative calm of changelessness.*

Recent research helps resolve aspects of the entropy debate. It deals with the paradoxes raised in the 19th century and sets the stage for implications in the 21st century. Beginning in 1981, an IBM researcher, Charles Bennett, gave resolution to the dilemma of Maxwell's Demon by showing how a perfectly efficient engine was impossible not just in fact, but also in principle. He showed how even Maxwell's "demon" must expend energy in the process of becoming sustainable via "saving" energy. The "demon" has to forget each transaction prior to the next encounter. Relying on work by Rolf Landauer some years before, that the only steps in computation that necessarily produce waste heat are erasures of information, Bennett could show the perfectly efficient engine to be impossible. One caveat remained in the dilemma posed by Maxwell. Bennett's proof relied on classical physics thus there remained a shadow of doubt relative to entropy's operations in the realm of quantum mechanics, and then of course within statistical thermodynamics. In a 1997 Physical Review article by Seth Lloyd of MIT it is shown that in the wholly quantum world the "demon" is even less efficient than he was in the classical world.

In the fall of 1998 further evidence of the sanctity of entropic process, and thereby change processes, emerged from the CPLEAR collaboration at CERN in Geneva and the KteV collaboration at Fermi National Accelerator Laboratory in Illinois. They found:

> "This shows that you can't turn the clock backward" and always get the same results, says CPLEAR spokesperson Pagagiotis Pavlopoulous." And "These rates differed by about 13%, 'It's a huge effect,' says Fermilab physicist and KteV collaborator Vivian O'Dell. The amount of time asymmetry is just about right to fix the CP asymmetry first observed over 3 decades ago. 'I don't think anyone is surprised but everybody is very happy,' says University of Chicago theorist Jonathan Rosner. Why the decays should look any different forward and backward is still a fundamental mystery. But particles, like falling wine glasses, seem to know that the passage of time cannot be easily undone." [12]

The general issue of the nature of the entropy law is thus now settled in science. Entropy holds firmly at all levels of reality. It is time to carry this understanding to the larger consuming public. The implications are significant. This is a fundamental shift. It will clarify the current questions of what is sustainable about relations between human actions and their environments. In light of the entropic process, can any human activity be considered "sustainability?" Perhaps it is better to say it shouldn't be, so that the concept of change can be better embraced in order to work continuously to infinitely improve what we do. The possibility for human arrogance in the entire sustainability dialogue looms large.

This agenda also calls for reconsideration of fundamental distinctions between open and closed systems in light of what is now known of systems of living order. We could begin this be returning to early distinctions on the subject as made by Ludwig von Bertalanffy.

> "Thermodynamics expressly declares that its laws apply only to closed systems. In particular, the second principle of thermodynamics states that, in a closed system, a certain quantity, called entropy, must increase to a maximum, and eventually the process comes to a stop at a state of equilibrium. The second principles can be formulated in different ways, one being that entropy is a measure of probability, and so a closed system tends to a state of most probably distribution…So the tendency towards maximum entropy or the most probably distribution is the tendency to maximum disorder.
>
> However, we find systems, which by their very nature and definition, are not closed systems. Every living organism is essentially an open system. It maintains itself in a continuous inflow and outflow, a building up and breaking down of components, never being, so long as it is alive, in a state of chemical and thermodynamic equilibrium but maintained in a so-called steady state which is distinct from the latter." (von Bertalanffy, 1968)

The distinction between open and closed systems has proved to be beneficial to a fundamental understanding of relationships between entities and their environments, but it is perhaps unfortunate that the entropy concept was introduced to assist in the ordering of these relationships. It is clear that entities find a means to interact with their

[12] Science Now, http://sciencenow.sciencemag.org/cgi/content/full/1998/1020/1/7:00 PM.

surroundings and in so doing come to define themselves by defining an environment. Angyal formulated this process quite clearly in his early work on systems theory but there is a weakness that lingers in the reasoning that needs to be addressed. The weakness comes from the bias towards believing in entropic processes as reversible, which happened to also support mainstream thinking that supported changelessness over change.

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SYSTEMS THEORY AND FINANCIAL MARKETS: SOME THOUGHTS ON CONSCIOUS MARKETS, INFORMATIONAL QUANTA AND MARKET MEMORY[13]

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On the auspicious occasion of celebrating the 80th birthday of Russell L. Ackoff, who, along with a small group of scholars has challenged conventional economic-financial wisdom, it may also be appropriate to enhance their intellectual momentum by risking the presentation of some other irreverent thoughts.

The topic of this paper being financial markets, we will deal with four related concepts: a) "conscious" or "intelligent" markets as juxtaposed to the economists' benchmark of rational markets; b) "informational quanta" that arrive in the marketplace discontinuously as compared to the benchmark of continuous information flows that are received and disseminated instantaneously; c) "informational accumulation" that may result in "undisseminated information" (Nawrocki, 1995) and move the system out of equilibrium (into bifurcation); this idea of informational pile-ups translates into a condition of market memory in contrast to the benchmark of market-informational clearing and the concomitant state of zero-market memory; and d) "nonequilibrium ordered systems driven by the flux of information and financial innovation as contrasted to the benchmark of equilibrium systems. The non-equilibrium systems addressed here lead to self-organization (Nicolis and Prigogine 1977).

Our purpose here is not to destroy or even attempt to damage the extant edifice in financial economics, but rather to climb the hill of "gnosticism" and, having enjoyed the new vistas, to propose some viable alternatives to the conventional wisdom in the 20th century.

Let us begin now by providing some rationale for the aforementioned concepts:

A. In financial economics, we labor hard to uncover evidence that financial markets are rational and hence informationally efficient. Perhaps we should be concerned more with "conscious" or "intelligent" markets that are components of the broader conscious universe in which we live (Kafatos and Nadeau, 1990). Such markets will accommodate both the analytic behavior entrenched in neoclassical economics and the intuitive performance underlying "evolutionary" as well as "behavioral economics" (See G. Philippatos and M. Guth, 1989). Simon (1979) and his associates did some work in this broad and important area in the 1950-60s by proposing "satisficing" as a human decision rule rather than the conventional "maximizing." Markets that allow for "conscious" or "intelligent" human behavior can accommodate human whims and intuitions as well as the felicific calculus of utility or wealth maximization.

[13] A paper presented at the "Ackoff Systems Conference, Villanova University, Villanova, PA, USA, March 4-6, 1999. Some of the thoughts and conjectures presented in this paper have evolved over several years of collaborative research and have been discussed in several published and conference papers in the USA and Europe. We wish to thank all our colleagues who have helped us clarify the sound ideas and rethink some of the others.

B. In financial economics, we strive hard to convince others and ourselves that market information is continuous, arrives instantaneously and is disseminated in similar fashion. Perhaps we should be more concerned with information that arrives in packets (bundles) or quanta, as the physicists have believed since the turn of this century. The arrival and dissemination of informational quanta will allow for the discontinuities and asymmetries observed in financial markets as normal economic phenomena. Some work in this area—albeit unambitious—has been proposed in the large literature that deals with "event studies" and "event windows."
C. In financial economics we seek evidence that markets are efficient—hence they have little or zero memory (R. Murphy, 1965). Perhaps we should be concerned more with markets that accumulate information in the fashion of sum-over-histories (Feynman, 1965,1995; Gell-Mann, 1994; Hawking, 1988). When the accumulated information reaches a critical level, the market participants act by taking long or short positions. Some work in this area has been done by Cohen, et al. (1980), Nawrocki (1984,1995), Nawrocki and Harding (1985), and by Harding (1999), among others.
D. In financial economics we have adopted the concept of equilibrium systems. Perhaps we should be more concerned with non-equilibrium ordered systems. Since markets are organic living systems, a non-equilibrium approach might be more appropriate. Financial information and innovation lead to complexity in the markets and market complexity leads to self-organizing systems (See S. Kaufman, 1995).

In systems theory, researchers have come to realize that systems in equilibrium are dead. Living systems exist in a state far from equilibrium (Capra, 1996). As the market is an organic living system, it would exist in a state far from equilibrium. As this market adds people and institutions, it increases in complexity. Finally, it transitions into a "complex adaptive system" replete with new, life-like characteristics. The system becomes more complex than the pieces that comprise it. This transition, "self-organized criticality", occurs without design or help from any outside agent. (Mauboussin, 1997). Bak (1996) describes the general concept of self-organized criticality.

Nawrocki (1995) describes a non-equilibrium market where investors:

1. Engage in satisficing behavior by joining cooperative groups like financial institutions (banks, insurance companies, mutual funds, pension funds, etc.) where the resulting portfolio does not maximize the utility of every participant but simply provides a satisfactory result.
2. Invest for different time horizons, thereby moving into different segments of the market. The market itself segments because of technological changes that cause companies to run through product life cycles. Firms in one stage of the product life cycle are segmented from firms in other stages.
3. Change their investment and consumption plans due to changes in the macro-economy's business cycle (Tvede, 1997)

The result of these interactions is a complex adaptive system that operates far from equilibrium.

Summary

The purpose of this paper is to build onto the current edifice in financial economics and to offer future avenues of research in financial markets by using systems theory.

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Pentagon Capitalism and the Killing of the Red Queen: How the US Lost the Coevolutionary Arms Race Between Firms, Markets and Technology

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ABSTRACT

Adapting recent results from evolutionary theory (R. Wallace and R.G. Wallace, 1998) to evolutionary economics, we examine the effects of the massive diversion of US technical and capital resources into the system of Pentagon Capitalism during the Cold War.

The methodology provides a clearer view of how market segments, firms and technology become closely intertwined in a highly punctuated Lamarckian evolutionary process.

Repeated episodes of pucntuated consensation and fragmentation analogous to coevolution and speciation, in conjunction with competitive 'selection' pressures, produce intricate, hierarchically-structured firm-market-technology complexes subject to the Red Queen dilemma of Alice in Wonderland fame, requiring constant development of technology, and the availability of related capital, just to maintain themselves.

Establishment of a draconian military-centered planned economy in the US after WW II, the system of Pentagon Capitalism, absorbed sufficient capital and technology from civilian enterprise to kill the Red Queen. The economic system became fatally sensitized to external perturbations, and catastrophic 'Rust Belt' deindustrialization followed as a 'phase transition.' This has triggered a balance of payments catastrophe and related stresses which compromise national security.

We outline the reindustrialization policies necessary to interrupt a punctuated ratchet of similar and associated events, a staircase to Hell.

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Copies of this paper will
be distributed at
the Conference

A Consideration of Market Dynamics

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Much analysis has been done in finance from the point of view of equilibrium. Equilibrium is an idealization, which appears to be rather limited in its generality (Nawrocki, 1984, 1995). Nawrocki and Harding (1985) considered a portfolio's evolution from the perspective of a type of multi-compartment model where simplification could be obtained by means of time scale analysis with respect to the "compartments" within and external to the portfolio structure. That is, some of these "compartments " could be considered slowly varying thereby allowing a decoupling within the differential equations describing the portfolio system and simplification of the analysis.

The model also considered entropy and information from a standpoint similar to that of Shannon (1948) and connected to the input/output portfolio rate coefficients using a concept from Murphy (1965), which has a structure analogous to Fick's Law as seen in chemical reaction theory. The description was considered incomplete since no account was taken of bifurcation points associated with the portfolio structure.

The following discussion is a consideration of how information pileup would lead to bifurcation and a non-equilibrium dissipative structure in the general sense of Nicolis and Prigogine (1977), Peters (1991,1994), Feigenbaum (1978) and others.

We have considered several models describing certain aspects of the theory of financial markets since their dynamics occur by means of different mechanisms and at different scales.

We note here that mathematical constructs have no scale but scale is important and sometimes crucial in the application of mathematics to a system or process. Most of the problems which have been "solved "in physics have been solved on their own natural scale or level as seen in the classical, quantum mechanical and relativistic modes. Since scale may refer to both time and space, one aspect of this notion involves those properties of the system (or subsystem) that are preserved over time or are slowly varying.

In this critical though not exhaustive analysis:

We wish to concentrate on the use of mathematical constructs to clarify the dynamics of certain market related subsystems rather than these constructs themselves being a constraint on our considerations. Our approach, therefore, is mostly expository since we prefer to differentiate between the system dynamics and the mathematics.
We view the basic problem in financial economic analysis to be the propensity to increase the size of poorly performing models that have become paradigms over a long period of use.

We begin with a consideration of the nature of a paradigm in its problematic sense:

Paradigms (governing models that provide a disciplinary matrix) are abandoned reluctantly because they have been able to structure well much of the data previously "seen". It is a very difficult process to recognize that exception to the paradigmatic "rule" which brings it down because there is no precedent.

Some paradigms start to be saved by means of ad hoc hypotheses, which actually insulate the theory from experience. This may occur in the gestalt sense of completing a pattern that is not there in reality. The theory then acts to transform experience rather than the reverse.

We next consider the character of a paradigm:

A good paradigm has a map-like attribute in that reality is selected and represented by it and passed into a fundamental structure that makes sense of a "critical mass" of data. A paradigm therefore defines the nature of both explanation and intelligibility i.e. One "sees" to some extent what one expects to see vis a vis the paradigm itself. A good paradigm needs to allow for an objective perspective so it can in fact be self-correcting.

The Nawrocki and Harding (1985) paper notes that the stock of undisseminated information in the market is defined by Cohen et al (1980) as:

$$g_t = -(H^* - H_t) \qquad (1)$$

where H* is the maximum entropy and H_t is the actual entropy for the information process.

A dynamic portfolio model is then proposed as shown in Figure 1.

As a first approximation, the change with time of the risky portion, P, of the portfolio is:

$$\partial P/\partial t = K_1 N + K_4 P^* - (K_2 + K_4) P \qquad (2)$$

Several considerations were made including:

$$K_i = k_i \, e^{g_t t} \qquad (3)$$

as given in Murphy (1965) and especially that the risky part, P, can be reasonably considered an open system, decoupled from the riskless portion, P* and the number of

external shares, N, since they can be modeled as slowly varying (a time scale consideration in the manner of Nicolis and Prigogine, 1977).

In their implications for future research, Nawrocki and Harding (1985) noted that some account of bifurcation processes needed to be made and factored into an improved evolutionary model. A more general perspective of that concept is considered here.

Morse (1980) argues that the speed of information dissemination varies with the amount of new information as:

$$\P I / \P t \Leftrightarrow I \quad or \quad \P I / \P t = kI \qquad (4)$$

We argue that the speed of information dissemination within the market is derived from the stock of information available to the market as:

$$\P I / \P t \ <=> I \quad or \quad \P I / \P t = -kI, \quad Exact\ solution\ is: I(t) = I_0 e^{-kt} \qquad (5)$$

We define I_0 as the minimum amount of information to which the market will react. We note that I_0 will vary from market to market. The k value is the dissemination constant. It should be noted here also that this particular k value is just a proportionality constant.

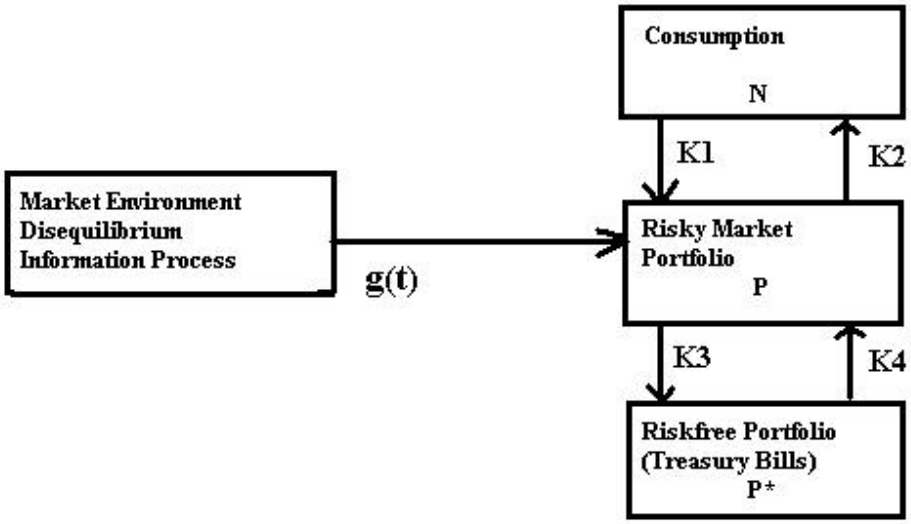


Figure 1 - A Dynamic Portfolio Model

In Figure 1, P is the risky portion of the portfolio, P* is the riskfree portion of the portfolio and N is a very large number that indicates the number of securities in the market. By selling securities to the market (N), a consumption decision is made and by buying securities from the market (N), an investment decision is made. By making N a large number, we are assuming that the portfolio is sufficiently small in relation to the market that it will have no effect on the market's information process.

K_1 is a decision variable denoting the investment in the portfolio by moving securities from the market into the portfolio. (N decreases)

K_2 is a decision variable denoting consumption by moving securities from the portfolio to the market. (N increases)

K_3 is a decision variable denoting a portfolio rebalancing by switching from the risky portion (P) to the riskfree (P*).

K_4 is a decision variable denoting a portfolio rebalancing by switching from the

riskfree portion (P*) to the risky (P).

Based on models developed by Nicolis and Prigogine (1977) a relation appropriate to the risky portion of the portfolio can be proposed as a first approximation. From Nawrocki(1995), the author suggests that information arrives sequentially due to frictions in the marketplace. This may be modeled in the following manner:

$$I = I_0 + 1_1 + I_2 + I_3 + \ ... \ + \ I_n \qquad (6)$$

Where $I_1 = I_0 + I_0 e^{-kt} = I_0 + R_1$

$I_2 = I_0 + (I_0 e^{-kt} + I_0 e^{-2kt}) = I_0 + R_2$

$1_3 = I_0 + (I_0 e^{-kt} + I_0 e^{-2kt} + I_0 e^{-3kt}) = I_0 + R_3$

|

|

|

$$I_0 = I_0 + (I_0 e^{-kt} + I_0 e^{-2kt} + \ldots + I_0 e^{-nkt}) = I_0 + R_n \qquad (7)$$

where:

$$R_n = I_0 e^{-kt} [\sum_{j=0}^{j=n-1} e^{-jkt}] \qquad (8)$$

The term in brackets is a convergent geometric series for the conditions under consideration and therefore:

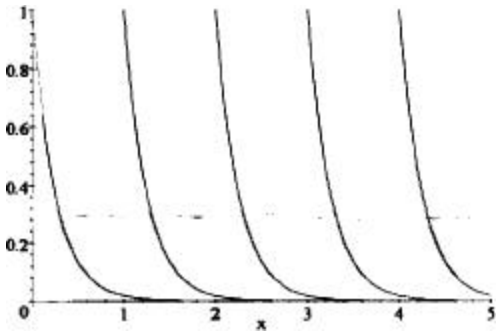
$$R_n = I_0 e^{-kt} [(1 - e^{-nkt})/(1 - e^{-kt})] \text{ and (in the } \lim_{n->\infty}) \longrightarrow R \qquad (9)$$

where:

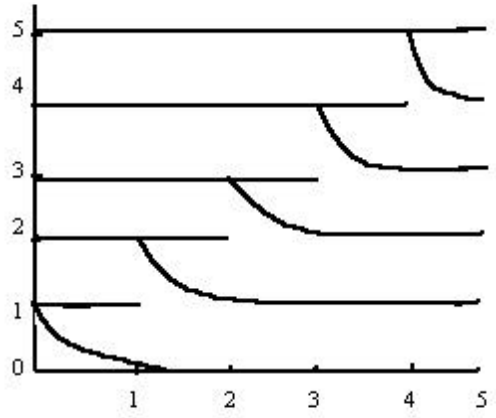
$$R = I_o /(e^{kt} - 1) \qquad (10)$$

The ***R*** values in the above equations are related to $\boldsymbol{I_0}$, the stock of undisseminated (***R***esidual) information and are related to the entropy of the market system from Nawrocki and Harding (1986).

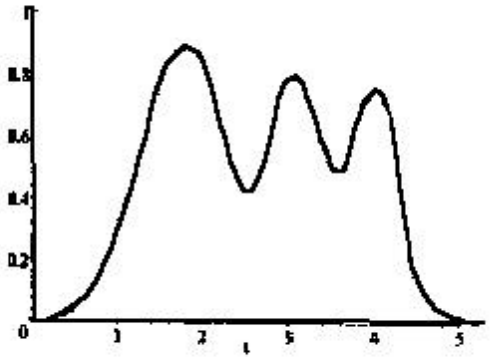
In equations (6) to (10) above, we let $t = T$. We define T to be the arrival period associated with each I_0 that are just large enough that it will cause a market response. We note from the foregoing that for a long arrival period, T (large T), between successive I_0's, we would expect a series of orderly information dissemination size I_0.



However, for smaller and smaller (shorter) arrival periods, $T_n \longrightarrow \infty$ and $R_n \longrightarrow R$. We would then expect an oscillatory buildup of undisseminated information in the market taking the system out of equilibrium (a bifurcation). The stock of undisseminated information would oscillate between $R = I_0 / e^{kT} - 1$ and
$I_0 + R = I_0 e^{kT} / e^{kT} - 1$ (a dissipative structure) decaying back toward equilibrium until the next burst of unassimilated information.



Again, from our phenomenological analysis, we would expect to observe a structure something like a sigmoidal buildup to an oscillating resonance-like state that would tend to decay back toward equilibrium as the information rate decreased. This would look somewhat as depicted in the figure below.



What can we learn from the foregoing in the sense of some additional mathematical notions that may help clarify the analysis? Consider the following:

In their weighted entropy paper, Nawrocki and Harding (1986) analyze a weighted entropy structure from the perspective of information theory. The basic entropy structure has the form

$$S = \Sigma p \ln (1/p) \text{ or}$$

$$S = -\Sigma p \ln (p)$$

The point here is that a logistic structure is under consideration. Suppose we look at a logistic iteration. In the following we observe the behavior of the iterative logistic equation in a variation of parameters analysis. The equation is of the form

$$x_{i+1} = Ax_i (1 - x_i).$$

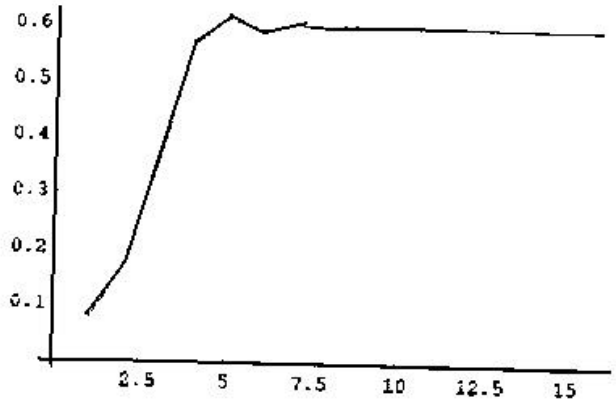
In[4] = x_0 = 0.03

Out [4] = 0.03

In [5] = **t = Table [x_{i+1} = 2.5 x_i (1 - x_i), (i, 0, 15,1)]**

Out [5] = (0.07215, 0.168644, 0.350507, 0.56913, 0.613053, 0.593048, 0.603355, 0.598294, 0.600346, 0.599575, 0.600212, 0.599994, 0.600053, 0.599973, 0.600013, 0.599993)

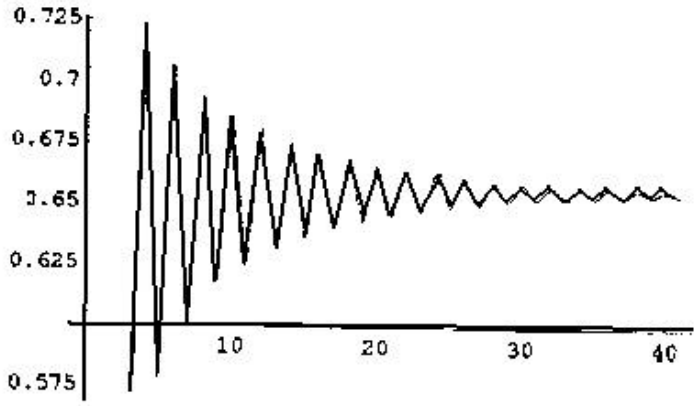
In[6]= ListPlot[t, PlotJoined —> True



In[7]= **t = Tab1e(x_{i+1} = 2.9 x_i (l - x_i), (i, 0, 40, 1)]**

Out[7] = (0.08439, 0.224078, 0.504215, 0.724948, 0.578255, 0.707241, 0.600448, 0.695739, 0.61389, 0.637384, 0.623172, 0.681003, 0.62999, 0.675997, 0.635172, .672013, 0.639194, 0.663813, 0.642357, 0.66623, 0.644866, 0.66414, 0.646868, 0.662446, 0.648472, 0.661072, 0.649762, 0.659957, 0.6508, 0.659052, 0.651637, 0.658318, 0.652312, 0.651723, 0.652853, 0.65724, 0.6533, 0.656848, 0.653656, 0.63653, 0.653945)

In(8):. ListPlot(t, PlotJoined —> True)



Re-examining the second calculation with a different initial value.

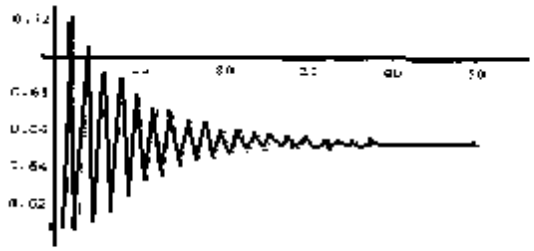
In[9] = $\mathbf{X_0 = .8}$

Out[9] = 0.8

In[10] = $\mathbf{t = Tab1e[x_{i+1} = 2.9\ x_i\ \ (1 - x_i)\ \{ i,\ 0,\ 50,\ 1\}]}$

Out[10] = {0.464, 0.721242, 0.583051, 0.704997, 0.603131, 0.694156, 0.61568,
0.686192, 0.624464, 0.680075, 0.630961, 0.675262, 0.635921, 0.671424,
0.63978, 0.668338, 0.64282, 0.665847, 0.645235, 0.66383, 0.647163, 0.662194,
0.64871, 0.660868, 0.649952, 0.659791, 0.650954, 0.658918, 0.651761,
0.658209, 0.652413, 0.657634, 0.652939, 0.657168, 0.653365, 0.65679,
0.653709, 0.656483, 0.653988, 0.656234, 0.654213, 0.656033, 0.654396,
0.65587, 0.654544, 0.655737, 0.654663, 0.65563, 0.65476, 0.655543, 0.654638}

In[11] = **Listplot [t, PlotJoined —> True]**



The equation hones in on a single value again.

With a different value for the proportionality constant, we find

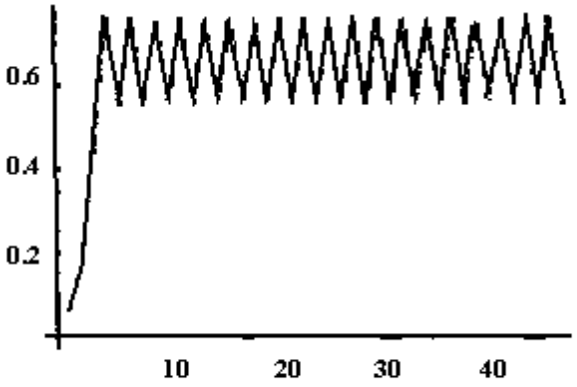
In[12]= x_0 = **.02**

Qut[12] = **0.02**

In[13] **= t =Table [x_{i+1} = 3.1 x_i (l - x_i), {i, 0, 40 }]**

Out[13] = (0.06076, 0.176911, 0.451403, 0.767679, 0.552879, *0.7332*, 0.555109, 0.765585, 0.55634, 0.76516, 0.557039, 0.76493 4, 0.557443, 0.764771, 0.557679, 0.764687, 0.557812, 0.764637, 0.557898, 0.764608, 0.557946, 0.764591, 0.557974, 0.764581, 0.55799, 0.764575, 0.558, 0.764572, 0.558006, 0.76457, 0.558009, 0.764568, 0.558011, 0.764568, 0.558012, 0.764567, 0.558013, 0.764567,. 0.558014, 0.764567, 0.558014)

In[14]: **ListPlot(t, PlotJoined —> True]**



Here we see an "erratic sigmoid" behavior reminiscent of the information pileup that was first considered.

Modifying the initial value, we observe similar behavior.

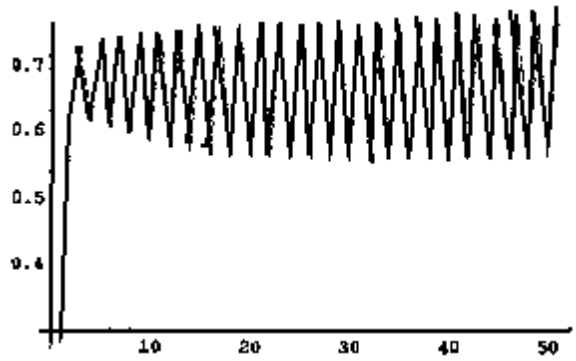
In[15] = x_0 = **.9**

Out[15]=0.9

In[18] = **t = Table [x_{i+1} = 3.1 x_i (1 - x_i) , { i, 0, 50, 1}]**

Out[18]= {0.279, 0.623593, 0.727647, 0.614348, 0.734466, 0.60453, 0.741095, .594806, 0.747136, 0.555663, 0.752252, 0.577744, 0.756263, 0.571421, 0.759187, 0.366749, 0.761189,0.56352, 0.762492,0.561403, 0.76331, 0.560067, 0.763815, 0.559245, 0.764119, 0.558748, 0.764301, 0.558449, 0.784409, 0.558272, 0.764474, 0.558166, 0.764512, 0.558104, 0.764534, 0.558067, 0.764547, 0.558045, 0.764555, 0.558033, 0.76456, 0.558025, 0.764563, 0.558021, 0.764564, 0.558018, 0.764565, 0.558016, 0.764566, 0.558015, 0.764569

In[19]= **ListPlot(t, PlotJoined -> True)**



Investigating additional proportionality values, we find

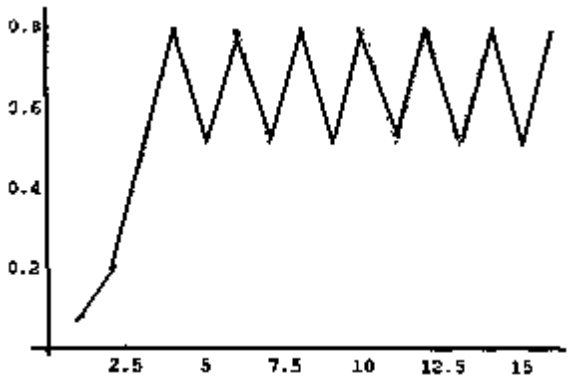
In[41] **= x_0 = .02**

out [41] = 0.02

In[42] **= t = Table [$x_{i+1} = 3.2\ x_i\ (1 - x_i)$, (i, 0, 15, 1)]**

0ut[42] = {0.06272, 0.188116, 0.48873, 0.799594, 0.51278, 0.799477, 0.513003, 0.799459, 0.513038, 0.799458, 0.513043, 0.799456, 0.513044, 0.799456, 0.513044, 0.799455}

In[43]: = **LinePlot [t, PlotJoined -> True]**



Again, the 'erratic sigmoid" structure . Since the sigmoid exhibits this periodic structure, it has a lower entropy, i.e. more order.

Finally considering one last proportionality value, we observe

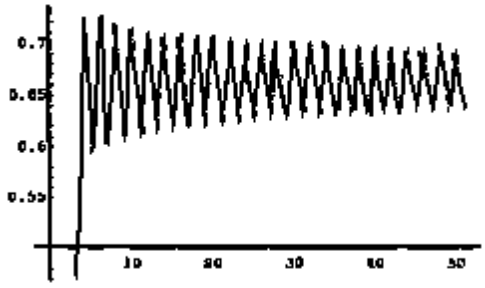
1n[44] = x_0 **= .02**

Out [44] = 0.02

In[45] = **t = Table [x_{i+1} = 3.0 x_i (1 - x_i), { i, 0, 50, 1}]**

Qut[45] = 0.0588, 0.166028, 0.415387, 0<728522, 0.593333, 0.723867, 0.599651, 0.720209, 0.604524, 0.717224, 0.608441, 0.714722, 0.611684, 0.71258, 0.614429, 0.710718, 0.616794, 0.709078, 0.618859, 0.707617, 0.620685, 0.706305, 0.622314, 0.705118, 0.62378, 0.704035, 0.625109, 0.703043, 0.62632, 0.70213, 1.627431, 0.701284, 0.628454, 0.700499, 0.629401, 0.699766, 0.63028, 0.699081, 0.6311, 0.698438, 0.631867, 0.697833, 0. 632536, 0.697263, 0.633262, 0.696724, 0.633899, 0.696213, 0.634501, 0.695728, 0.635072}

In[46] = **ListPlot (t, PlotJoined —> True)**



Summary and Conclusions

We've attempted to realize some of the aspects of market dynamics from the standpoint of information considerations. In particular, the information buildup or pileup concept can be seen from our first analysis to result in a jump from equilibrium (the smooth dissemination of information) to a resonance-like state. Upon an analysis of a logistic iteration model, it seems not unreasonable to conclude that a variation of parameters shows a transition through a bifurcation point somewhere around the value 3 which leads to the "erratic sigmoid' structure cited in the first analysis. That is, the underlying structure may be seen as the information buildup process. This bifurcation- oscillation characteristic may be a major reason why the adoption of certain goods, services, or practices are difficult to analyze.

One of the aspects not touched upon involves the fact that the modern market is rooted in an industrial based society. With the emergence of an information, technology and service based society, we believe that these market nonequilibrium processes will come into play to a far greater extent reshaping the constraints under which individuals and firms will need to act and react. That this is so will be partly due to the reality of the nonequilibrium structure which has existed since the time when a fairly large number of individuals and firms became interested and involved with the market. Thus the situation may become highly exacerbated due to facts such as electronic trading and the vast differences between say the time horizons of day traders and those of investors i.e. information pileup has some subjectivity associated with it.

All in all, however, the market dynamics involved should prove to be a very interesting and very multidisciplinary subject indeed.

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Coherent Market Theory and Nonlinear Capital Asset Pricing Model

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"Practitioners use capital market theory each time they put together a financial plan, a retirement plan or an investment plan for a client. The major academic theory of the past 30 years is Capital Asset Pricing Model or CAPM. Professor William Sharpe(1964) won a portion of the Nobel Prize in Economics in 1990 for his work developing the CAPM."

"The classic CAPM theory is too simplistic. Modern theories of capital market behavior study the financial markets as complex dynamic processes. The theories themselves are more complex. However, they provide an improved understanding of how the financial markets operate. This understanding of the financial markets is crucial to the investment decision making process and therefore, to practitioners."

-David Nawrocki (1996)
Capital Market Theory: Is It Relevant To Practitioners?

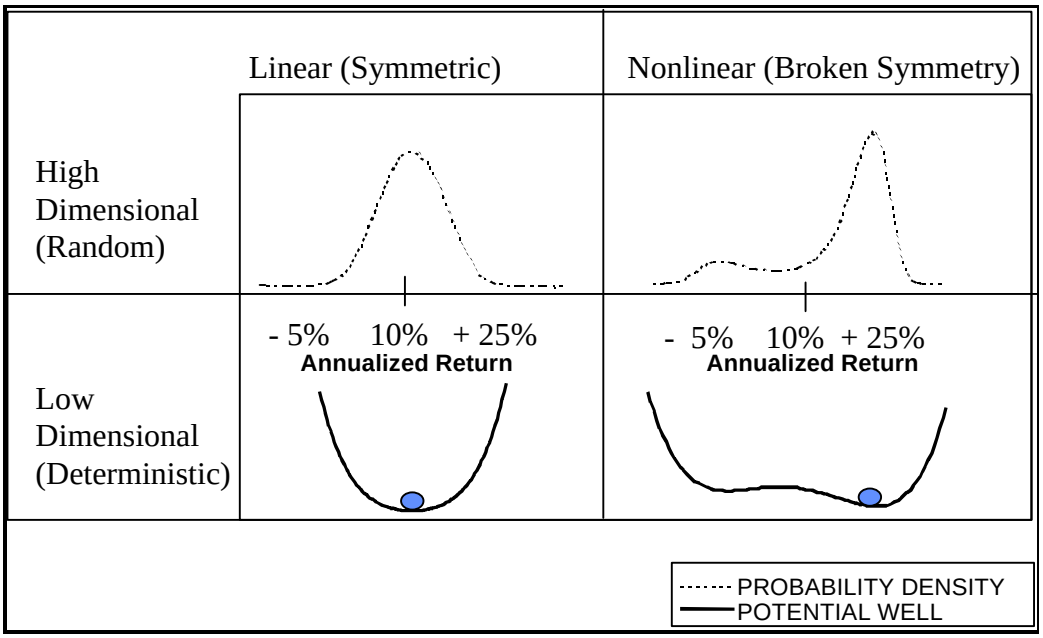
Introduction.

The Capital Asset Pricing Model or CAPM (Sharpe, 1964) suggests that in equilibrium there will be a simple linear increase in rewards compensating greater investment risk. Buying and holding stocks over the long run has indeed been a profitable strategy for investors. However one's resolve can be severely tested by extended bear markets such as occurred in 1973 and 1974, as well as the anomalous volatility during unstable periods such as October, 1987. Such periods can put unwary practitioners out of business. So while the CAPM may provide a long term perspective, practitioners can benefit from a better model of the dynamics of bull and bear markets on shorter time scales. Market equilibrium and returns can deviate widely around the long term CAPM forecasts and new theories seek to further refine our understanding of the market's dynamics.

Persistent biased random walks in the financial markets have been described by Peters (1991, 1994). Peters has popularized the rescaled range analysis as a diagnostic test of deviations from true random walk in the capital markets. He has shown that the range over which some markets trade will deviate from the predictions of a pure random walk process, indicating persistent, biased random walks. This suggests that there is more to market dynamics than just the element of chance. While Peters' does not offer new trading strategies for practitioners, his results are an important indication that the linear random walk model does not totally describe market dynamics.

"The Coherent Market Hypothesis" (Vaga, 1990) introduced a non-linear state transition model of market returns. Figure 1 summarizes the general classes of models that might be considered to predict market returns. In the best of all possible worlds (with neither random forces nor nonlinear effects) a low-dimensional harmonic oscillator model would be capable of predicting returns far into the future. Unfortunately the capital markets do not behave as a ball in a simple potential well, and instead have been described as a random walk process. The random walk model suggests that only the long term trend (historically 10% annual rate of return for the market index) is predictable and that all other fluctuations are simply due to the element of chance. It follows from the Efficient Market Hypothesis (EMH) that standard technical and fundamental analysis do not add value.

Figure 1. Nonlinear state transition models predict symmetry breaking and biased random walks in the capital markets.



Low dimensional, deterministic nonlinear models can produce disorder at an exponential rate, yet offer the hope of short term prediction. Nonlinear effects can be illustrated using the potential well with two low points, each far from the center of the well. In this situation the ball is forced away from the center and breaks symmetry. This nonlinear potential well may produce chaotic dynamics. However, financial markets fail to exhibit low dimensional chaos. Most academic researchers have concluded that while there is evidence of "nonlinearity" in markets, there is little evidence that a "low-dimensional" process alone underlies the dynamics. Nevertheless it remains possible that a low dimensional dynamic together with random forces affect the market.

J. Doyne Farmer, one of the founding partners of the Prediction Company, has stated that even if a nonlinear system is 95% random (i.e. high dimensional chaos), a 5% predictable component can still be very profitable. The most general case in Figure 1 would involve

both the nonlinear potential well and random forces buffeting the ball (which represents market returns). In this situation the well determines the shape of the probability distribution governing the position of the ball in the well, i.e. market returns.

The Coherent Market Hypothesis is based on a model that features both nonlinear deterministic forces along with the element of chance. It was published nearly 25 years ago as "A Theory of Social Imitation" (Callen, Shapero, 1974). The authors proposed that a variety of social systems such as fish aligned in schools, birds flying in flocks, and people conforming to the dictates of fads and fashion share the properties of state transitions from disorder to order that occur in physical and chemical systems. For example, the orientation of molecules in a bar of iron may transition from disorder (random orientation) to order (uniform alignment). In a laser, photon emissions may transition from disorder (random, ordinary light) to order (coherent, laser light). This model suggests that transitions from disorder (random walk) to more ordered states (bull and bear trends) may also occur in the financial markets.

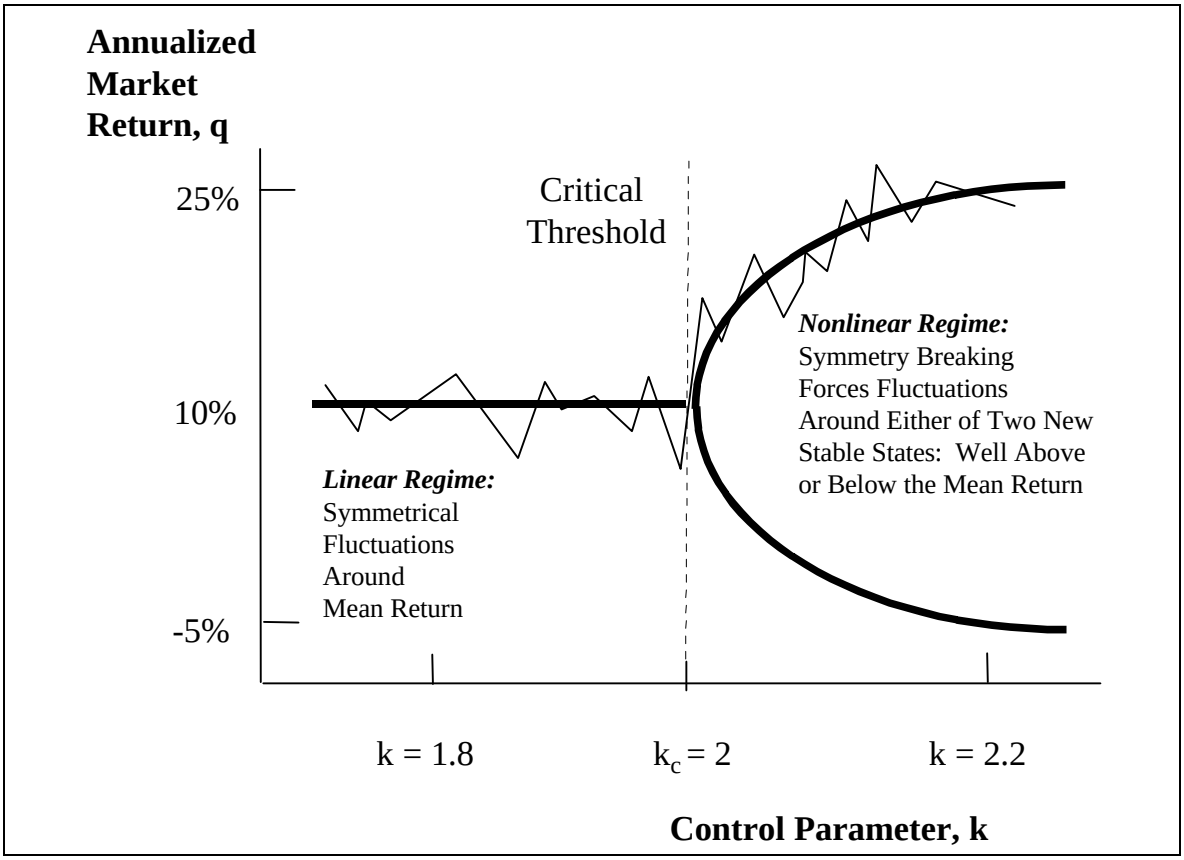
The nonlinear model is described in detail in references such as *Synergetics* (Haken, 1978). For the purposes of this discussion, market returns, q, are a nonlinear function of two primary control parameters, k and h. The first parameter, k, controls transitions from a random walk state in which returns fluctuate symmetrically around the long term average to broken symmetry states in which returns are forced to fluctuate around quasi stationary stable states either well above or below the long term average. The second parameter, h, reflects an external bias which would cause one state to be more probable than the other.

Figure 2 illustrates the state transition concept as a function of the control parameter, k. This parameter measures whether the degree of coupling (positive feedback forces) among subsystems (relative to the magnitude of random forces) is above or below a critical threshold. In the linear regime, market returns should be stable around the long term average. However, nonlinear "feedback" forces tend to push returns into new stable states well above or well below the long term average, a process known as "symmetry breaking." In this regime the impact of any external bias (in the control parameter, h) is magnified. Even small fundamental biases can cause large changes in the most probable return distribution.

A second parameter "h" controls the relative stability of the positive and negative market states. Most traders intuitively view a market as either "in play" or not. Stocks that have been in long term basing patterns may suddenly "wake up" as a result of a new product, management changes, or other industry developments. Technicians have long looked at chart patterns to identify stocks breaking out of trading range or basing patterns. Hence, practitioners have evolved their own strategies for identifying state transitions in various markets. Once a stock has broken out and established a clear trending pattern, the next issue is the stability of the trend. Some stocks establish stable or coherent, long-lasting trends; others tend to reverse their trends rather quickly and exhibit more chaotic results with much movement but little net long term gain.

In bistable markets the long term average return may not describe the market's dynamics very well. Returns may be stable well above the long term average, or well below the long term average and switch between these extremes. This is the broken symmetry that occurs as a result of nonlinear forces. Returns are stable far from the long term average in persistent short term bull and bear markets. The duration of short term trends is a random variable, governed by an exponential distribution function. The mean duration of trends depends exponentially on the potential barrier between states and inversely on the average magnitude of random forces.

Figure 2. The nonlinear model predicts stable market states in which returns are forced well above or well below the long term average.



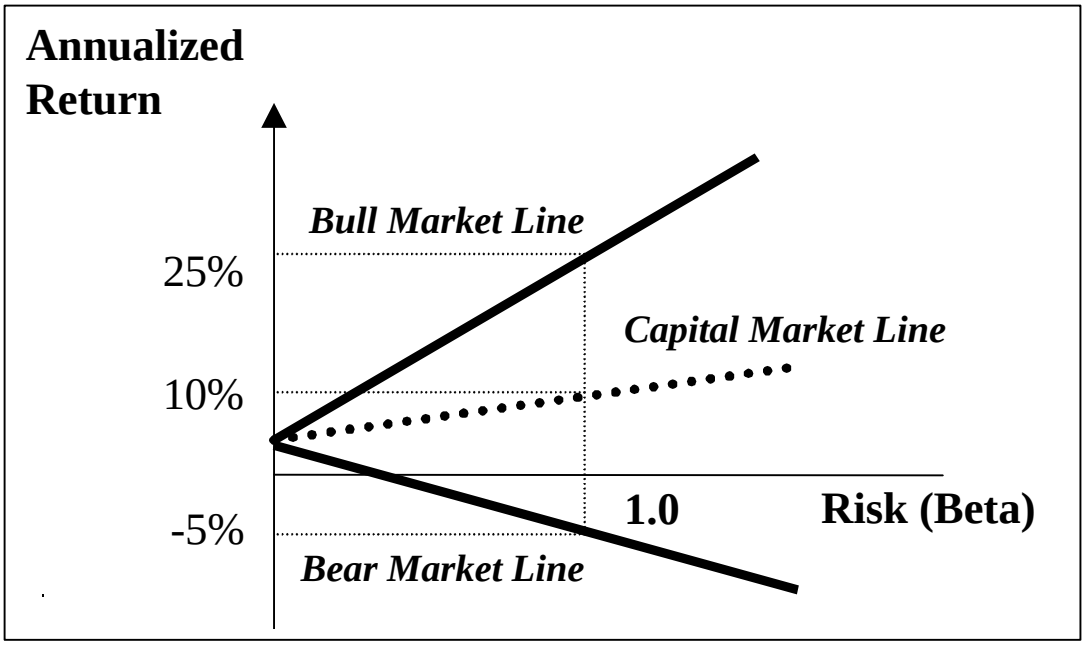
Nonlinear Capital Asset Pricing Model.

The bi-stable market model suggests that the relationship between risk and reward is more complicated than expected from a linear random walk process. As shown in Figure 3, the Capital Market Line of the CAPM represents a simple, linear relationship between risk and reward. In contrast, the nonlinear state transition model suggests that symmetry breaking will force returns into quasi stable states either well above average (bullish) or well below the long term average returns (bearish) for investments of a given level of risk. Both states have some degree of stability which will persist over time; the average

period of time between reversals from either state into its mirror image is an exponential function of the fundamental bias and magnitude of random fluctuations.

A "coherent" market represents a special case of the nonlinear bistable process in which one state is far more probable than its mirror image. For example, when there are large cash reserves, stocks are cheap by historical measures, and the Fed has adopted a policy of easing monetary policy, fundamentals may be considered overwhelmingly positive. Under these conditions, the bull market line is far more probable than the bear market line. These conditions occurred in early 1975 and the summer of 1982. Both times the market exploded to the upside and the trend persisted, i.e. the bullish state was stable, for a considerable period thereafter.

Figure 3. The nonlinear CAPM is represented by stable bull and bear market lines



The CMH suggests that practitioners may be able to add value after all. *Profiting From Chaos* (Vaga, 1994) examined how the methods of successful practitioners of stock selection, market timing and option valuation are tied to nonlinear market dynamics. Successful stock pickers may not have any background in physics or mathematics; however, both momentum and value strategies can be directly related to the persistent trends that are spawned at times by "symmetry breaking" state transitions in the markets.

Momentum Investing: Buying Above Average Returns.

The recent bull market has seen exceptional performance results posted by momentum investors such as Louis Navellier. The publisher of *MPT Review* has been ranked at the top of the list of those who have beaten the market by Mark Hulbert, who tracks the performance of market letters in his *Hulbert Financial Digest*. Navellier and former

associate Jim Collins, publisher of *OTC Insight*, have refined the art of momentum investing and now manage funds as well as publish investment advice.

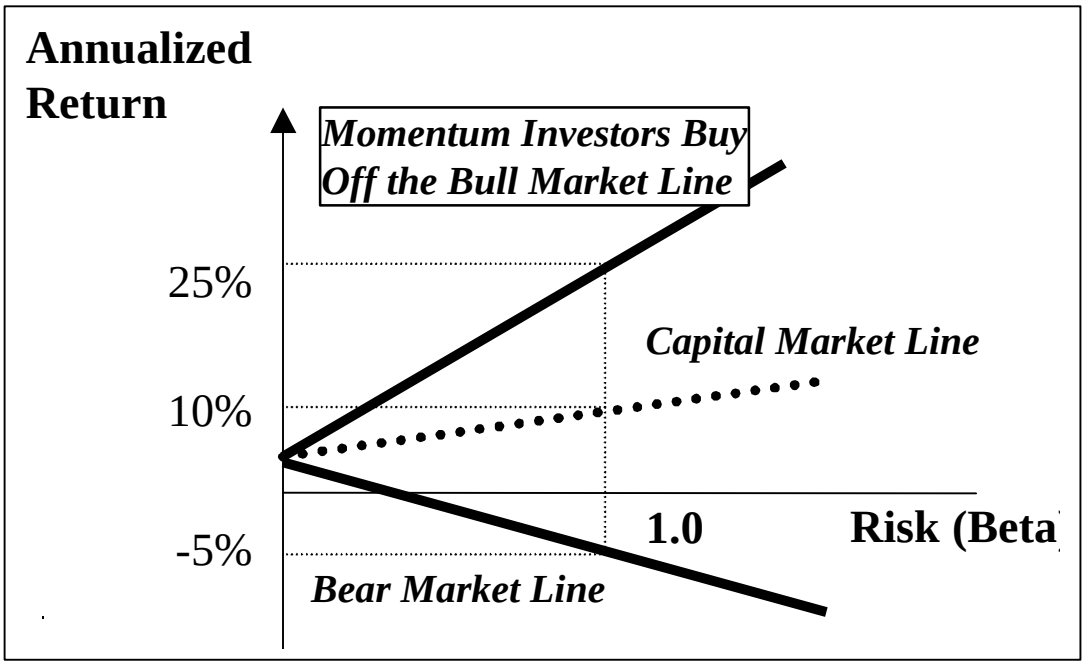
Navellier developed a stock screening method based on the ratio of excess return to the volatility of a stock. This method seeks to capture those stocks that have outperformed the market by the widest margin for a given level of risk. By establishing and holding a portfolio of such high excess return stocks, Navellier has managed to consistently outperform the market.

As shown in Figure 4, Navellier prospects for stocks on the bull market line of the nonlinear or Bi-stable Capital Asset Pricing Model (Bi-CAPM). The bull market line is a stable state and persistence in this state will be a random variable following an exponential distribution, e^{-at}, where a is a function of the height of the potential barrier between the two states and the magnitude of the random forces. If random forces are large relative to the height of the barrier, then the duration of trends becomes short; if the random forces are small relative to the barrier, then the duration of trends becomes longer at an exponential rate.

Navellier's stocks tend to be smaller, growth oriented companies, and he maintains a fully invested position without being a market timer. He has also observed that in weak markets, his screening method produces numerous low beta stocks. This is also consistent with the nonlinear CAPM in which low beta stocks will be the best performers in bear markets, just the opposite of what happens in bull markets.

The persistence of stocks in the bull market state is critical to Navellier's success. If bullish periods were simply the above average returns of a linear random walk process, there would be no persistence of this state, and stocks that show up in the screen would not necessarily continue to do better than average. In contrast, the nonlinear model suggests that the bull market line is a stable state, and that there is apt to be significant persistence of returns from stocks that have entered that state. Hence Navellier's approach is a simple method of profiting from "high dimensional" chaos in the capital markets.

Figure 4. Momentum investors buy stocks in a stable bullish state.



Since Navellier and other momentum investors are paying for above average short term returns, their strategy inherently requires one to sell stocks that transition from the bullish state to the bearish state. The short term excess returns will not last indefinitely and any disappointment in the earnings or other fundamental developments could torpedo the prospects of a momentum stock. Hence this style requires one to be vigilant and willing to assume the transaction costs of frequent buying and selling of portfolio stocks. In fact the duration of stocks on Navellier's buy list follows an exponential distribution: most drop off the list after a relatively short period of time, while some show persistent above average returns for unusually long periods.

Value Investing: Buying Below Average Returns.

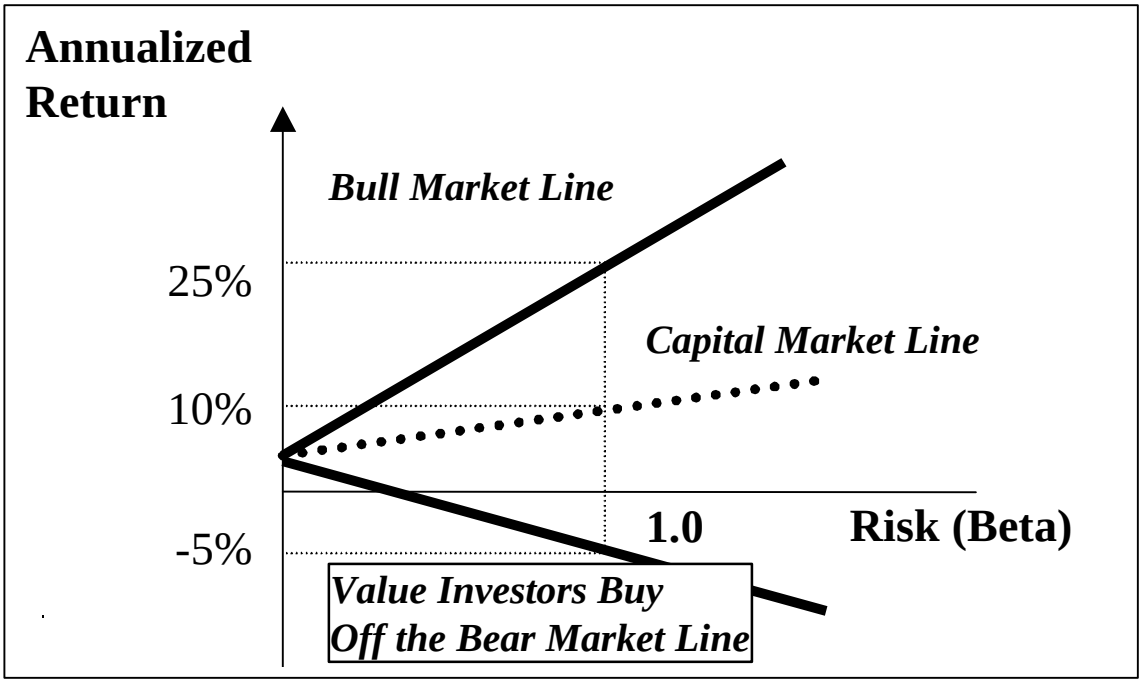
In contrast with Navellier's momentum investment style, practitioners such as Peter Lynch and Warren Buffet have espoused a stock selection strategy that favors purchase of fundamental value. As Buffet has stated, "great investment opportunities come around when excellent companies are surrounded by unusual circumstances that cause their stock to be misappraised."

Unlike the momentum investor, the value investor must have a long term investment horizon. As shown in Figure 5, the bear market line of the nonlinear CAPM is a stable state. Stocks in this state are likely to continue underperforming into the future. However, positive fundamental developments can enhance the transition probability from

the bearish to bullish state. Some value stocks may persist in the bear market state for an unusually long period, following an exponential distribution for trend persistence.

At times growth stocks can become so undervalued that their pricing is more typical of value stocks. For example, Charles Allmon, editor of *Growth Stock Outlook* established a solid long term track record by recommending growth stocks that were hard hit in the bear market of 1973 and 1974. However, recently his performance has suffered because of the persistent high valuations in the current market environment.

Figure 5. Value investors buy stocks in a stable bearish state.



Market Timing.

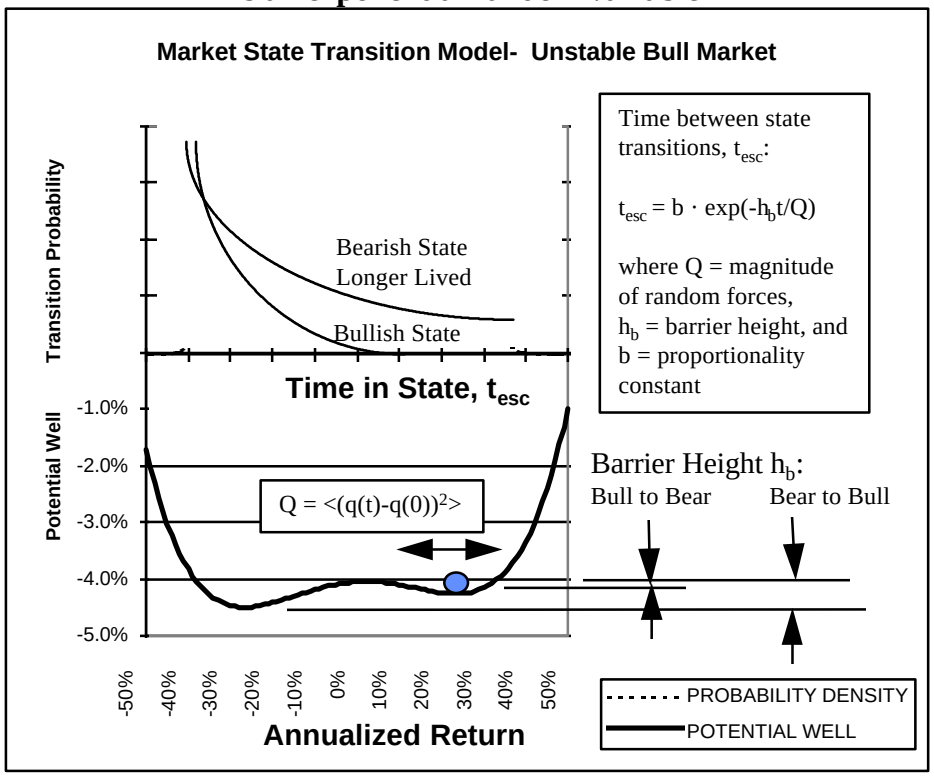
Both momentum and value investors seek to benefit from the stable short term trends that nonlinear forces produce in the capital markets. In both cases the duration of trends can be an important factor that contributes to the success of either strategy. Theoretically the fundamental bias can increase the persistence of trends exponentially. David Nawrocki and William Carter (1996) have found that phases of the business cycle are a valuable indicator of the fundamental bias and have correlated business cycles with the market states predicted by the nonlinear state transition model.

Market timers such as Martin Zweig also assess the prevailing fundamental bias. Zweig cites two sacred rules: first, don't fight market momentum; and second, don't fight the Fed. When the market trend as determined by moving average breaks, is consistent with the Fed policy, persistent bullish bias may last more than 18 months according to some of the studies conducted by Zweig (1991). The use of simple technical trading rules for market timing has been found to be significant by Brock (1992).

Figure 6 summarizes the duration of trends. The height of the potential barrier is one critical factor and depends directly on the fundamental bias. The barrier may be higher for state transitions from bullish to bearish or vice versa. This depends on the external bias parameter, h. Hence in the capital markets the stability of market states depends exponentially on the prevailing fundamentals. The magnitude of random forces is the other key variable; large fluctuations relative to the height of the barrier will rapidly increase the chances of a state transition and reduce the average duration of trends.

When the market stabilizes on a short term basis in the less probable of the two stable states, it may be characterized as being in a mania. A bullish mania occurred in the first half of 1987 when the stock market advanced strongly in spite of rising interest rates. Bearish manias occur when fundamentally sound companies enter persistent negative states. These manias can provide sound long term investment opportunities for contrarians with patience.

Figure 6. The duration of bull or bear market states is an exponential random variable



Short Term Prediction.

The use of computationally intensive methods such as neural networks, genetic algorithms and other technologies under the artificial intelligence umbrella has received considerable attention. However efforts toward short term prediction will always be complicated by the high dimensional or random character of short term fluctuations. The element of chance is always at work, making short term prediction difficult. However,

the nonlinear model suggests that there is a deterministic element involved in market dynamics as well as the element of chance.

The German finance professor, Manfred Steiner (1997), has developed a neural network approach for portfolio optimization. His method is based on training the neural network to recognize market states predicted by the Coherent Market Hypothesis. Portfolios which are rebalanced daily to include those stocks in the bullish state on average continue to show persistent excess returns into the near term future. Stocks in the bearish state show persistent persistent poor performance into the immediate future.

In recent tests for short term trend persistence the author has found excess returns for the S&P 500 index over a period from August 1987 to the present. This period has on average been highly favorable for stocks and the passive index has provided a 15% annualized average daily rate of return with a 16% annualized volatiliy. Over the same period, a simple short term prediction model pinpointed days having an average 56% annualized returns with 13% annualized volatility. These periods of high return occurred 24% of the time.

The stock market has historically shown high Hurst coefficients and biased random walks. Recent market behavior has been quite unique. Not all financial, commodity and currency markets exhibit the same degree of trending. Furthermore, market conditions are non-stationary. Hence the short term prediction rules that would have worked well in the recent bull market for stocks do not work well for other markets. However, under the right conditions it appears that short term prediction may also add value.

Conclusions.

Many practitioners have established solid track records using simple technical and fundamental indicators. Yet their results have been criticized as being just a matter of luck. Nonlinear models suggest otherwise. The basic principle of symmetry breaking in physics can help us better understand the behavior of a wide range of complex systems whether they be ferromagnets, lasers far from equilibrium, big bangs in cosmology, the behavior or ants in colonies, or the global capital markets. Nonlinear models refine rather than replace the classical CAPM and provide additional insight on how market risk and reward may deviate for significant periods from long term average behavior.

Traditional technical and fundamental analysis may add value for practitioners. Both momentum and value investors benefit from persistence in bull and bear markets of varying durations. New short term market timing methods are also emerging. However, practitioners must recognize that both chance and necessity govern market action in complex, non-linear, non-stationary ways that are not yet fully understood.

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Structural Process Improvement

Gary Burchill, Center for Quality Management

In the course of an average business day, managers face a steady stream of problems. Taking them on one by one is often described as "fire fighting," or "crisis management." Traditional Total Quality methods introduced process-oriented management, enabling managers to see beyond their individual problems to the underlying pattern of events. Process-oriented management has led to tremendous increases in productivity through incremental process improvements. However, traditional Total Quality methods have been criticized for not generating step-function, or breakthrough, productivity improvements.

A new approach, structural process improvement, was developed to meet this need at the U.S. Navy's supply division, the Naval Inventory Control Point or NAVICP. The work was based on collaborative efforts between the Center for Quality of Management (CQM) and INTERACT in 1992 and 1993, in which I took part. By combining some of Russell Ackoff's Idealized Design framework with concepts and methodologies from the domains of Total Quality Management (TQM) and Systems Dynamics, structural process improvement attempts to get below the pattern of events to the underlying structure[1] and to step beyond incremental improvement to breakthrough improvement.

Phases of Structural Process Improvement

Structural process improvement consists of three broad phases: structural mapping, environmental assessment, and structural alignment.

Structural Mapping

The two primary approaches used in structural mapping are Language Processing (LP) and system diagramming. We use LP Diagrams to develop grounded facts and to abstract these facts into higher-level concepts.[2] Then we use causal-loop diagrams to integrate these concepts into a map of the structure.[3]

Language Processing

The NAVICP team first developed several LP diagrams. The first LP Diagram addresses the images of employees who work in the operating environment. The next five LP Diagrams focus on obstructions in the five crucial structural dimensions of the operating environment (as identified by Russell Ackoff and his colleagues): authority (power), emotion (beauty), physical processes or method (knowledge), measurement systems (wealth), and conflict resolution (values).[4]

- The authority obstruction LP Diagram addresses people's difficulties in executing authority they've been granted or in having higher levels in the organization exercise authority on their behalf.

- The emotion obstruction LP Diagram identifies problems people have had with their emotions or feelings getting in the way of job performance.

- The method obstruction LP Diagram is designed to uncover problems people have had in performing in their work process.

- The measurement obstruction LP Diagram uncovers problems caused by measurement systems associated with work.

- The conflict resolution LP Diagram deals with problems people have had resolving known and identified conflicts.

- The seventh and final LP Diagram in the structural mapping procedure is a summary diagram that pulls together a number of the titles from the initial image LP and the five focused obstruction LPs; see Figure 1 on the previous page.

System Diagramming

The Language Processing Method is an excellent way to develop grounded data and to abstract those to higher-level concepts. However, LP Diagrams are not well designed to show the dynamic relationships that exist between concepts. Causal loop diagrams complement the LP Method and help overcome this limitation. Causal loop diagrams are a technique from Systems Dynamics designed to show the principal feedback loops in a system.

The basic steps for developing a causal-loop diagram are as follows:

1. Establish the pairwise relationships of relevant variables;

2. Ascertain the direction of causal influence between the pairs;

3. Fit together the causal pairs into closed loops; and

4. Test for loop polarity.

Pairwise variable relationships are diagrammed with directed arcs. Arcs are used to connect factors that influence each other; an arrow indicates the direction of influence. Each arc is annotated with an indication of the causal change (polarity) between the two factors. An S indicates that the two factors move in the same direction; that is, all other things being equal, as one variable increases, the other variable also increases.

An O indicates that variables move in opposite directions; that is, all other things being equal, as one factor increases the other factor decreases. These pairwise arcs can then be connected to form closed feedback loops.

Evaluation of feedback loops helps explain the dynamics of complex situations.[5] There are two basic types of feedback loops, reinforcing (positive) and balancing (negative).

Reinforcing loops promote movement-either growth or decay-by compounding the change in one direction. Balancing loops hamper change in any direction and tend to bring a system back to a specified goal or equilibrium state. These two simple types of loops can be combined in a large variety of ways into causal-loop diagrams to describe complex systems.

Two-thirds of the effort in structural process improvement goes into structural mapping. This time-consuming mapping process allows us to find the pathway to structural alignment.

Environmental Assessment

The second phase of structural process improvement focuses on three related lines of inquiry into stakeholders, market trends and business opportunities. This assessment is conducted in an iterative fashion and usually requires three or more cycles through all three areas before coherence is achieved.

The environmental assessment begins with the identification of the organization's internal and external stakeholders. Each stakeholder is evaluated to determine the amount of influence they can exert on the organization's policies and practices. Additionally, an evaluation is made to determine the amount of leverage the organization has on the policies and practices of each stakeholder. An x-y plot, with "Degree of Influence" on the vertical axis and "Degree of Leverage" on the horizontal axis, is prepared.

A dependent relationship will exist with those stake-holders which have a high degree of influence on the policies and practices of the organization, but are subject to low leverage. Conversely, an independent relationship can exist with those stakeholders in the lower right quadrant of the graph which exhibit low influence, but high leverage. A partnership is desirable when stakeholders exhibit both a high degree of influence and can be subject to a high degree of leverage. Finally, a marginal relationship can be established with those stakeholders who have low influence and low leverage.

The second area of the environmental assessment is the trend analysis of the market, competitors and technology associated with the operating environment. Market trends influence customer requirements and expectations. Competitor trends affect the customer's ability to find suitable substitutes. Finally, technology trends affect the organization's ability to deliver their product or service. Each trend is analyzed to determine both the expected impact on the current rules of the game and the rate at which the change is happening over an appropriate planning horizon. An x-y plot with "Degree of Impact" on the vertical axis, and "Rate of Change" on the horizontal is prepared.

The third area of investigation attempts to identify the key success factors of a successful business operation under the environmental conditions characterized by the stakeholder and trend analysis. Specific emphasis is focused on those stakeholder groups with high influence and those trends with both a high degree of impact and a high rate of change. The analysis attempts to answer three related questions. What conditions must be met in order for the organization to be viable in the environment? What problems or needs

should the organization try to meet? What capabilities does the organization have to be good at in order to deliver the necessary products or services? While an extensive list of requirements can be developed, a focus on the vital few is essential. If the results of this stage indicate a major shift in business strategy may be required, the more extensive Idealized Design process should be pursued.

Structural Alignment

Structural alignment consists of obstruction analysis, to find the high-leverage intervention points; gap analysis, to develop an improvement target; and Hoshin Management, to deploy the implementation.

Obstruction Analysis

The purpose of obstruction analysis is to reveal the high-leverage points for structural alignment within each of the major loops of the structural map (the causal-loops diagrams). A high-leverage point is a variable that can be altered easily in order to drive the system behavior in the desired direction. High-leverage points are usually associated with tangible (mechanical or "physical") processes and seldom involve the behavior of individuals or organizations. As we all know, it's far easier to change a mechanical process than it is to change our own or someone else's personal behavior. Ideally, obstruction analysis will help the organization discover high-leverage intervention points in all of the major loops of the structural map. The combined effect of these high-leverage interventions should remove the structural obstructions and allow the organization to meet the key success factors in the environmental assessment.

Gap Analysis

After the high-leverage points have been identified, you can use gap analysis to develop performance improvement targets for each intervention point.

Begin by establishing the "ideal" state of the selected variables, either through formal benchmarking, or creative thought experiments. The only constraint placed upon the "ideal" state is that it must exist somewhere today (though not necessarily in your company or industry). Following establishment of the "ideal" state, establish the "current" state of the selected intervention point within the operating environment. Once you have determined the "ideal" and "current" states you can describe the gap between them. Next, propose a solution that reduces the gap between the ideal and current states-and that is feasible in the current operating environment. Then conduct a second gap analysis. In this second gap analysis iteration, describe the gap between the proposed solution and the "ideal" state, and agree upon a solution that reduces this second gap and is feasible in the current operating environment. Then conduct additional iterations of gap analysis as necessary until the gap between the proposed solution and the "ideal" state is negligible. At this point, you should be able to see a feasible path from the "current" state to the "ideal" state. Based on available time and resources, define appropriate improvement targets along this path, as suggested by each gap analysis.

Hoshin Management
Given the "current" and "target" state for each intervention point, traditional Hoshin Management practices[6] are used to deploy the improvement goals. That is, each part of the plan is described with specific steps. Each step involves a statement of desired outcome, a metric, a target value, a deadline date, and a means statement.

Conclusion

This brief outline of structural process improvement shows how an organization creates a structural map from observable facts relating to diverse aspects of the operating environment. High-leverage intervention points are explored through gap analysis; improvement targets are established; and these targets are pursued by means of Hoshin Management techniques.

Structural process improvement forces us to look at a pressing problem from perspectives more diverse than those typical of traditional quality management tools. Traditionally, TQM tends to concentrate on "physical" processes and data-driven measurement systems. The advantages of structural process improvement are threefold:

First, structural process improvement incorporates crucial work-life variables which create obstructions, such as problems arising in connection with authority, emotion, and/or the handling of conflicts. These variables, often swept under the rug, can ultimately determine whether process improvement really takes hold in an organization.

Second, causal-loop analysis makes it possible to integrate these variables in the structural map; this lets people see how well intended actions in one area may show up as unintended and undesirable consequences somewhere else. Causal loop diagrams allow us to map out a change, the constraints surrounding it, and areas of potential resistance by the change process.

Finally, when we examine feedback loops, we often recognize that we may have to intervene in more than one area within the structure in order for the overall effect of change to be positive. This represents a third major advantage of this approach.

In sum, structural process improvement-linking Total Quality discipline and Systems Dynamics tools to structural analysis and improvement-can be very powerful for breakthrough organizational improvement.

References

1 This article uses the word structure to refer to dynamic interrelationships among people, procedures, and policies in an organization. This sense of "structure" differs slightly from the architectural or "organization-chart" meaning used in "Combining Idealized Design and TQM" (pages 4-21).

2 The Language Processing Method is used to analyze qualitative or language data. People using the method review statements written on note cards in terms of their accuracy in conveying factual information and then organize the cards to create a diagram of interrelated, abstracted concepts. The Language Processing Method is a registered trademark of the Center for Quality of Management.

3 A causal-loop diagram, one of the tools of systems thinking, is used to capture how variables in a system are interrelated in the form of a closed loop that diagrams cause-and-effect linkages

4 Four dimensions of development-truth, plenty, good, and beauty-Russell Ackoff describes in Creating the Corporate Future, John Wiley and Sons, New York, 1981. In the summer of 1992, during a three-day workshop between CQM and INTERACT, discussions surrounding these concepts redefined the dimensions as: power (authority), beauty (emotion), knowledge (method), wealth (measurement system), and values (conflict resolution).

5 Goodman, Michael. 1974. Study Notes in System Dynamics. Cambridge, MA MIT Press.

6 Hoshin Management principles and practices are outlined in Shoji Shiba, Tom Pursch, Robert Stasey; "Introduction to Hoshin Management", CQM Journal Vol. 4, No. 3 (Fall 1995); pp. 22-33.

Studying the Sense & Respond Model for Designing Adaptive Enterprises, and the Influence of Russell Ackoff's System of Thinking

David Ing[14]

In the process of developing a system specification for the Sense & Respond model -- an approach to strategy in which enterprises are designed as adaptive, purposeful, open, social systems -- the author was directed to read Russell Ackoff's writings. This article describes how reading *The Democratic Corporation*, *Creating the Corporate Future* and *On Purposeful Systems* led to a greater appreciation of the practice of enterprise design.

KEY WORDS: Sense & Respond, adaptive enterprise design, social systems, purposeful systems

1. PURPOSE OF THIS ARTICLE

This article describes the influence of Russell Ackoff's writings on an important business research initiative within the IBM Corporation. This initiative is known as the Sense & Respond model. Its goal is to help IBM's customers to think about issues associated with discontinuous change in the business environment, and the functions in which information technologies can enable their organizations to be become successful, adaptive systems.

2. HOW DOES A PERSON APPROACH A SYSTEM OF THINKING?

The concepts of the Sense & Respond model have been discussed in classes offered to executives of IBM customers, by the IBM Advanced Business Institute, since 1993. Steve Haeckel introduced these concepts with the publication of "Managing by Wire", co-authored with Richard Nolan, in *Harvard Business Review* and in "Adaptive Enterprise Design" in *Planning Review*. I had attended a class on Sense & Respond at the IBM Advanced Business Institute in June 1997, with an IBM team interested in business modeling. In the months following the class, an informal study group -- composed of experienced researchers and consultants within IBM -- formed with an interest of understanding the Sense & Respond model in depth. The more we thought we understood about adaptive enterprise design, however, the more questions we had.

Steve Haeckel was generous with his time in helping this group with its learning. We were impressed at the depth of his understanding of the approaches and methods by which an enterprise should be designed. In fact, his complete conviction on certain fine

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1 [14]IBM Advanced Business Institute, Palisades, New York, U.S.A. Internet:

points about the Sense & Respond model -- unwavering in the face of vigorous debates -- often left us puzzled. At the end of a day of discussion, it would not be uncommon for the group to scratch our heads and ask "How can he say that?"

Finally, after a particularly exasperating session, Steve proclaimed "Go read Russell Ackoff!"

This proved to be a turning point in our pursuit of understanding. In reading Russell Ackoff's work, we discovered that ...

> ... a system is a whole that cannot be divided into independent parts. (Ackoff 1994, p. 21)

Our primary effort had been to understand the Sense & Respond model itself, with a core concept that an enterprise should be designed and managed as a system. Less obvious, however, was the fact that Steve Haeckel had managed to form a complete system of ideas, such that anyone attempting merely to nibble at the parts of the system might miss interactions with other parts in the whole.

By leading us to read Russell Ackoff, Steve Haeckel presented us both with a gift and a curse. The gift was that Russell Ackoff has been extremely prolific, and thus, we were able to draw on a great wealth of publication that has helped to deepen our understanding of social systems concepts. The curse was that, once we started digging into Ackoff's work, we were faced with an even richer system of ideas -- generated over a fifty-year career -- which not only involved Ackoff's own work, but also those of other thinkers within his lifetime, such as West Churchman and Fred Emery. This expanded into readings associated with institutions such as the Society for General Systems Research (now the International Society for System Sciences) and the Tavistock Institute.

In the end, Haeckel had provided us with a remedy of the type of "the hair of the dog that bit you". To specify the Sense & Respond model at the rigorous depth that would satisfy us, we would need to learn about Russell Ackoff's perspective on systems.

3. S&R IS A STRATEGY FOR AN ERA OF DISCONTINUOUS CHANGE

For a more complete description of the Sense & Respond model, the interested reader may refer to a book published in 1999 -- *The Adaptive Enterprise: Creating and Leading Sense & Respond Organizations.* For the immediate purpose, however, an extremely brief description of the premise and promise of the Sense & Respond approach follows.

3.1 Strategy as planning is inappropriate if change is unpredictable

Today, most companies create strategy through a (yearly) procedure of (attempting to) predict the future, followed by development of a plan to reach the goal within a period.

Fewer and fewer companies now have a ten-year (or even a five-year) plan as a published document, because they have discovered that as the nature of change has become discontinuous, the relevance of such a work diminishes rapidly.

Thus, in an era of discontinuous change, the only appropriate strategy is a strategy to become adaptive.

A strategy to become adaptive means designing an organization that can systematically sense and respond to environmental change. More specifically, this strategy requires designing a purposeful, complex, adaptive social system.

3.2 Systematic adaptation must occur both in the enterprise as a whole, and in its parts

For an enterprise to be seen as a social system, adaptation must take place at least at two levels:

> adaptation of the enterprise as a whole, as represented by the role of leadership; and

> adaptation at the level of teams and/or workgroups, through individuals who play different roles to carry out various functions.

Haeckel refers to this conception of design as "Context and Coordination", which is an alternative to the traditional management orientation towards "Command and Control".

The cycle for organizational learning is depicted as an adaptive loop with four emphases: Sense, Interpret, Decide and Act. Successful adaptation requires that a system be capable of processing information about changes in the environment at a rate faster than that at which the information comes in. This type of loop can be applied to all types of systems -- including each of the individuals within an enterprise -- but the organizational challenge for systematic adaptiveness requires that teams of individuals and the organization as a whole both demonstrate this capability.

3.3 Leadership provides the organizational context for the enterprise as a whole

At the level of the enterprise as a whole, the purpose of the enterprise must be declared by its leadership, based upon an inquiry into attributes of value amongst its constituencies. The leadership of the enterprise is accountable for defining:

> the purpose and bounds for behavior within the enterprise, as well as

> a high-level business design of roles to be filled with capabilities, modularized so that responses by customers can be dispatched to the appropriate resources.

The purpose and bounds, combined with the high-level business design, comprise the organizational context within which individuals within the enterprise are empowered to make decisions. This is not leadership in the "we know, you do" tradition, but instead "we declare, you know, you do".

3.4 Coordination of teams occurs through a protocol of commitments with accountabilities

Business processes are based not only on sets of procedures (as means), but also on individuals who must accept accountability for an outcome (which is an end). Customer

requests are received by a person in a dispatching role, who directs the communication to an appropriate supplier.

> The protocol for conversations about commitments follows a formal protocol of speech acts, of: offer/request/counter-offer/counter-request; agree or withdraw; report completion; and assess outcome.[15]

> Commitments become coupled into chains, as each supplier becomes an internal customer to a subordinate supplier.

Commitments towards an outcome that are sufficiently important to impact the function of the system as a whole should be recorded in a database. Management of the commitments is not based on the content of the commitment, but on the maintenance of the integrity of accountabilities for outcomes within the system. An adaptive system requires that subsequent renegotiations of commitments should be supported, with consequences for those commitments that have not been successfully renegotiated.

3.5 An essential element of S&R is the design of an enterprise as an open system

Although the brief description above does not do justice to the depth of the Sense & Respond model, at its core is the fundamental idea of the enterprise as an open system. Openness in the system requires that the enterprise must adapt to changes in its environment. Internally, the enterprise is designed to function as a system as a whole, with appropriate subsystems. If it is possible to adapt while maintaining the integrity of the enterprise as a whole -- i.e., without changing the purpose and bounds defined by the leadership -- then adaptation can occur by the subsystems adjusting their designs to a more appropriate structure. If this is not possible, then adaptation must take place at higher levels -- either on the boundaries on behavior, or for the purpose of the enterprise as a whole.

Long-time systems thinkers might find many of these concepts supporting the Sense & Respond model to be familiar. However, to the average business reader (or even the best-trained MBA common in today's business community), the presentation of an organization and its purpose in this manner is in striking contrast to the approaches based on economics or sociology. How could the Sense & Respond model be validated as a logically coherent approach, as compared to large number of management fads that have emerged in the past decade of "fad surfing"? As a logical system, the answer could not be contained within the Sense & Respond model itself, but would have to come from an external reference point -- which turned out to be the books and articles of Russell Ackoff.

4. ACKOFF PROVIDED INSIGHT ON SOCIAL SYSTEMS, DESIGN & PURPOSE

An immediate parallelism between the writings of Steve Haeckel and those of Russell Ackoff is the specificity with which words are chosen. The quick scan of a chapter will

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2 [15]Haeckel (1995) cites Winograd & Flores (1986) as the source for concepts about speech acts, and Scherr (1993) as the source for application in business

usually make sense to the reader, but a return to the text a few months later often produces a greater insight into a deeper idea. A word that would seem commonplace in "simple English" gains richness not only by its use in the context of systems thinking, but also in the context of other ideas by the same author.

The process of reading and re-reading Ackoff's writings produces insights, but not necessarily in the time expected. The sections that follow describe some insights gained about the Sense & Respond model through studying Ackoff's works -- gained possibly not even in the publication that explains it best, but instead at the point in time at which sufficient understanding had been accumulated to appreciate some aspect of the system of thinking. This is not a complete list of insights, but some which were particularly relevant to the Sense & Respond model.

4.1 *The Democratic Corporation* led to an understanding of social systems

In the Sense & Respond model, Steve Haeckel is insistent on the appropriateness of the "Context and Coordination" approach, whereby some decisions are set by the leadership, and others are determined by teams or individuals within the enterprise. This idea is consistent with the description in *The Democratic Corporation* of the decline of the organismic view of the enterprise, in favor of the social systemic view. This understanding was later amplified by Russell Ackoff and Jamshid Gharajedaghi in "Reflections on Systems and their Models", in which social systems are categorized as having choice both in their parts and the whole.

[Ackoff & Gharajedaghi] Table 1: Types of systems and models

Systems and models	Parts	Whole
Deterministic	Not purposeful	Not purposeful
Animated	Not purposeful	Purposeful
Social	Purposeful	Purposeful
Ecological	Purposeful	Not purposeful

> Social systems -- for example, corporations, universities, and societies -- have purposes of their own, contain parts (other social systems or animated organisms) that have purpose of their own, and are usually parts of larger social systems that contain other social systems (for example, corporations and nations). [p. 14]

In addition, Steve Haeckel specifies the "high-level business design" as the "essential structure" for the enterprise. Through Ackoff's clear definitions of function as distinct from structure -- particularly important for social systems -- it is clear that the purpose of the enterprise in the Sense & Respond model should be the defining function for the system, and that the essential structure should be determined after the purpose had been defined.

In the section on Quality of Work Life in *The Democratic Corporation*, Ackoff reminds us of the legacy of management thinking from the Tavistock Institute, which unfortunately declined in popularity during the "downsizing" era of the 1980s. In many

respects, enterprises in the 1990s have taken a large step backwards, retreating not only to organismic conceptions of their systems, but also to mechanistic conceptions.

4.2 *Creating the Corporate Future* led to an understanding of design of systems

If *The Democratic Corporation* provided evidence that thinking about the enterprise as a system was a good idea, the function of *Creating the Corporate Future* was to suggest an approach by which the process of design could be made practical.

The Sense & Respond model requires the identification of a primary constituency, to which the enterprise owes its defining purpose -- called the Reason for Being -- as compared to subsidiary functions that can be satisfied as merely bounds or constraints. A key issue of understanding is centered on this Reason for Being, which challenges the popular business orientation towards "maximizing shareholder value". Which constituency of the enterprise should be considered the primary?

Ackoff provides a first step towards clarification, through the recognition that an enterprise produces outcomes other than just those which are economic. This discussion takes place under the context of the nature of ideals:

> The ancient Greek philosophers identified four pursuits individually necessary and collectively sufficient for the development of man: *truth, plenty, good* and *beauty*.
>
> 1. The pursuit of *truth* is the *scientific* and *technological* function of society. [....]
> 2. The pursuit of *plenty* is the economic function of society. [....]
> 3. The pursuit of *good* is the *ethical-moral* function of society. [....]
> 4. The pursuit of *beauty* is the *aesthetic* function of society. (Ackoff 1981, pp. 38-39)

The concept that an enterprise has multiple constituencies is not difficult. The concept that some constituencies expect other than economic outcomes is not surprising. However, within a facilitated Sense & Respond session, the typical realization that an enterprise may produce economic returns in multiple ways always raises the issue about which enterprise function and which other constituency should then form the defining purpose.

The additional consideration of a horizon in time in the Sense & Respond model brings forth the idea that the Reason for Being should be expressed as more durable than any high-level business design, or any commitment made between any two individuals at any point in time. From Ackoff's section on ideal-seeking behavior, ...

> There are three types of ends that people pursue:
>
> 1. *Goals*: those ends that we can expect to attain within the period covered by planning.
> 2. *Objectives*: those ends that we do not expect to attain within the period planned for but which we hope to attain later, and toward which we believe progress is possible within the period planned for.

3. *Ideals*: those ends that are believed to be unattainable but towards which we believe progress is possible during and after the period planned for.

> Planning ought to involve all types of ends, but it seldom does. (Ackoff 1981, p. 63)

The Sense & Respond model does not require that the Reason for Being be expressed as an ideal. However, in facilitated sessions, the statement of the defining purpose as an ideal is usually encouraged. In the face of discontinuous change, commitments between individuals should be made only for periods over which there is certainty (rather than an arbitrary one-year horizon), and thus the period planned for may be as short as a few days or weeks. The structure of the high-level business design can be reorganized when the change is even greater.

While the techniques for design suggested by the Sense & Respond model are different from those suggested in Interactive Planning, the latter certainly provides a standard of completeness by which business models should be judged. In particular, the differentiation between Means Planning and Resource Planning provides an interesting distinction between the Sense & Respond model and the "Make-and-Sell" approach. In a traditional Make-and-Sell organization, means are committed and resources are allocated at the commencement of the planning period, based upon the expectation of customer demand, rather than the actual requests of customers. In a systematic Sense & Respond organization, the capabilities for a range of alternative responses may be established in advance, but modular capabilities are dispatched and assembled only after a commitment by a customer has been obtained.

4.3 *On Purposeful Systems* provides final definitions for purpose, function and structure

In the absence of personal communications with Russell Ackoff, *On Purposeful Systems* serves as the final word on his system of thinking. Not only is this work absolutely rigorous in its definitions, but some of the examples provided can result in a profound understanding. As an example, to gain a full appreciation for systems design, the distinction between producer-product and cause-and-effect is essential.

> An acorn is insufficient for an oak because in a number of environments it cannot cause an oak -- for example, in a waterless sandy soil. [....]
>
> Producer-product is ... a special case of cause-effect. [....] An acorn, which was shown to be necessary but insufficient for an oak, is thus a producer of an oak, its product. (Ackoff & Emery 1972, p. 22)

In the Sense & Respond model, Steve Haeckel emphasizes that "only human beings can be held accountable", which leads to questions as to whether the new technology of "intelligent software agents" should be consider as accountable for their outcomes. This can be resolved through an examination of the "Classes of Functional Individuals and Systems" (Ackoff & Emery 1972, p. 29), which determines that software agents may demonstrate either goal-seeking or multi-goal-seeking behavior, whereas only people are classified as purposeful. With the distinction of free will, human beings therefore have

choices for which they should be held accountable. The most intelligent software will only have the goals programmed into it by human beings.

As a more academic work, *On Purposeful Systems* also provides citations to the wealth of literature that has influenced his thinking. This reading produced a context in which the work of West Churchman, and other thinkers in the Society for General Systems Research could be appreciated.

5. ACKOFF'S SYSTEM OF THINKING IS RIGOROUS, BUT OPEN

At the beginning of 1998, I was appointed to a position within the Advanced Business Institute, where I have been conducting research associated with tools and techniques that might be applied with the Sense & Respond model. After I had conducted a few months of testing (or inquisition) of the Sense & Respond concepts on Steve Haeckel himself -- often about how the Sense & Respond model was similar to or different from Ackoff's approach -- Steve exclaimed: "I said that you should read Russell Ackoff, not become Russell Ackoff!"

At this point in time, I have come to appreciate the philosophical differences between techniques such as Sense & Respond and Idealized Design, but more importantly, have gained a greater respect for the works of both Steve Haeckel and Russell Ackoff. Although they have suggested slightly different means by which an end may be achieved, they are both interested in the same end -- the improvement of the practice of management, and the recognition that enterprises can provide multiple functions to society.

In the family tree of management thinking, there is at least an indirect relationship between Sense & Respond and Russell Ackoff. I nominate him as a honorary uncle of the Sense & Respond model. When he makes a suggestion, we may not always follow it, but if we ignore his contribution, we do so at our own peril.

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Implementation of Learning & Adaptation at General Motors

Wendy Coles, General Motors Corporation

Introduction

Russ Ackoff introduced his learning and Adaptation Model to General Motors in the fall of 1996. The following General Motors Corporation Decision Record reflects the decision GM made to begin the development of their Knowledge Network using the Learning and Adaptation Model. The style by which the decision is recorded reflects the methodology recommended by Russell L. Ackoff.

GENERAL MOTORS CORPORATION DECISION RECORD

Decision Title/Topic

Organizational Learning at General Motors

Description of Issue:

Lack of a General Motors system-wide process to learn from past decisions, and thereby improve future decisions.

What was decided (check one):

- No Decision
- Decision To Do Nothing
- **x** Decision To Do Something (Describe):

Apply Ackoff's Learning and Adaptation Model to improve General Motors' strategic decisions.

Decision Makers: .

Name	*Title*	*Initials/Date*

Vince Barabba, General Manager of Corporate Strategy & Knowledge Development Oct. '96
Ron Zarrella, VP and Group Executive of Vehicle, Sales, Service and Marketing
Bob Hendry, General Director of Finance and Business Processes

Strategic Context

The past few years have brought change to the top leadership of GM, the marketing organization, and engineering. There is a call for increased competitiveness through learning. General Motors University is commencing, with an initial focus on delivering education and training programs.

Vince Barabba is assigned to lead Corporate Strategy and Knowledge Development, reporting to Bob Hendry and Harry Pearce. The company is exploring moving from a make-and-sell to a sense-and-respond organization. Maintaining a sense-and-respond organization will require an organization that continually is learning and adapting.

Arguments Pro:

Ackoff Model reinforces focus of Corporate Strategy and Knowledge Development: to improve the strategic decision making of General Motors.
Model enhances the opportunity to leverage GM's size. Given the size of the workforce, the number of vehicle programs, and the number of decisions - there can be more cycles of learning than the competitors, providing the opportunity to get smarter faster.

Arguments Con:

Implementation requires leadership understanding of the model, organizational discipline and resources.

Expected Outcomes:

An organization where strategic decisions are recorded, tracked, analyzed and the insights and hypothesis are integrated into the next round of decision-making.

Assumptions on Which
Expected Outcomes
are Based:

- Organizational learning is not a natural act. GM may talk about the need to learn - but an intervention is required to cause the change.
- An intervention is required that will change the way work gets done. This change in behavior will drive the change in thinking and valuing learning.
- Leaders want to learn and improve their decision making

Who is responsible for
Implementation:

Jay Stark and Wendy Coles, Corporate Strategy and Knowledge Development

Implementation Plan:

Begin implementation in Planning, Vehicle Development, and Sales, Service and Marketing.

Decision Making Process

The General Manager made the decision after consultation with his staff and Russell Ackoff.

Alternatives Examined

- Senge's Learning Organization
- Fred Kofman's Learning Leaders
- It was recognized that these alternatives have value, but tend to focus more on individual change. They should be addressed by the Employee and Organizational Development community. An intervention is required that addresses not the individual but the collective understanding of the organization.

Key Information Used:

The Democratic Corporation, by Russel Ackoff
On Learning and Systems That Facilitate It, by Russell Ackoff

Additional Comments:

Decision Summary:

Reviewed & Approved:

Vincent Barabba October '96

Appendix A

Request for Tracking

Outcomes/ Assumptions	Measures	Acceptable Range	Review Date to begin	Frequency of Review	Source of Information	Monitors Name & Dept.
Vehicle Incentives Project	Dollars spent on incentives	Close to Saturn model	Aug. '97	Weekly	Divisional Incentive Directors	Ken Barb, Chuck Newcomer
Events & Sponsorship			June'97	Monthly	Divisional E&S Directors	Ken Barb, Chuck Newcomer
Collaborative Decision Centers			Sept. '98	Quarterly	IS&S	Chuck Newcomer
GMX 111	Speed to market	Guidelines for Vehicle Dev.Process	June '97	Weekly	Vehicle Team Functional Reps.	Ruth Bardensteir
GMT 222	Speed to market	Guidelines for Vehicle Dev.Process	Feb. '98	Weekly	Vehicle Team Functional Reps.	Dianne Bommarito
GMX 333	Speed to market	Guidelines for Vehicle Dev.Process	Jan. '99	Weekly	Vehicle Team Functional Reps.	Ruth Bardensteir
GMT 444	Speed to market	Guidelines for Vehicle Dev.Process	Feb.'99	Weekly	Vehicle Team Functional Reps.	Dianne Bommarito

LOOKING AT LEADERSHIP FROM A SYSTEMS PERSPECTIVE

by Erwin Rausch, Didactic Systems, Inc.

Introduction

Much effort has been expended on defining leadership. Rost quoted Bass and Stogdill (Rost, 1991, p.4):

> Many scholars have wondered why we have not been able to get a conceptual handle in the word 'leadership'. Stogdill (1974) and later, Bass (1981) collected and analyzed some 4,725 studies of leadership that Bass listed on 189 pages of references in his handbook. Stogdill concluded that "the endless accumulation of empirical data has not produced an integrated understanding of 'leadership' (p.vii). Bass, in his update of Stogdill's 'Handbook', came to the same conclusion but ended on a note of optimism:
>
> Some disparage the thousands of research studies completed with the supposed lack of progress. Yet when we compare our understanding of leadership in 1980 with what it was thirty years earlier, we can agree with T.R. Mitchell (1979) that there seems to be progress in the field. Theory and research are developing and much of what is being done is being used in practice. There is reason for controlled optimism. Yet, the challenges are still there for the years ahead. (Bass, 1981, p. 617).

Another observer (Klenke, 1996, p.55), selected this quote to express the frustration with leadership studies:

> We need to rediscover the phenomena of leadership theories; the pursuit of rigor and precision has led to an overemphasis on techniques at the expense of what is going on in a direct human way. As a result, we have masses of findings that no one seems to be able to pull together - they simply float around in the literature, providing nothing from which one can push off to anywhere (McCall and Lombardo, 1978, p.xii)

Since then, things have not gotten much better. Beyond transformational leadership theories came concepts of full range leadership, collaborative and/or shared leadership, post-industrial leadership, and others. Still as Rost notes, (p. 11):

> A new school of leadership is as elusive in 1990 as it was in 1978, when Burns wrote his book (what Rost refers to as 'a monumental study of leadership').

Leadership from the Systems Perspective

When looked at from a systems perspective, this lack of practicality of leadership research findings is not surprising. The research focused primarily on definitions - attempting to establish what leadership IS. Every writer and researcher has been free to

define it. Research thus wound up with subjective labels, and theories, sometimes drawn validly from the research, and sometimes rationalized from it.

While research concerned itself, partially obliquely and partially directly, with what leaders do, it did not come to grips with investigating the range of leadership decisions that are important to performance of leaders, whether they be in anthropology, education, human relations/resources, political science, social psychology, sociology, theology, or private and public 'business'

For a system of leadership, what is needed is a comprehensive picture of all the issues that might be involved, so that all the bases will be covered when decisions are made. Armed with a thorough concept, leaders can help their teams or organizations meet the challenges of rapid change, including growing pluralism, without overlooking important elements that should be considered in decisions.

The literature did teach us many things about what distinguishes competent leaders from the others. As a result, a comprehensive picture can indeed be developed and everyone who aspires to it, can become a MORE effective leader. In short, we can create the conditions for learning ABOUT leadership, BUT we cannot teach HOW to be a leader (like Lincoln, Joan of Arc, Billy Graham, Martin Luther King, Jack Welch, Mother Theresa, Napoleon, Hitler, or Saddam Hussein).

Leadership Decisions

In public and private organizations where there is a need for 'management' or possibly for governance (such as in associations and institutions of higher learning) MANAGERS can become better managers by becoming more effective leaders.

First though, it is important to recognize a distinction that is obvious, and though it is of crucial importance, rarely receives the attention it deserves.

It is that there are two types of considerations that should enter every managerial decision: those that pertain to the function and those that involve the leadership aspects.

The functional aspects of decisions are those considerations which pertain to the work, such as operations, manufacturing, customer service, membership, editing, marketing, or accounting, and to the organization's activity, such as banking, engineering, IT or IS, retail, health care, or government agency work.

The leadership aspects of managerial decisions are those which apply to all functions and types of organizations. Though equally important, they are often given less thorough attention because training and experience of most managers concentrates primarily on functional issues. Furthermore, short-term job success, at least in the past, often heavily favored functional competence. That, however may be changing as we move further and further away from an industrial to a post-industrial knowledge/service economy.

From the systems perspective, what will make leaders successful, when they are competent in their respective fields (entrepreneurship can be considered a functional area as much as all the others), is attention to ALL the leadership issues, in addition to the relevant functional ones that should be considered in every decision.

For the functional considerations in decisions, each function has models, operational theories, or practical guidelines, that provide a systematic foundation for the respective decisions. considerations.

A Systematic Leadership Model

For the leadership considerations a simple, yet comprehensive model (Rausch 1978 and 1985, and Rausch & Washbush, 1998) can serve as foundation for similar practical use. It is based on the statement that it is the leader's responsibility to lead the team, the organizational unit, or the organization, toward doing the right things right.

That requires involving people and/or affects people.

When people are involved, it is necessary to consider their reaction.

In effect, leaders must bring alignment between the characteristics and needs of the organizational unit, or of the task, with the characteristics and needs of the people involved and/or affected (the 'stakeholders').

To achieve this alignment three sets of characteristics and needs must be considered.

- The Control needs of the organizational unit or of the task, and the attitudes of the staff members with respect to the methods used to achieve and exercise control

- The Competence needs of the organizational unit or of the task, and the knowledge, skills and abilities of the stakeholders (the staff members and others who are affected by a decision)

- The Climate offered by the organization and the psychological and tangible needs of staff members.

A Comprehensive Initial List of Leadership Decision Considerations

When analyzed comprehensively and in detail, to create a systems view of leadership, these characteristics and needs bring a list of at least an initial group of all the leadership considerations that should enter every decision. The six sets of issues below should be modified, expanded or pruned, to fit a specific organization's need and situation.

1. How to set goals for the organization or organizational unit (decide on direction and priorities, including vision), how to organize to achieve them, and how to assign accountability. (To avoid misunderstanding it is necessary to point out here that 'How to

set goals' refers to the process, the HOW that should be used, whether it be participative, democratic, or authoritarian. It does not mean that the leader makes this 'HOW' decision but that it be made on the basis of an appropriately participative process that is likely to help the organization move effectively toward its vision.)

2. How to ensure appropriate participation in decision-making and planning with consideration for who should participate, when and how

3. What and how to communicate with stakeholders, individually and in groups

4. How to ensure coordination, and stimulate cooperation, while anticipating, preventing, and managing potentially damaging conflict

5. How to ensure that there is at least adequate competence of all stakeholders, (through selection and development efforts) and that most effective use is made of competence strengths of individuals and/or teams

6. How to ensure that intangible, as well as tangible, rewards exist for all stakeholders

Thinking along these lines leads to decision processes, and habits that dig deeper and deeper into the needs of the situation and the changes that occur within and outside an organization. Beyond initiating and responding to changes, beyond the obvious and often superficial responses to challenges, and opportunities, there is attention to several layers of issues that might have to be addressed.

An Illustrative Scenario

A simple example might illustrate this systems approach to leadership decisions. The example, deliberately, focuses on a manager without staff, to dramatize the applicability of leadership systems thinking to all levels of an organization.

A high tech company developed and used a very nice telephone recording on its Help line that expressed empathy with the person who is holding on the line. However, traffic on the line had become very heavy and some customers had to hold on for more than 25 minutes. Meanwhile the recording repeated, very frequently, how much the tech support people understand the situation and explained that a representative will soon pick up, that they are doing their best to get to the customer quickly and that, when that happens the customer will get the same high quality service as the person being helped at the moment. It even told some customers, from time to time, that they were next, even though that did not seem to be true at all times.

The recording which had been intended to improve customer relations, understandably began to have a negative impact as more and more customers reached the frustration stage. As the complaints increased, the customer service manager became aware of them and started to work on the obvious problem - the recording itself. It was changed to

provide information about the hours when the line was least busy and the wait would be shortest. It also gave the busiest times and informed customers that the wait during those times was up to a half hour. The new recording brought the complaints down to what was considered an acceptable level.

Analyzing the Scenario from the Systems Perspective

An organization which approaches the issues raised in this scenario on a comprehensive/systems basis must look at several layers of challenges.

- The most obvious layer includes the recording itself and that, as is usual, was quickly rectified. Many organizations will stop there, possibly after ensuring that the expected drop in complaints actually occurred.

- With a somewhat broader view of the situation, some goals might be set on the maximum length of time that customers would have to wait. That, in turn might lead to analyzing full time and part time staff, productivity, or both, in the tech services department. Additional goals might be set pertaining to productivity and staffing levels.

- It is likely that most managers would tackle one or more of these problems and be satisfied with that, without looking further for underlying causes. That's because most managers see primarily the functional aspects of problems and think of the managerial/leadership issues only occasionally, and then not necessarily in a systematic way.

- From the comprehensive perspective provided by the model, there are more issues to consider. These become obvious to anyone who looks at control, competence and climate with every decision. They include:

    - How was the recording decided on and how should future decisions be made that will change it or leave it alone?

    - How should staffing levels in tech services be decided on, and by whom? How should they be monitored?

    - How should productivity be measured in the tech services department? How should it be monitored?

    - How can competence needs of tech services staff be identified and what should be done to ensure that they are adequate or better for all staff members

    - How should productivity be rewarded in the tech services department?

    - These more important issues are still primarily shadows of the core issue: what are the management/leadership decision practices at this firm, and how could they be enhanced to bring all the potential benefits of high quality management, and leadership,

when seen as a system? Or, what guidelines (Rausch & Washbush, 1998) are used, or standards applied, to decisions, to ensure that they will be of high quality and cover ALL the relevant issues?

Conclusion

No matter what leadership theories one considers as most useful guidance for leader behavior, even if one believes that several or all can contribute useful insights, decisions based on the systems perspective discussed here, can be considered in line with their conclusions.

Leaders with functional competence will satisfy the requirements of high quality leadership if they lead the team or organization toward setting a challenging, potentially most 'productive' vision and toward realistic and suitable goals to achieve it; if they practice appropriate participation in decision-making and planning, with consideration for who should participate, when and how; if they lead toward decisions on what and how to communicate with stakeholders, individually and in groups, and toward thorough coordination, and maximum cooperation, while anticipating, preventing, and managing potentially damaging conflict; if they ensure that there is at least adequate competence of all stakeholders, (through selection and development efforts) and that most effective use is made of competence strengths of individuals and/or teams; and if they see to it that appropriate intangible, as well as tangible, rewards exist for all stakeholders.

Effective actions in all these areas are stimulated by consideration of control, competence and climate, issues, and their components, as defined by the six sets above, or as revised by the team or organization. When managers/leaders develop the habit to think about them with all important, and even many less important decisions, they become more effective leaders. Appropriate actions based on these considerations will satisfy all leadership theories, not only those that see transformational or broad-range leadership theories (Avolio and Bass) as most effective, but also those that consider, possibly in addition, transactional leadership behaviors, the contingency factors, path-goal theories, expectancy theories, member-leader exchange concepts, even charismatic leadership views, and any others that may be thought of as useful, except possibly the most restrictive leader trait theories.

When functionally competent leaders take this comprehensive approach, the team or organization has the greatest possible opportunity to achieve its vision.

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A Theory of Resonance: Intentional Emergence and the Management of Loosely Coupled Systems

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Abstract

There are two conceptions of organizational change in the systems theory literature. One is based on evolutionary theory, highlighting how changes emerge through a process of a variation and selection. In the strategy literature this conception is associated with the idea for example, that strategies are emergent and enacted, and that only when they have been successfully implemented do we in retrospect describe them as if they had been purposefully planned. Purposefulness in this conception, is an illusion. Instead, in this way of thinking people in organizations are constantly innovating, that is creating new practices, trying out new ideas, but only a fraction of these ideas are institutionalized. Barriers to institutionalization are based on political and psychological dynamics, faulty execution, serendipity, or inadequate support from the external marketplace. These barriers are often described under the umbrella concept of the "resistance to change." Yet as the concept of "environmental fit" in evolutionary theory suggests, resistance is important because organizations need to protect themselves against recklessness and opportunism. Resistance to change becomes paradoxically a survival tool.

The limitation of this point of view of however is that it provides an executive with no guidelines for acting purposefully. Russell Ackoff's most important contribution to systems thinking has been his insistence that because human systems are created by human beings they reflect our purposes and intentions. He developed "idealized design" as a method organizational stakeholders could use to make their intentions manifest and to put their hoped for designs into practice. The purpose of this paper is to ask how can we reconcile the notion of "purposeful systems" with the theories of organizational emergence and evolution.

In our paper, we present the idea of "resonance" as a bridge concept between purposeful change and emergent change. While individuals can act upon institutions by coming into touch with their purposes, only some purposes will resonate with stakeholder. Resonance in affect acts as screen, making it easier or harder for certain purposes to be institutionalized in new practices and designs. We will argue that a change idea has resonance when it helps point to a "root cause" of a range of seemingly disconnected problem. The root cause is poorly understood precisely because different people experience its manifestations in very different and often contradictory ways. Thus for example consider the case of a hospital that has an usually high level of accounts

receivable. There are many proximate causes of this problem, e.g. clerical errors made when a patient first registers, or when a diagnosis is recorded for reimbursement purposes. But the root cause may lie in the hospital's un-worked conflicts over how much charity care it can and should give. This unresolved conflict will in turn have many manifestations, such as poor implementation of a billing system, high turnover among clerks, or along waits for operating room space. A change idea with resonance thus creates a "meaning" that is shared, because it helps articulate a heretofore shared but unexplicated experience. In this sense we will argue that the creation of meaning bridges the phenomena of emergence with the exercise of intention. We will conclude our paper with a description of change technology that takes account of our theory of resonance. It is based on the idea of "organizational campaigns" through which change agents create resonance, by interpreting already existing pilots as harbingers, stitching together already existing innovators, and staging events and forums that help people interpret changes "in front of their noses" but heretofore out of view. We will argue that campaigns are organized around strategic themes that invite interpretation and discovery. That means that campaigns start with a relatively high level of relevant ambiguity. The campaign initial theme is not clearly specified from the beginning. Instead, a relatively unclear subject, which nonetheless has resonance, is chosen, which is purposefully ambiguous to invite actors to interactively co-define and clarify it. By doing so, actors interactively co-create their own definition of the campaign's objective. This interactive collective interpretation process is the key to blending emergence and intentionality and creating a new approach to organizational change.

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Adaptation Revisited

Wladimir M. Sachs
December 1998

In 1976 I was the first graduate of the S^3 Program. In the spring of 1975 I took a course with Russ Ackoff (in the evenings, at his home) as well as with Eric Trist and Hasan Ozbekhan. In all three courses I worked on the subject of **adaptation**. Tom Cowan and, to a lesser extent, West Churchman were benevolent "kibitzers" of my work. This resulted in an article co-authored with Marybeth Meditz, as well as in extensive parts of my Ph.D. thesis. Much of my work was an extension of previous research by Russ, Fred Emery, Eric Trist and Francisco Sagasti, who was the last pre-S^3 graduate of our little coterie, and who recruited me to join the program. Erik Winther based some of his later research on what I did. I do not remember any other sentimental reasons for which it is appropriate to revisit my work on adaptation on the occasion of this S^3 reunion honoring Russ and Company.

There is one more reason as well. In the past twenty-five years I led a strange and turbulent life, that required a lot of adaptation, and at times suffered mightily from maladaptation. I found myself blessed and cursed by the notions developed in these early days, applying them to both personal and professional situations. It may look a bit narcissistic, but to me the most important intellectual contributions of S^3 coalesce around the issue of adaptive behavior. As I observe with keen interest the great transformations of our times, especially the Information Industry and the Emerging Europe, I find myself wishing that we put more emphasis on **Proactive** rather than **Interactive** planning.

So here is a bit more about all this.

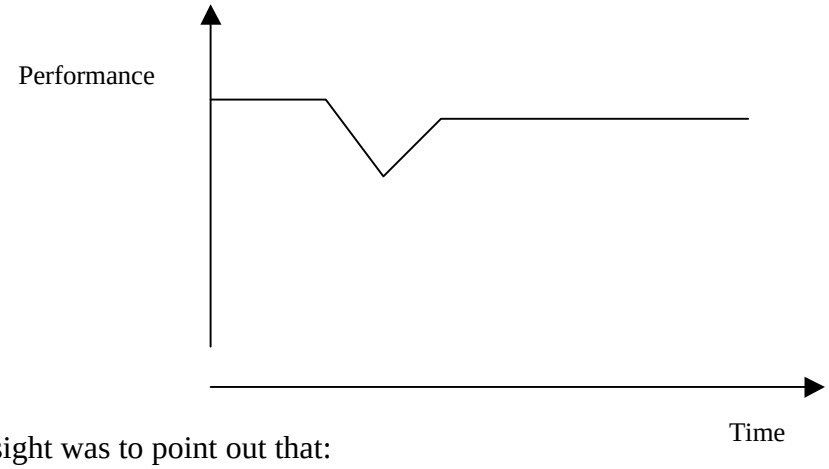
A Concept of Active Adaptation

By the time I started to work on adaptation, Ackoff and Emery have proposed an approach that encompassed and generalized the state-of-the-art on the subject. They defined an instance of adaptive behavior as occurring when a system responded to a decrease in its efficiency by regaining at least some of the lost efficiency. Sagasti pointed out that while most instances of adaptation occur when a system changes the manner of pursuing its ends, there also are instances where the system adapts by changing the ends themselves. I generalized the Ackoff and Emery definition slightly to take into account Sagasti's observation:

> *An instance of a system's adaptation occurs if, when the system's performance is reduced, the system responds by regaining at least partly the lost performance.*

I left the notion of system's **performance** deliberately vague, and I wish to do so now as well. Suffice to say that it is anything that makes sense: "profits" for a firm, "happiness" for a human being, and so on.

This diagram illustrates an instance of adaptation:



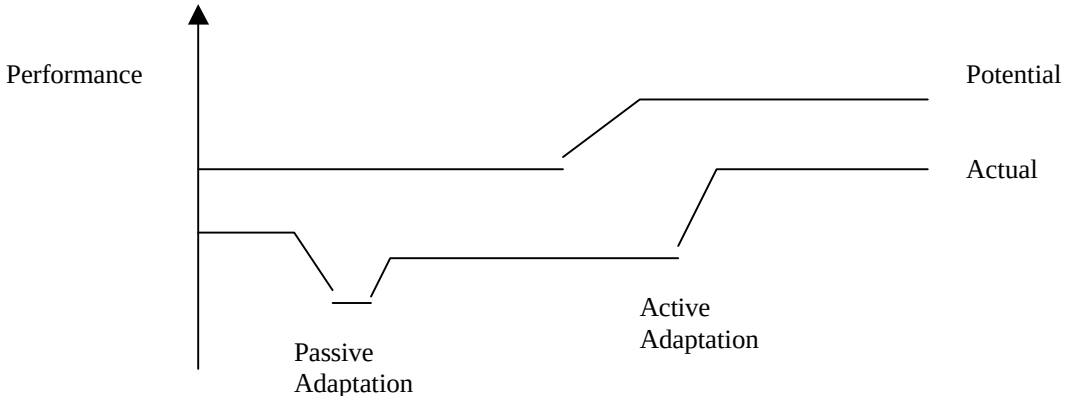
My insight was to point out that:

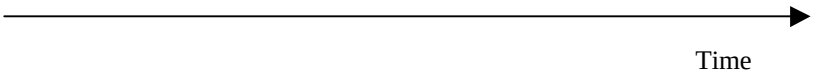
- No system ever works at its peak performance. It is useful to distinguish between a system's **potential** and **actual** performance.
- Potential performance does not decrease over time.
- Instead of talking about a decrease in the system's actual performance, we may speak of the increase in the gap between the system's actual and potential performance.
- Now we can distinguish between two types of adaptation:
  - When the gap increases because the actual performance decreased. I called this **passive** adaptation.
  - When the gap increases because the potential performance increased. I called this **active** adaptation.

For completeness, here is a formal definition:

> *An instance of a system's adaptation occurs if, when the gap between the system's potential and actual performance is increased, the system responds by reducing at least partly that gap.*

And a diagram:

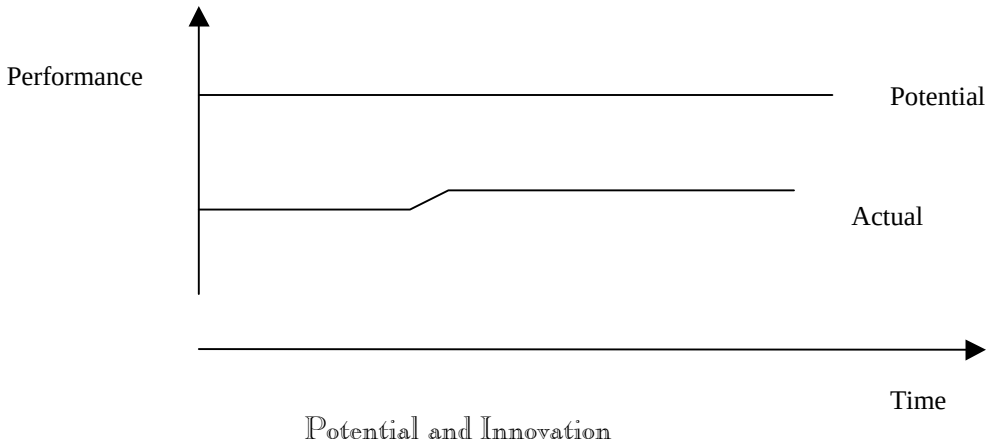




Learning

Learning is closely related to adaptation. Formalistically, I find it useful to think of it as a limit case of adaptation. Whereas adaptation in general is a response to a stimulus that consists of an increase in the gap between actual and potential performance, learning requires no such stimulus:

> *An instance of a system's learning occurs if the system reduces the gap between its potential and actual performance.*



Potential and Innovation

How do you establish a system's potential performance? There are essentially four ways:

- Based on a model of the system, compute its optimal performance. This might be called an **optimizing** approach. A factory's potential output may be established in this way. Standard Cost Accounting methods compare actual costs to lowest possible costs.
- Take the best performance out of a population of comparable systems. This might be called a **comparative** approach. A firm's potential productivity may be defined as the productivity of the industry leader. An athlete's potential may be defined by reference to a World record.
- Combine the two, defining the potential as the optimal performance of the leader. This might be called a **contextual** approach.
- Go a step beyond, and compute the optimal performance of the best system that you can imagine. This might be called a **proactive** approach. I missed this one in my original work.

Not surprisingly, the best way of conceptualizing a system's potential is the **proactive** one. It is also the most difficult and the most subjective one. I will come to this later.

Clearly there are situations in which the system does both: it increases its potential and actual performances. For example, a company may develop a new technology (which increases potential) and then applies it (which increases actual performance). Or, more subtly, it imagines and then applies a new way of doing business. I propose to call this **innovation.** Innovation is, of course, a special kind of learning. I also missed this in my original work.

The way in which systems approach the question of potential performance (implicitly, most of the time) is crucial to their success or failure. There is nothing wrong with the optimizing approach, of course, but it fairly narrow and limited. The comparative and contextual approaches are critically dependent on how one perceives the population of comparable systems. One's imagination and ability to innovate limit the proactive approach.

In the Information Technology field new products may have a life cycle as short as a few months. Successful firms are ones that build platforms from which they can rapidly evolve products that they may not have even imagined a few months earlier. This can be done only with a proactive approach.

Having moved back to Europe less than a year ago, I observe with wonder (and often fright) the process in which hundreds of thousands of firms, agencies and other organizations are suddenly confronted with a situation where their potential is measured in reference to a dramatically enlarged and liberalized market place. Suddenly, systems that were doing perfectly well in their home markets are poor performers when looked at in the context of a larger European market.

Performance

In my original work the notion of performance was "swept under the rug." To accomplish my ends I only needed to assume that there is a measure of performance, and I did not need to know anything about it.

Now what remains of my hair are considerably whiter. And all I can say is that the crux of planning and consulting is laying one's hands on a good notion of performance, which entails understanding what the system's purpose is. I know of no formalistic solution. All I know is that it takes a lot of hard work and complex processes to arrive at a good understanding of performance.

Consider the confusion that reins when we try to answer questions such as "What is a good society?," "What should NATO be all about?" Again, observing the process of European integration is fascinating. What started as a price and production-fixing coal cartel has now evolved into a quasi-federation of states. What do Europeans want from Europe? Who knows? The French seem to want it to be like France, only bigger. The British seem to want it to go away. And the Eurocrats want what most bureaucrats seem to want, that is more and more rules and regulations.

Proactive Adaptation and Interactive Planning

In light of my thinking about adaptation, the technique of **idealized design** is critically important. It can be used to define potential and, at the same time, to innovate.

Seen in that way, it is primarily a technique of **normative planning**. What matters most is getting rid of constraints and letting one's imagination fly. It is a technique for **designing the system**. When successful, and it is not always, it leads to a redefinition of a system's performance (à la Sagasti) and hopefully to the superseding of its current potential. It is a technique of **proactive planning**.

In the last decade or so, most of us emphasize the use of idealized design as a technique of **interactive planning**, with emphasis mostly on participation.

I take no issue with the idea of, or the need for participation. Participation makes a design better, more "objective," and makes its implementation easier. It also may be, and most of the time is, a moral imperative.

But what makes our approach unique, and important, is the **proactive** idea, not the **interactive** idea. There are other techniques that achieve participation, build consensus, and implement democracy. I know of no other technique that even comes close in implementing proactivity.

Can Potential Go Down?

One more point. I noted earlier that one of my assumptions was that a system's potential performance can only increase. I am not sure any more. Maybe limits, such as the finiteness 0f the physical environment, can be captured by rejecting that assumption. How to extend the formal framework to adjust to this situation?

Russ: consider this a small progress report for the last twenty-five years. Will keep thinking about this!

Large Scale Corruption: Definition, Causes and Cures

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1. Introduction.

Corruption at first glance seems like a simple concept. However, most people do not know exactly what is it, how it works, and know less about its consequences. Corruption is an incredibly complex problem. In this paper we take a historical and present day view of corruption to show what corruption can mean to individuals, groups, organizations, and society.

To define corruption and its characteristics is to understand and measure the serious long term effects on development on both developing and developed countries.

Corruption is a social pathology. It has much the same effect on the development of a nation that cancer has on the life of a biological organism. Corrupt networks multiply quickly, inhibit or prevent the healthy growth and development of others and induce social, political, and economic instability. Development and corruption are opposite sides of the same coin. Corruption is present in developed as well as underdeveloped countries

The design and implementation of social measures for preventing and curing corruption require understanding the processes and social conditions that produce it and the structures that nurture it.

2. What is corruption?

Corruption is a social phenomena based on a relationship of complicity.

Corruption is a *social network* phenomena. One does not find corruption in relation to the animal kingdom. Van Roy (1970, p. 93-94), in his study of corruption in Thailand, cited connections as the central feature of Thai society: to secure his place and his future and to improve his lot, the individual in the Thai social order seeks to affiliate himself with those about him who can most effectively and most faithfully serve his purposes.

The structure of a social network is determined by the exchange relationships between individuals or units. Three factors that govern *exchanges* are: the direction of the exchange (horizontal, among same level members, or vertical, in patron-client relationships); the type of resources exchanged i.e. capital, power, information, work, goods, services, loyalty; and the mode of exchange i.e. formal or informal. Exchanges may vary in each culture and organization as to content an acceptable form. Each type of exchange has rules that each individual internalizes from an early age. Lomnitz (1982)

Horizontal exchanges and reciprocity networks.

A *horizontal exchange* is one in which both parties involved perceive the exchange as fair. It usually is done among individuals of similar social or economical hierarchical level. *Horizontal exchanges* are the core of *reciprocity networks* and usually consist of goods, services and information. These networks expand or contract depending of the flow of exchanges among its members. For an individual, a *reciprocity network* is not only a useful mechanism to obtain resources, it is a resource in itself. Mobilization of the network to improve work performance increases his value as employee, and promotion possibilities.

Vertical exchanges and redistribution networks.

Vertical exchanges provide the main channel for resource distribution through the network: capital and power flow downward; and work and loyalty flow upward. The asymmetry of things exchanged condition the level of asymmetry in the relationship. Individuals receive loyalty and service from his/her subordinates, and give loyalty and service to their superiors. As a result of his services and loyalty, an individual receives material rewards and power from their superiors and provides rewards and power to his subordinates.

Where vertical relations prevail, the structure tends to replicate itself at each successive level. Each part is a pyramid with the leader on top and clients ordered in terms of their distance from the top. The leader is a "middle man" who generates resources from his *brokerage* with other structures and distributes a part of these resources to his followers or subordinates in accordance to their level. Loyalty toward the leader determines the social cohesion or solidarity within the group As the network grows, it becomes capable of generating more resources and can support more subordinate positions, more groups and more hierarchical levels.

Corruption involves an exchange between individuals or groups in violation of an obligation or duty. Corruption implies betrayal of trust, therefore it is based on non public or secret exchanges in which denunciation is curtailed. Corruption is based on a *relationship of complicity*.

Definition of corruption.

The literature provides a wide variety of definitions of corruption. Although most of them identify it with deviations from some kind of norm or criterion, they emphasize different aspects of such deviations. The characteristics most frequently emphasized are: agent-client relationships, misuse of public office, infractions of the law, incompatibility with public opinion, and violation of public interest.

Agent-client relationships.

According to Banfield (1975): "An agent is a person who has accepted an obligation to act on behalf of his principal in some range of matters and, in doing so, to serve the principal's interests as if it were his own. An agent is *personally corrupt* if he knowingly sacrifices his principal's interest to his own. He is *officially corrupt* if, in serving his principal's interest, he acts illegally or unethically albeit in his principal's interest" (pp. 587-588).

Alatas (1991) uses exchanges in order to define "*transactive* corruption, were there is a mutual arrangement to the advantage of the agent and the party directly served", as well as "*extortive* corruption where the party directly served is compelled to pay the agent in order to avoid harm being inflicted upon his person, his interest, or upon those persons or things dear to him" (p. 3)

Misuse of public office.

The widespread popular understanding of corruption as misuse of public office is indicated by its dictionary definition: "inducement (as of a public officials) by means of improper considerations (as bribery) to commit a violation of duty". (Webster's Third New International Dictionary, 1961)

The World Bank defines corruption as the abuse of a public office for private benefit (Whitehead, 1999, p.16). McMullan (1961) wrote: "A public official is corrupt if he accepts money or money's worth for doing something that he is under duty to do anyway,

that he is under duty not to do, or to exercise a legitimate discretion for improper reasons" (pp. 183-184).

Van Klaveren (1963) extended the concept to an organized behaviour of a public official: "A corrupt civil servant usually regards his public office as a business through which he will seek to maximize payments for favors given related to his position. The office then becomes a *maximizing unit*. The size of his income depends upon the market situation and his talent for finding the point of maximal gain on the public's demand curve" (in Heindenheimer, 1970, p. 5).

Infractions of the law.

Some say that corruption is what the law defines it to be; for example, *malfeasance*. Those who take such a position maintain that behavior should not be considered to be corrupt unless the law explicitly forbids it. A legal definition of a common form of corruption is provided in section 161 of the Indian Penal Code: "Whoever, being or expected to be a public servant, accepts or obtains, or agrees to accept, or attempts to obtain from any person, for himself or for any other person, any gratification whatever, other than legal remuneration, as a motive or reward for doing or forbearing to do any official act or for showing favor or disfavor to any person, or for rendering or attempting to render any service or disservice to any person, with the Central or State Government or Parliament or the Legislature of any State or with any public servant as such...[is guilty of corruption]". (Monteiro, 1966, p. 17).

Incompatibility with public opinion.

Aikin (1964) defined corruption as an act involving a violation of public duty or departure from high moral standards in exchange for personal pecuniary gain, power or prestige. Such conduct may be illegal or may constitute departure from ethical standards without violation of law (p. 142). Therefore, legislators who pass laws that provide tax loopholes for the rich are corrupt, despite the legality of their action, because they sacrifice public interest.

The greatest difficulty that arises from reliance on public opinion is its cultural relativism. For example, in 17th century France the selling of public offices was considered to be perfectly legitimate.

Violation of public interest.

The notion of *public interest*, albeit vague, ambiguous, and difficult to operationalize, has been used by some to define corruption. For example, Heidenheimer (1970) quotes Rogow and Lasswell (1963) as follows: "A corrupt act violates responsibility toward at least one system of public or civic order and is in fact incompatible with any such system. A system of public or civic order exalts common interest over special interest; violations of the common interest for special advantage are corrupt" (p.6).

From the previous review we can point out some characteristics of corruption.

- Corruption involves a violation of duties or obligations. These may or may not be legally specified.
- The obligation to serve a party can be direct or indirect.
- Any public or private agent may be engaged in corrupt acts.
- Corruption can be restricted to the actors directly involved in the exchange or may deal with complex patterns where several hierarchical levels participate.

- One who induces corruption in another to obtain a benefit for himself or his client is also corrupt.

Therefore:

A party is corrupt if:

he has a (financial, legal, or moral) obligation to serve directly or indirectly a second party, but serves him in such a way that the second party's interest is sacrificed to his own;

or

he induces another party to be corrupt.

Large scale corruption

The size, strength and structure of a corrupt structure is directly related to its resources, the people involved and the time it has been in operation. In general, more resources, time and people implies a bigger and better organize network. The economic effect of corruption, in a given period, is the product of three factors:

- The *amount* of resources extracted in each corrupt action.
- The *frequency* of corrupt actions.
- The number of *people* involved.

In terms of its economic effect, corruption can be divided in two classes: *small* and *large* scale corruption. *Small scale corruption* produces just enough resources to complement the income of one or few individuals. *Large scale corruption* generates vast resources, that permit growth and the purchase of protection. *Small scale corruption*, when it does not evolve into large scale, tends to be controlled by the victims or the supervisors.

Large scale corruption is seldom an isolated event. Generally, sets of corrupt individuals are linked and support each other through networks. Corrupt individuals often try to maintain their position by involving their supervisors and/or setting up a relationship of complicity with their victim, whereby the victim will be caught. If the victim denounces the corruption, he will expose himself as well.

Causes of large scale corruption.

Review of the literature.

To understand how large scale corruption emerges and takes hold in society asks us to examine its roots and causes.

Bad men.

Explanations of corruption are as old as corruption itself. In the 10th century Wang An-Shih, a Chinese Philosopher, said it was the result of "*bad laws and bad men*" (quoted by Sherman, 1974b, p. 1). Machiavelli viewed corruption as a process that destroys whatever virtue citizens have. It is ever threatening, he argued, because ordinary men are weak and not very virtuous. Therefore, citizens must be properly guided by a great leader who can infuse others with his own virtue. Without such a leader, corruption thrives and spreads.

Leadership's reputation for integrity is an important factor affecting the amount of corruption within an organization. As Sherman noted, nonexemplary behavior by a leader produces cynicism which is conducive to corruption; but exemplary behavior may provide the best incentive to honesty.

Protection of self interest of groups or individuals.

The issue of loyalty to the tribe, caste, clan, or extended family versus loyalty to the state has been mentioned by Wraith and Simpkins (1963), Bayley (1966), McMullan (1961), and Smelser (1971), among others. Scott (1968, p. 48) looked at corruption from a minority's point of view: Where a minority is discriminated against and its political demands are regarded as illegitimate by the governing elite, its members may turn to the corruption of politicians and/or bureaucrats to safeguard their interests and avoid damaging political attacks from more powerful groups.

Bad laws.

McMullan (1961) pointed out that all prohibitory laws put certain individuals or groups at a disadvantage, those who wish to do what the laws forbid. Therefore, such individuals or groups may be drawn to corruption as a way of evading such laws. For these reasons import-export regulations, and taxes, are major incentives to corruption.

Ramsey Clark (1970), the former Attorney General of the United States, maintained that moralistic and/or unenforceable laws are the basic causes of police corruption. He argued that laws which are inconsistent with public morals create pressure on the police to enforce them selectively, and this is conducive to corruption.

Sunday-closing laws and construction-site regulations have been particularly exploited by the police in the United States as a source of graft (Sherman 1974b, p. 24; Gardiner and Lyman, 1978). Victimless crimes in which illegal transactions take place with the consent of the parties directly involved breeds corruption, for example, prostitution and gambling (Geis, 1972, and Schur, 1965)..

Pathology of the body politic or the market structure.

Rousseau argued that it is not the corruption of men which destroys the political system but the political system which corrupts and destroys men. He saw the proper function of the political system as insuring and maintaining equality against the corrupting influence of power-hungry individuals. Merton (1968, pp. 126-136) regarded *political machines* as structures that "perform positive functions which are at the time not adequately fulfilled by other existing patterns and structures". Therefore attempts to abolish this *machine* without making adequate provisions for alternative structures to carry out its functions would inevitably fail.

Monopolies relegate client satisfaction to a secondary position. Monopolies are prone to resort to corrupt practices in order to restrain alternative suppliers to preserve their condition as sole provider of goods or services.

Ineffective control systems.

The extent to which individuals or groups are drawn to corrupt practices, depends upon the profits to be made, the ease with which the law can be broken, and the level of public support of the law. A small likelihood of detection of corrupt activities and soft of penalties associated with such activities are one cause of corruption. Large scale corruption generates a sense of impunity for the corrupt persons, and impotency to the public. People believe that nothing can be done to fight corruption.

The lack of effective internal and external investigative units is a cause of corruption. Sherman (1974b) argued that where internal investigative units operate, a greater risk of apprehension and punishment for corruption is perceived, hence there is less undiscovered corruption.

Bureaucracy.

The slowness and cumbersomeness of bureaucracies have been identified by many as a major cause of corruption. The use of so-called "speed-money" is a very common type of corrupt practice in developing nations. The Santhanam Committee (1964) reported: Generally the bribe giver does not wish....to get anything done unlawfully, but wants to speed up the process of movement of files and communications relating to decisions. This custom of speed money has become one of the most serious causes of delay and inefficiency (pp. 9-10).

Comments.

When one views corruption as the product of corrupt people, the question is, how do people become corrupt? Virtues and follies are evenly distributed in society. Frank Serpico, the honest New York policemen stated: "Ten percent of the people in the police department were unalterably corrupt, ten percent were unalterably honest, and the other eighty percent wished they were honest" (quoted by Duchaine, 1979, p. 126). Virtue and corruption weights more as more influential are the persons. Leadership is where corruption spreads and also where it can be controlled.

Moralistic, unenforceable, and prohibitory laws put certain individuals or groups at a disadvantage, those who wish to do what the laws forbid. Therefore, such individuals or groups may be drawn to corruption as a way of evading such laws. Import-export regulations, taxes, Sunday-closing laws, construction-site regulations, and prostitution and gambling are major incentives to corruption, and are used by organize groups as a basis for their corrupt activities.

Large scale corruption emerges not of a single cause, like people, laws or bureaucracies, but as a product of complex interactions of all factors, articulated by *power networks* that profit and grow by exploiting the opportunities that arise. They actively transform programs, laws, and organizations in a source of additional revenue for them. Bureaucratic organizations are an effective instrument of corrupt groups.

Large scale corruption is sustained by power networks.

Large scale corruption is linked to *power networks*, a social network that functions through *horizontal and vertical exchanges*. It may behave as an organization or as a network adapting to the prevailing conditions i.e. as in a *systemic network.*

Systemic networks are structures that have the dual capacity of behaving as a network or as a system. System and network states coexist in a systemic network. Its ultimate potential lies in the capacity of adopting the appropriate form for a given situation. The members of a *systemic network* must: have a disposition to act jointly based on trust, compromise and motivation; have the capacity to carry out the necessary tasks to confront a crisis or exploit opportunities through a common language and conceptual frame; identify under what conditions to behave as a network and in which conditions as a system. *Corrupt power networks* are examples of *systemic networks*. They are formed by individuals engaged in profitable illegal activities. Large scale corrupt activities involves cohesive groups. In normal conditions, these groups work like a network. But, when a member is threatened, the group materializes as a system. (Carvajal, 1985, p. 860)

A *power network* may or may not be corrupt, however large scale corruption is always sustained by *power networks*.

Components of a power network.

In order to operate and survive, a *power network* requires five capabilities:

Economic. A continuous flow of resources is required to operate, grow, maintain an equilibrium with other power groups and, in the case of corrupt networks, give them the resources to buy protection.
Political. A power network needs friends in influential positions in order to: maneuver payoffs; thwart regulations contrary to their interests; prevent infringement of their territory of other power networks; influence government and legal bodies; promote allies with key political positions; and to neutralize *immunosuppressive systems*.
Technical. The operation of a *power network* requires information and knowledge. Businesses that can produce additional payoffs are actively sought. Sometimes corrupt groups operate companies that provide some products or services . They require privileged information about other networks and, especially, about the *immunosuppressive systems*.
Physical. Physical retaliation may be exerted directly or indirectly (i.e. private police) by the *power network*. Physical power may be used to prevent others from exposing or limiting the operation of the network.
Ideological. The *power network* needs to be perceived positively by its members, by the public and other institutions in order to maintain cohesion and avoid a massive eliminatory reaction against it. As it grows, it is more in the public eye.

Even though a *power network* may derive its strength from one of the components, it must have a basic capability in each of the five components. For example, a *power network* whose strength is derived from its economic capability based on legitimate business (such as a large corporation) also requires political capability. It could resort to corrupt practices when there is an effective way to achieve its goals or secure its position. The distastefulness and risk of exposure is perceived to be small compared to the potential gain. The corporation would coerce or bribe individuals within the political system to do their bidding.
A network with a political power basis, such as a political machine, requires economic resources to operate. Additional resources allows them to incorporate new allies, reduce the strength of enemies, and increase the reward to its members. Growth, however, generates the need for more resources. If non-corrupt options are exhausted they will resort to corrupt practices. The bigger they get, the harder it becomes to stop them.
Power networks are not purely corrupt or legitimate. Corrupt practices may be present at some stages and may be absent in others. For example, a *power network* in its initial stage of growth, may generate vast amount of resources through corrupt practices. Once its basic operations are established, it may operate legitimately.
In general, large scale corruption is related to the growth and survival of *power networks*.

The police and legal system are institutions that society developed to maintain corrupt networks. For this reason, they are the primary target of large corrupt networks. Corrupt networks need a weakened *immunosuppressive system*. In societies where the legal system is weak and corrupt, it is very difficult to generate strategies to fight corruption, but, more importantly, to promote development.

3. Dynamics of large scale corruption.

The size and stability of a corrupt structure is limited by the enemies it has.
Corruption implies a default on an obligation that result in personal gain. Corruption is essentially to cheat, steal and betray (Alatas, 1991, p. 8). The people or entities that suffer

the effect of corruption may be directly affected, as in extortion, or indirectly affected i.e. the case of a corporation that obtains an unwarranted tax break.

The ability to carry out corrupt acts requires power to overcome the resistance or opposition of the victims. When corruption seriously affects an institution or part of society it triggers a reaction by those entrusted with the task of preserving laws, norms, and the proper operation of institutions. The *immunosuppressive system* of the institution or the society is activated.

In order to survive, the corrupt structure needs to neutralize the *immunosuppressive system.* It will attempt to involve people in key positions to protect itself against attack and elimination. In particular, it seeks to mitigate the harm to the victims directly involved, and if possible, make them accomplices.

Individual corruption acts are usually discovered through detection or denunciation either by a supervisor or by the victims. This type of corruption *is not stable*. Corruption practiced by power networks *is stable*. If a civil servant repeatedly solicits payoffs for simply carrying out the duties of his office, he may be easily stopped either by denunciation by the victim or by detection by his superior. If the civil servant enters into a relationship of complicity with the victim, either by providing him special service or a service for which is not entitled, the corrupt act will continue as long as it is not detected. The most stable situation occurs when he acts in complicity with his superior and victims.

Large scale corruption is an emergent social process.

An *emergent social process* that leads to a corrupt network has four phases: *setting the corrupt nucleus*, expansion through a *network* of accomplices, *exponential growth*, and *stabilization*. (Figure 1)

In the *initial stage* the setting of a corrupt nucleus is initiated by a party who: seeks additional resources; feels that they are not justly rewarded by their employer; is a part of an actual or previous external corrupt network; feels that his employer or the government is his enemy; or for any other reason, betrays the trust deposited with him. Corruption can be initiated externally. For example a politician that belongs to a power network is *rewarde*d with an appointment in an governmental regional office. From the time he sets foot in his new office, he seeks ways to profit from his position for personal gain and to support the network. . In short time he organizes an internal corrupt power network.

In the second stage, the individual seeks to expand the network by involving other people, specially his superiors and those capable of exposing him. The members have become accustomed or *addicted* to the extra money, therefore more resources are required, making it more likely to be detected. If the corrupt network is not detected, or is tolerated by key actors, the network will continue to grow. As the effects begin to be noticed, complaints from the victims arise and the corrupt acts in the operation of the organization become evident. If the network is perceived as a threat, an elimination or *immunosuppressive* reaction may be triggered by the “guardians” of the organization. To insure survival the network incorporates key people who can protect them. The corrupt nucleus evolves into a corrupt network.

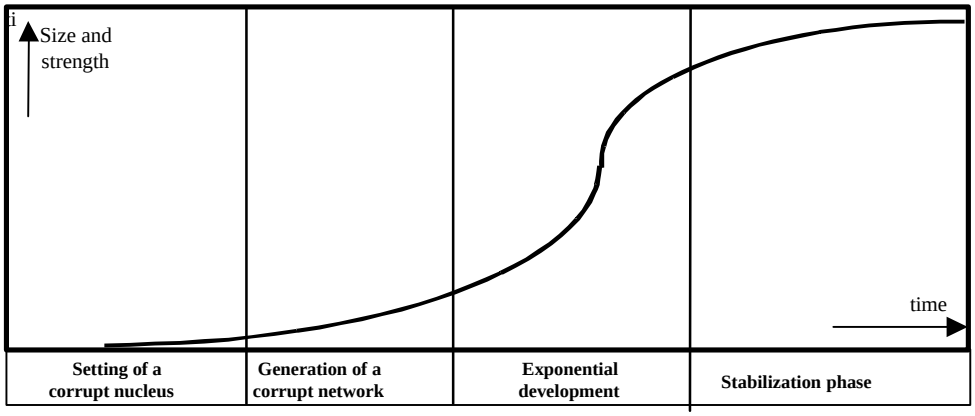

Figure 1. Development of a corrupt power network.

In the *exponential growth stage*, the corrupt power network expands inside and outside the organization that harbors it. As the corrupt network grows it requires more resources. The corrupt acts in one sector spread to other sectors. An internal protective system is established to prevent its neutralization or elimination. The corrupt network overtakes a substantial part of the organization, and involvement or tolerance of the main executives is needed.

In the *stabilizing stage*, the corrupt power network establishes a routine or normal operation and it has reached an equilibrium with other existing networks and with the *immunosuppressive system.*

Where the *immunosuppressive system* is strong, few networks reach the *stable* or exponential stage. (Figure 2).

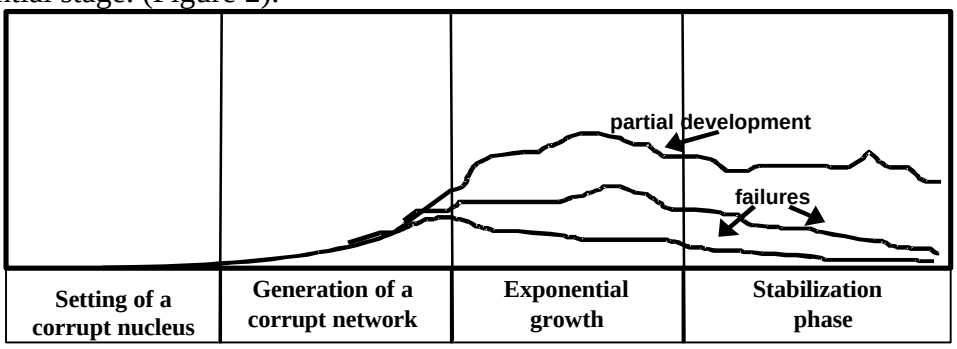

Figure 2. Unsuccessful development of a corrupt power network.

An example of an emerging corrupt network is a purchasing agent that accepts a bribe from a supplier. In the initial phase, the agent buys products or services from a supplier that are *needed*, in the correct quantity, at the required quality, and at a fair price, but receives a kick back from the supplier. The corporation for which he works does not suffer. In fact, he is getting some kind of special discount that is not transferred to the company. The agent may feel that he/she is getting a "bonus" for the good service he/she is providing to the company. But with this act he/she initiates a complicity relationship with the supplier. The agent may continue receiving payoffs as long as his/her performance is satisfactory and the activity is not detected by his superior or other part of the *immunosuppressive system* of the company. The victims, in this phase, are not within the company, they are the other suppliers who did not get the orders.

When the agent becomes greedy or the supplier reduces the quality of the products or services, a new phase of corruption is initiated. The agent, now accustomed to the extra money seeks larger amounts. As long as the agent continues to bribe the purchasing agent, the supplier does not have to compete for a contract in terms of price and quality. If the agent wants to switch suppliers he may be exposed because he has become a hostage of the supply company. The supply company must continue to grant favors or payoffs otherwise he may also be exposed. The agent and the supplier are entrapped in the network. As a consequence, the quality of goods or services decreases; the amount purchased becomes greater than necessary; products or services that are not needed are acquired; and/or the price is increased. The agent justifies his corrupt behavior as compensation for the lack of recognition and compensation from the company for his valuable services. As the effects begin to be noticed, the head of the purchasing department receives complaints from the customers of the products or services, inventories grow, and information about the payoffs leak out from the other suppliers. The agent, to insure his survival in the company, must incorporate the head of the department or another executive who may protect him.

In the exponential phase, as the network grows, it incorporates key elements inside and outside the company. The corrupt agent gives rise to a corrupt network.

4. Effects of large scale corruption.

Large scale corruption is a major obstruction to development.

Sociologists stress the futility of trying to check corruption by focusing only on it. To fight corruption for its own sake is a lost battle. The type of corruption that must by combated is the one that posses the mayor obstacle for development.

Large scale corruption is a powerful enemy. To acknowledge it as an enemy is to invite personal danger. Many of those who benefit from corruption, and particularly those who benefit from large scale corruption, can cause harm to those who discuss it openly. The principal beneficiaries of corruption are often in positions of power and can command the resources required to incapacitate or reduce the security of those who bring it to public attention and those who are dear to them.

Large scale corruption cannot be attacked by government without the involvement of the governed, nor by the governed without the involvement of government. It is a systemic problem that requires all parts of the system to work together in harmony. The design and implementation of social measures for preventing and curing corruption require understanding the processes and social conditions that produce it and the structures that nurtures it. The key to such understanding as is required to bring about the necessary social changes lies in the facts that *large scale corruption is a major obstruction to development.* Where corruption is rife long term development is impossible.

The vast majority of proposals for the containment of corruption really presuppose development, but *the same factors that sustain large scale corruption are the ones that oppose any effort, needless to say an overall planning effort, to promote development*.

Development must lead the strategy to control corruption.

An understanding of corruption presupposes an understanding of the nature of development, and of what society must do to encourage and facilitate it.

On the Nature of Development and its Pursuit (Ackoff, 1994).

Development is not a condition or state defined by what a person has. *It is a process in which an individual increases his ability and desire to satisfy his own desires and those of others.*

A government cannot develop the governed. The most it can do is *encourage* and *facilitate* such development. But, on the other side, a government *can prevent the development* of many individuals, groups and organizations.

There are five pursuits that are individually necessary and collectively sufficient for the development of man: the pursuits of *truth, plenty, good,* and *beauty*. The fifth one, *politics* is concerned with the way society is organized to perform these functions: the way its work is divided and coordinated.

A *scarcity* of any of the five functions that are necessary for development is an obstruction to development.

Science and technology

McMullan cited as a source of corruption the divergence of a literate government and an illiterate society. This breeds a sense of defenselessness in illiterate persons when they deal with government officials (p. 184).

The greater the ignorance of people, the more susceptible they are to voluntary or compulsory collaboration with those who are corrupt and who offer to provide them with something they desire. The more ignorant such people are, the easier they are to manipulate. The ignorant are least likely to resist exploitation by others.

Economics

The ignorant are easily tempted into collaboration and support of the corrupt. If the ignorant are also impoverished they are even more susceptible to such collaboration and support. They are easily induced to engage in such activity by small payments that relieve their poverty, even if only temporarily.

Donald Cressey's (1953) argued that trusted persons become trust violators when they conceive of themselves as having a financial problem which is non-sharable, are aware that this problem can be secretly resolved by violation of the position of financial trust, and are able to justify their own conduct (p. 30). Cressey reported that the most common justification is that they are just "borrowing" the money and intend to return it without causing harm to anyone.

The greater the poverty and maldistribution of wealth, the less distinction is made between "clean" and "dirty" money. The known criminal who has accumulated wealth is more respected in a poor community than in a wealthy one. The law, therefore, is less a deterrent to power, prestige, and status than is a reduction in poverty.

Inadequate compensation has been mentioned by Monteiro (1966) as a cause of corruption in public officials. In many cases the great powers of these officials are not reflected in their pay and this tempts them to use their powers for personal benefits. No amount of compensation seems *adequate* to high-level officials who live beyond their means.

Ethics and Morality

Not only is corruption tolerated, but it is often condoned in less developed communities. Corruption is seen by the disadvantaged as a way of bringing about a more equitable distribution of wealth; that is, robbing the rich to benefit the poor. In general, whenever government restricts strongly favored choices of people at least some of them try to

corrupt government officials so to have the constraints removed. When a law puts government in conflict with public morality, behavior is seldom changed and corruption is invited as a way to avoid paying the *legal price* for not changing. For example, this is the case when the law creates *victimless crimes* such as gambling and prostitution. Such laws seldom work but they do succeed in creating a corrupt power network in which police are bribed by gamblers and prostitutes to ignore their infractions of the law.

Aesthetics

There are two aspects of aesthetics: *recreation* - the satisfaction derived from what we do independently of what it is done for; and *creation* - the satisfaction we derive from a sense of progress towards ideals. Creation provides us with inspiring visions of ideals and *pulls* us toward them; as recreation it makes the pursuit of ideal rewarding enough to *push* us toward them. When one's life seems to "be going nowhere" life becomes meaningless. Those who find no significance in what they do, lack any sense of personal development, and see no role for themselves in society usually lack a vision of a better life and any hope that such a life could be obtained even if it were visualized. This is why the disadvantaged are so susceptible to recruitment into ideological movements, into political or religious crusades or into criminal and corrupt causes. Such movement gives them something to live for.

Zeitlin (1971), identified job dissatisfaction as the major cause of pilferage in retail stores. He argues that most retail-store jobs offer limited chances for advancement, no decision-making powers, and boredom; they rank high on all three dimensions of alienation. In this situation, "pilfering is both a way of getting back at the system and a means of introducing intellectual and physical challenges into everyday tedium." (in McCaghy, 1976, p. 181). Dalton (1959) observed that such pilferage can be regarded as an unofficial self-reward: compensation for unsatisfying work. Both Sherman (1974b) and Monteiro (1966) have noted that when there is little opportunity for advancement within an organization, cynicism and corruption tend to follow.

Alienation from a bureaucratic public or private system is often cited as a cause of corruption. Gharajedaghi (1980) identified dimensions of alienation as: powerlessness, rolelessness, and meaninglessness.

Politics.

Politics has to do with power. The proper function of the political system is to insure and maintain equality against the corrupting influence of power-hungry individuals. The powerful can often encourage corrupt selling and buying of opportunities. The more powerful the powerful are, the less the risks in corruption, hence the more corruptible they are. Complete deprivation of power, powerlessness, breeds alienation from society and abdication of any sense of responsibility to it. Thus the powerless make fertile ground for corruption. The powerful are equally inclined to corruption as an effective means of making it secure. From these facts derive the familiar aphorism: "Power corrupts," but powerlessness does too.

5. An example of the effect of large scale corruption on development.

The effect of large scale corruption on development can be traced through the case of a government institution, *Crupté*, in a developing country. The purpose of *Crupté* was to promote the development of small farmers through credit and technical assistance. *Crupté* was part of a system of government institutions.

Small farmers were not usually eligible for loans from private institutions. At best they were subject to local merchants and loan sharks who charged outrageous interest rates. Therefore, *Crupté* was a welcome means to free the farmers from exploitation.

Many of the farmers used the same products, therefore, a significant part of the proffered credit consisted of required materials for farming. The rational was that better prices could be attained through purchasing in bulk. Through dispensing products and services instead of cash, as an encouragement to the farmer, it was hoped he would be more likely to repay the loan. Government companies supplied the products at lower prices than private companies.

A serious problem for farmers was to get their products to market. Local merchants usually paid prices well below the market level, but were the only option available until this time. To stimulate and encourage production and increase farmers' income, a price-support program was initiated by the government through a Basic Commodity Agency. As a complementary measure, *Crupté* established a special department to assist the farmer in the sale of their crops.

A government insurance agency insured the loan by accepting the crops as collateral for the loan. Therefore, if the harvest was lost due to natural or unpredictable causes, the insurance agency paid the loan to *Crupté.*

Over time, *Crupté* gradually deteriorated due to two emergent processes. As it started up operations in areas where local merchants were firmly entrenched, local executives and employees of *Crupté*, together with the merchants, constituted a local *power group.* At national level the main executive posts at *Crupté* were allocated through political selection, that is, to members of national *power groups*. Therefore, *Crupté* was infiltrated by corrupt *power networks* that deformed the purpose of the institution and thwarted those who tried to work in an honest and efficient way**.** The *power networks* transformed the *Crupté* operation into their private business.

The most common forms of corrupt acts were:

- Loans were processed only when a kickback or payoff had been agreed upon beforehand; suppliers were bribed; jobs were given to friends and allies.
- Prices of inputs were artificially increased, quality was reduced, quantities were altered.
- Unnecessary products and services were purchased or contracted, inventories increased beyond reasonable expectations.
- Sale of acceptable product as if it was defective only to be later resold at a profit.
- Crops sold through *Crupté* were reported as being sold at a lower price.

In order to extract wealth from the system, they generated: waste, reduction in production, negative reactions from the victims, and growth of *power networks*.

Waste. In order to eke out extra income, unnecessary jobs are created and unneeded products were acquired. Estimated loss was 6% of the loans proffered.

Reduction in production. Low quality raw materials generated a reduction of useful production. The estimate of this was a loss of 21%.

Negative reaction from the victims. Reduction in the quantity and quality of the materials and products, and the required payoffs in order to receive the loans, angered many farmers. At this point the default ratio was about 15% of the loans extended.

The resources diverted toward the networks was estimated to be 17% of the total loans extended. The additional waste, resultant loss in production, and increment of the default on loans ratio amounted to 42% of the total loans extended. That is, for each dollar embezzled there was a resulting loss of 2.5 dollars. The annual loan operation of *Crupté* was estimated to be 1 billion dollars.

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The corrupt networks reached such a level that the government had to disassemble the agencies. At the present, *Crupté* has been reduced to one seventh of its original size, the government goods and supply agencies have been sold outright to the private sector, the insurance agency was eliminated, and the Basic Commodity Agency is practically nonexistent.

Development requires careful and intelligent planning

Large scale corruption seen over a long time period gives perspective, and can elucidate problems that are not as yet solved. The previous example is part of a long and complex process. The now extinct set of government agencies were designed to solve a previous large scale corruption situation: *local power networks*. Before the formation of *Crupté*, *local power networks* dominated several outlying areas in the country. Small farmers were crudely exploited. Loans were set using exorbitant interest rates, seeds and fertilizer were overpriced, and the farmers were obliged to sell their produce well under market value.

Just as *Crupté* was developed as a solution to the exploitation and corruption of the *local power networks*, the *local power networks* had been a solution to a chaotic decade of civil strife. After a protracted war, in order to appease local military chieftains, the government awarded them resources and political power that eventually gave rise to the *local power networks*. Benefited by peacetime, the chieftains garnered power while depleting the meager resources of the farmers.

> *Historically the programs that were set in place were conceived as solutions to a dilemma. Overtime, each solution, in the face of human shortsightedness and lack of control, gave rise to new problems and structures that grew uncontrolled until they had to be replaced. Without securing control and management of the processes and power structures, history is bound to repeat itself. Development can not attained without careful intelligent planning.*

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MANAGING COMPLEXITY THROUGH PARTICIPATION: THE CASE OF AIR QUALITY IN SANTIAGO DE CHILE

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Abstract. *Three concrete results have been achieved over a five-year period in Santiago de Chile, in a process addressed to managing through participation the difficult air quality situation of this 5-million metropolis: (1) A highly complex problem has become manageable; (2) A legitimate and effective Prevention and Decontamination Plan is in operation; and (3) Citizens and the Government are mutually committed about this process. This paper describes how these results have been achieved by applying Innovative Development, a social systems methodology developed by the author and co-workers over the last 20 years, and also applied in many other fields. The first section of the paper provides a look at the actual complexity of the problem to be discussed. The second one describes the results achieved in some detail. The third explains why a participative methodology is necessary for dealing with a highly complex problem like the current one. The fourth one provides a brief outline of the Innovative Development methodology. And the last section presents the case itself by describing the three stages that can be distinguished in it. In the short space available we have tried to balance the practical, methodological and conceptual issues of this case and this approach.*

I A LOOK AT THE PROBLEM'S COMPLEXITY

The story presented in this paper starts in 1994, when the implementation of a first Master Plan for cleaning Santiago's atmosphere, through a Special Commission, had just been completed. It was indeed a successful Plan of the government of President Aylwin, through which Chile had returned to democracy: It received top government support throughout its design and implementation and it demonstrated beyond doubt that democracy could be more effective than dictatorship for facing the real problems of the people. Santiago's air quality clearly improved over these years; a key indicator showed that the number of pre-emergency and emergency episodes declined steadily, from 13 in 1990 to only 4 in 1995.

Yet Santiago's air quality remained a complex challenge, and as the Hydra it showed many heads.[16] Its was far from complying with the established air quality standards, for both particulate matter and ozone. While concentrations of small particulates (PM-2.5) had been

[16] This metaphor belongs to Dr. Raúl O'Ryan, a former student of the author at whose initiative the process presented herewith started. The current section is based on O'Ryan and Del Valle, 1996.

falling, concentrations of larger particulates had increased and the rate of reduction in these pollutants was too slow to reach the desired quality standard in reasonable time. The ozone standard was being violated over 30 percent of the time in the city; notwithstanding, the Master Plan was introducing natural gas, which would increase ozone significantly within a few years. New problems were surfacing, such as pollution by sulfates and polycyclic aromatic hydrocarbons. A compensation system for freezing industry emissions seemed still far from implementation.

The Master Plan consisted basically of technical measures geared to reducing emission factors. At the start of the process to be described presently, it was not clear which could be the degree of consolidation and permanence over time of such measures. It was equally unclear what ought to be the *complete* scope of additional actions that could ensure that the city would actually meet its air quality standards. Moreover, there was no coherent consideration of many other actions that do affect the city's air quality: construction of new roads, housing projects, transport system, urban development plans, energy use. In the absence of such measures, there was no assurance that air quality would not revert as the city continued to grow in extension, the demand for trips continued to rise, and the circulation of cars continued to increase. As a transport study had suggested, "the rate at which the problems are solved or reduced is generally lower than the rate at which they are created or exacerbated" (CEPAL, 1995).

The usual way of facing such problems was trial and error. Trolleybuses were common in Santiago until 1978, when they were dismantled; in 1992 two private lines that crossed the downtown area were initiated, promising that in the near future 300 trolleys for a total investment of US$ 60 million, would be in operation; two years later, however, the trolley company filed for bankruptcy and left a debt of US$1.5 million. Testing of less contaminating bus technologies had been proposed but never carried out thoroughly. Bicycle paths and parking facilities had been constructed only to be left in disuse and disrepair. Bus fare collectors had been used in some lines, and then disappeared. A daily restriction to the circulation of 20% of cars, meant for emergencies, had become permanent and was going on for 9 months each year; many observers blamed it for the growth in the number of cars and for congestion, as people tended to buy additional ones for skipping the restriction day.

The institutional side of the problem was also difficult enough. Responsibilities related to air quality in Santiago were dispersed among 8 Ministries, 32 Municipalities, three other public services, the state-owned petroleum company, the just-created National Environment Commission (CONAMA) and the Regional Government of the Metropolitan Region. Under the new government of President Frei, no one held sufficient power in this scenario and the Special Commission, that had carried out the Master Plan under the powerful aegis of the Minister of the Presidency, was simply becoming the regional office of CONAMA, with only a handful of lawyers, engineers and other professionals. Moreover, it was also required to deal, at the broader scale of the Metropolitan Region, with other environmental problems such as sewerage and solid waste.

II WHAT HAS BEEN ACHIEVED TO DATE THROUGH PARTICIPATION?

Following a four-year period of systemic and participative work with the Innovative Development methodology, which included the formulation by the government of a new Decontamination Plan, three concrete achievements could be identified at the end of 1998[17]:

1. **A highly complex problem has been turned manageable.** Through methodical participation, an integrated vision of the challenge of cleaning Santiago's air has been created. By bringing together the views of all significant actors, this vision covers the whole scope of this problematic situation of the city. It shows explicitly that this situation has many dimensions, which interact, and that it cannot be simplified. Furthermore, it is an action-oriented vision, which provides directly a structure for managing the decontamination process. It is called the *Management System of Santiago's Air Quality* and is presented by means of the Innovative Development tool called *action map*. This is a vision that has already evolved, reflecting the learning process in decontamination that the city is going through.

2. **A legitimate and effective Plan is in operation.** The participative process that contributed to preparing the Prevention and Decontamination Plan gave it *legitimacy*, by obtaining its proposals directly from representative citizens of Santiago. It also gave the Plan *effectiveness*, by examining each one of its proposals from all viewpoints for ensuring its practicality. Finally, the participative process made all this particularly strong by reaching *consensus* for all its proposals.

3. **Citizens and government are mutually committed.** The participative process has evidenced high commitment and motivation from both citizens and government officers. Hundreds of citizens have given freely their time to participate in seminars and workshops. A leading group of citizens has played a decisive role in guiding and coordinating the process. Three actions that for Chilean culture are pioneering have already been practiced in the Plan's follow-up activities: (a) government officers gave account of their work to the citizens; (b) citizens made evaluations of progress made; and (c) citizens proposed priorities for government action.

III WHY A PARTICIPATIVE METHODOLOGY?

In this section we will provide grounds for using a participative methodology which go beyond the commonly accepted view, in the policy making world, that participation

[17] This section and the final one follow a presentation made at the opening session of the Launching Workshop for the Clean Air Initiative in Latin American Cities, sponsored by the World Bank (2-4 December 1998). The presentation's transparencies have been requested for publication in the Initiative's web site: http://worldbank.org/html/edi/cleanair.

humanizes and legitimizes action and is thus desirable. Such a view often leads people with a humanistic and democratic outlook to favor it uncritically, regardless of how effective participative action might be in actual practice. We will argue for a different notion, namely, that participation is the only way to face complex problems effectively, provided it is carried out with the appropriate concepts and methods.

Santiago's air quality situation is typically complex, problematic or *messy*[18]. Some characteristics that people usually observe, and especially feel, in complex situations like this are:

- Infinity of themes: More every day.
- Infinity of related institutions: More every day.
- All disciplines apply and it is difficult to decide which one to start from.
- A feeling that others are simplifying the issues.
- Feelings of agreement and disagreement.
- Difficulties in communication: Are we talking about the same thing?
- Even greater difficulties for acting: Things appear to move backward more often than forward.
- Everything seems to be related to everything: Where is the thread?
- The usual trial and error tactics help little: experiments, pilot projects, starting at a part of the problem, setting priorities, etc.; in spite of them, complexity remains.
- The analytical tactics help even less: whenever models or detailed studies are done from the perspective of any discipline, the above characteristics are perceived to be amplified; as a result of this, complexity increases.

Complexity is then a characteristic of social reality which cannot be faced effectively with the usual tools available. How do we face it in Innovative Development? We start by understanding complexity as the output of observation processes rather than a property of the things observed. Judging that something is complex means that the observer's description instrument does not have the capacity to give an adequate account[19] of the thing observed. For instance, if a regular user opens his computer, he will find it overly complex for lack of command of the distinctions necessary to describe it; but a computer specialist may probably find it simple.

In the practical world there are always *observers* which utilize *conceptual frameworks* to give account of *observed things*. If somebody judges some particular situation to be complex, he is in fact acknowledging that his conceptual framework falls short of

[18] Ackoff gives, in the sense shown, a technical meaning to the term "mess", and includes the "formulation of the mess" as a methodological step (Ackoff, 1981, Chapter 4). His approach to this opening step is intuitive, however, with no precise specification. The equivalent procedure in Innovative Development involves formulating the *action map*, a tool for which the specification will be given presently.

[19] The term "account" rather than "explanation" is used here, since the concern is with conceptual frameworks rather than with theories.

describing it in full.[20] Such a judgment means usually something else: That the situation is not only beyond his understanding, but also beyond his control. If he used his framework for managing the situation he would find it non manageable.

We can now take one of the key steps of our approach, by asking the following question, which reverses the direction of the previous argument: *Could we specify a particular class of conceptual frameworks that may have the property of giving account of any real-world situation, as seen by multiple observers, to the satisfaction of these observers?* If we could, both the understanding and the practical management of complex social systems could be considerably improved, with respect to the capabilities offered to date by the trial-and-error and the analytical approaches. We have found that in fact we can do so, both conceptually and in practice:

- Conceptually, we have specified the tool we call *action map*, by means of which any complex social system may in principle be described through its actions -both actual and potential- (Del Valle, 1992). This tool will be introduced in the following section.
- In practice, we have conducted dozens of participative exercises in which the action maps of a large variety of social systems have been formulated to the satisfaction of their participants. Some of them have continued to be used as reference frameworks for understanding and for managing the corresponding systems.[21]

Consequently, through the action map Innovative Development provides a systemic alternative to trial-and-error and to analysis for dealing in practice with complexity. It acknowledges and faces complexity by integrating into common visions the experiences, knowledge and intuitions of the past, the present and the future, possessed by all relevant actors, and thus enriching the visions and the attitudes of each one. The map is a systemic tool for participation.

IV THE INNOVATIVE DEVELOPMENT METHODOLOGY

Innovative Development may be characterized as a methodology for generating innovations and innovation capabilities, in simple or complex social systems, by means of participation. Its theoretical sources are found in the social systems sciences, particularly in the works of Ackoff, Ozbekhan and Beer. Its development started around 1978 at the Social Systems Sciences group of the University of Pennsylvania (Wharton School) and continued at international agencies (UNDP, CEPAL, OLADE), Chilean universities and private consulting activities. At present it goes on at the Innovative Development Institute in Santiago.

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[20] In terms of Ashby's Law (Ashby, 1956), his framework does not have the requisite variety for describing the social reality he is actually observing.

[21] For instance, the key component of Chile's National Policy for Traffic Safety, established through participation in 1993 and fully operational at the time of this writing (end-1998), is the action map of the National System for Traffic Safety (CONASET, 1994).

The conceptual development of this methodology was undertaken with strong empirical groundwork, by means of research on energy policy and planning, environmental management, technology development, metropolitan governance, urban transport, rural development and other fields. Research support came chiefly from IDRC (Canada). The most significant application processes -all of them participative- have been a corporate innovation policy, a town reconversion process, a regional development plan, the national policy for traffic safety and its implementation, a decentralization study for a Ministry, the design of an environmental management system, and Santiago's air quality process - being discussed in this paper.

The methodology consists of four methodological steps, which are all participative. Each of the steps produces concrete results and in practice they are combined in different ways. The steps will be better understood by making reference to the action map of Santiago's air quality, in its first version, which is shown on the following page. The methodological steps are:

- **Formulation of the action map:** Creation of a vision for action in a complex social system, concrete and reflecting consensus, which systematizes the whole action space of the system, both actual and potential. The map is a vision of attainable and desired future for that system.
- **Evaluation of development and maturity:** Estimation of the distance from the current situation to the attainable future, and of the available capabilities for attaining such a future.
- **Study of potentialities[22]:** Systematic identification and evaluation of each of the prospective actions of a self-sustainable nature that the system has available to create the future shown by the action map.

[22] The notion of *potentiality* is another key concept of Innovative Development. Potentialities, in our sense, are specific to the social systems in which they occur and are identified through matching systems of *requirements*, *resources* and *instruments*.

Error! Bookmark not defined.**Action map: (*)**Error! Bookmark not defined.

A MANAGEMENT SYSTEM FOR AIR QUALITY IN SANTIAGO

Key: **UPPER CASE - established line of action**
lower case: - non-established line of action

A MONITORING AND EPIDEMIOLOGICAL SURVEILLANCE
- A-1 AIR QUALITY MONITORING
- A-2 EPIDEMIOLOGICAL SURVEILLANCE
- A-3 Effects on flora and fauna
- A-4 Effects on materials
- A-5 METEOROLOGICAL MONITORING
- A-6 MODELING

B QUALITY STANDARDS
- B-1 CRITERIA POLLUTANT STANDARDS
- B-2 Standards for other pollutants

C STATIONARY SOURCE EMISSIONS CONTROL
- C-1 EMISSIONS INVENTORY
- C-2 EMISSION STANDARDS
- C-3 ENFORCEMENT
- C-4 Low and zero emission technologies
- C-5 GRAVEL AND SAND PRODUCTION CONTROL
- C-6 Control of remote sources
- C-7 EFFICIENT BOILER OPERATION
- C-8 Participative enforcement
- C-9 Specific economic instruments

D MOBILE SOURCE EMISSIONS CONTROL
- D-1 EMISSIONS INVENTORY
- D-2 EMISSION STANDARDS
- D-3 RESTRICTION TO CIRCULATION
- D-4 ENFORCEMENT
- D-5 Low and zero emission technologies
- D-6 Vehicle driving and maintenance
- D-7 TECHNICAL INSPECTION
- D-8 PARTICIPATIVE ENFORCEMENT
- D-9 Specific economic instruments

E Street dust emissions control
- E-1 EMISSIONS INVENTORY
- E-2 Management standards
- E-3 PAVING
- E-4 Rainwater collection
- E-5 Street washing

F Transient source emissions control
- F-1 Emissions inventory
- F-2 Operating standards
- F-3 Enforcement
- F-4 Promotion of lean technologies
- F-5 Brick manufacturing control
- F-6 Construction of infrastructure

G Domestic source emissions control
- G-1 Emissions inventory
- G-2 OPERATING STANDARDS
- G-3 Enforcement
- G-4 PROMOTION OF CLEAN TECHNOLOGIES
- G-5 Indoor air pollution control

H Agricultural emissions control
- H-1 Emissions inventory
- H-2 OPERATING STANDARDS FOR PESTICIDES
- H-3 Pesticide use control
- H-4 Implementation of clean technologies
- H-5 AFTERCROP BURNING CONTROL

I Technical support for measurements and certification
- I-1 STATIONARY SOURCE EMISSIONS MEASUREMENT
- I-2 MOBILE SOURCE EMISSIONS MEASUREMENT
- I-3 Certification of industrial equipment
- I-4 Certification of new vehicles
- I-5 Certification of household equipment

J Non-regulated pollutants
- J-1 Control of air toxics
- J-2 Foul smelling emissions control

K EPISODE CONTROL
- K-1 EMERGENCY PLANNING
- K-2 Development of predictive capacity
- K-3 Contingency plans
- K-4 MITIGATION ACTIONS

L Promotion of energy quality
- L-1 Fuel quality
- L-2 Industrial energy efficiency
- L-3 Household energy efficiency
- L-4 Vehicle energy efficiency

M Transport system
- M-1 STRUCTURING AND ACCESS ROADS
- M-2 Traffic management
- M-3 RAPID MASS TRANSIT SYSTEM
- M-4 BUS SYSTEM
- M-5 Taxi fleet size and use policies
- M-6 Disincentives for private car use
- M-7 Inter-modal and alternative transport modes

N Management of the bio-physical environment
- N-1 "GREEN LUNGS"
- N-2 Circulation of air
- N-3 Selection of vegetal species
- N-4 Erosion control
- N-5 Arborization of freeways
- N-6 Waterborne sediments control
- N-7 AFFORESTATION AND REFORESTATION OF MOUNTAIN SLOPES
- N-8 Peri-urban watershed management

O Socio-spatial management
- O-1 Impact assessment of public road construction
- O-2 Deconcentration policies
- O-3 TERRITORIAL MANAGEMENT
- O-4 Development of sub-centers
- O-5 Pedestrian areas in urban centers and sub-centers
- O-6 INDUSTRIAL LOCATION
- O-7 Policies for population distribution in Chile
- O-8 Policies on social segregation
- O-9 DENSIFICATION PROGRAMS

P Education and communications
- P-1 Formal environmental education
- P-2 NON-FORMAL ENVIRONMENTAL EDUCATION
- P-3 Technical dissemination
- P-4 Motivational communication
- P-5 INFORMATIVE COMUNICATION
- P-6 Training of journalists

- **Design for action:** For valuable potentialities, designing and implementing the projects that would materialize them; this involves, in each case, strategies for raising awareness of the corresponding potentiality and for building up the instrument[23], in interaction with the actors of the social system.

A key element of the methodology is naturally the action map. It is a tool for the representation of social systems of any complexity. The action map provides a particular kind of representation of a social system: It shows what it is doing at present, as well as what it could do in the future. Its main components are the *basic lines of action* (A, B, …), which have to be understood as parallel and interacting social systems. These lines have their own components, which are the *specific lines of action* (A-1, … P-6).[24]

A line of action is a particular way of observing reality, by observing actions rather than things. It is a social system that is apprehended as a unity and has three types of components: *activities*, *actors* and *objectives*. Lines of action at a particular level correspond to the activities of the higher level. The action map also shows a significant part of the *environment* of every line of action, which consists of the remaining lines of action. Lines of action may or may not be currently *established* in the real world, through actors effectively carrying out activities, since the specification is also applicable to action under consideration. In the map, established lines are shown through upper case letters and non-established ones through lower case letters.

All methodological steps are carried out in practice through participation of the relevant actors or stakeholders, who are convoked by an appropriate "group of convokers" with legitimacy in the corresponding action space. Participants are convoked from all parts of the space, seeking diversity and representativity, in order to guarantee the synergy that this process requires. The first and second steps are taken through a single workshop. The third one takes separate workshops for each basic line of action. The last one, separate processes for each specific project being implemented out of valuable potentialities.[25]

V THE EXPERIENCE: "SANTIAGO CLEANS SANTIAGO'S AIR"

Santiago's air quality experience started as a consulting study and is evolving towards full political consolidation. We will distinguish three stages: inception (1994-95), the Plan (1996-97) and the steps towards participative management (1998).

1. Action mapping and initial proposal (1994-95)

The experience presently known as "Santiago cleans Santiago's Air" originated when the Metropolitan Region directorate of the National Commission for the Environment

[23] One of the three components of a potentiality; see the preceding footnote.

[24] Lines of action are recursive. Further levels of particularity can be added if needed. Experience has shown, however, that the two levels shown in the current example are sufficient for practical purposes.

[25] The conduction of these workshops requires full command of the Innovative Development concepts, methods and techniques that have been developed over 20 years of work in this area.

(CONAMA-RM) commissioned a study about institutional aspects of air decontamination in Santiago from Dr. Raúl O'Ryan. He is a researcher at University of Chile, Department of Industrial Engineering, who had participated as a graduate student in the initial research work that led to the Innovative Development methodology, and he invited the present author to become a member of the project team, for applying the methodology in this study.

The study identified as its key subject the *Management System for Air Quality in Santiago*, that needed to be designed. Its main activity was a workshop with 25 participants to formulate the *action map* of this system, held in January 1995 and convoked by the Regional Governor (*Intendente*) of the Metropolitan Region of Santiago and the Mayor of Santiago, in his capacity as Chairman of the Coordinating Council of Mayors of Santiago26. Participants involved government officers, NGO members, consultants and university researchers. The study also involved subsequent consultations with workshop participants, following the map's structure, through which an evaluation was made of the existing institutional arrangements for managing Santiago's air quality, at the ministerial, regional and municipal levels. The map had minor revisions through this consultation process, and is the one presented in the previous section. Some of its messages are:

- The scope of action needed to achieve effective management of Santiago's air quality is extremely wide, since it comprises 16 basic and 92 specific lines of action. The map has been ordered to show on the left and center columns the lines directly related to emissions, and on the right-hand column those accounting for other factors.
- Of those 16 basic lines there are currently 5 established, whose names are capitalized on the map, and 11 non-established. At the level of the specific ones, 36 have been established and 56 have not yet been so. It is, therefore, a management system that is only partially built, and which is still far from being completed.
- The established basic lines correspond chiefly to the system building effort undertaken by the Special Commission for Decontamination of the Metropolitan Region between 1990 and 1994. This effort was focused on the control of emissions, including the monitoring and the norms that made it possible, and on the management of emergencies.

The project report (subsequently published) presented the proposal of the authors about what to do next. "*This is not a proposal for creating an institution, but rather for starting a process*. In specific terms, it is proposed to undertake a wide participative process in Santiago in order [*sic.*] discovering all the *potentialities* that the city may have for improving and maintaining at a good level the quality of its air. This proposal and its methodology make it possible to identify concrete and realistic actions, and simultaneously to build the

26 Governance of the metropolis of Santiago, with 5 million inhabitants, is complex and largely ineffective, because of three forms of government acting upon it: the central government, with 8 concerned Ministries; the regional government and 32 municipal governments. There is a Municipality of Santiago, which only has jurisdiction over the center of the city. The Coordinating Council of Mayors is a body with no formal authority.

consensus and the commitment that are required for implementing them effectively." (O'Ryan and Del Valle, 1996, p. 158).

2. Participative formulation of the Decontamination Plan (1996-97)

Under new environmental legislation, in 1996 the government received the mandate to prepare an Atmospheric Prevention and Decontamination Plan for Santiago. For this purpose the law specifies: (1) a technical analysis and design process that is to be carried out by the public sector, leading to a pre-Plan, and (2) a 60-day period of citizen consultation, through which the pre-Plan is made public, so that grounded observations can be made to it. The final Plan must consider the observations made and the government must respond to them. CONAMA is the government agency in charge this process, under its Council of Ministers; for the Plan work it established an Inter-Ministerial Coordination Committee and several Sub-committees.

In the context of this obligation, but going far beyond it, CONAMA accepted the proposal made by our team and established a project for carrying it out, which was called "Santiago cleans Santiago's Air". The project worked under the political conduction of the Regional Director of CONAMA and the technical conduction of the present author. Over an intense 8-month period the project undertook a complete process of participative identification of potentialities -under the name of *decontamination instruments*-[27] which involved the following main activities:

- Establishing a joint convoking and management structure for the process, involving CONAMA, the Regional Government and the Ministry from which CONAMA depends.
- Making sure that the time-schedule of the participative process was coordinated with the formal Plan and that the members of its Sub-committees were invited to participate.
- Establishing a *Coordinating Group of the Participatory Process*, formed by 60 well-known and active people from the academic, cultural, business, governmental and NGO worlds. It reviewed the overall design, revised the action map[28], proposed people to invite to the project activities, moderated working sessions and provided continuous monitoring.
- Organizing a one-day *Convoking Seminar*, with some 400 attendants, at which the action map and the working structure of the project were presented. One working group per basic line of action was established, through free registration. These groups held in parallel their first sessions, to make proposals, and were convened to

[27] The instruments were described as viable actions for the short, medium and long term that are required to decontaminate Santiago's atmosphere. They involve some activities and an organizational mechanism to carry them out. As examples the following were mentioned: Vehicle circulation restriction, territorial management plans, quality standards, educational programs and episode control plans. Air quality in the short, medium and long term would depend upon how many and which instruments are in operation.

[28] Version 2 of the action map brought down the number of basic lines of action from 16 to 14, through some mergers and the addition of a new basic line. It also changed some names of lines.

subsequent workshops. The final plenary session, with presentations from all 14 groups, was highly motivating.

- Giving methodological conduction to the 14 half-day *Identification Workshops* through which the decontamination instruments were identified, with full consensus, by the 200 people who participated in them.[29] All sessions were tape-recorded.
- Drafting, through experts in all 14 subjects under methodological supervision, the profiles of all the instruments that were identified by the workshops. Such profiles include (a) a detailed and unambiguous title, (b) a technical description involving all components of a potentiality, (c) a proposal for immediate action under the current conditions and (d) a list of actors who should be involved in the implementation of the instrument. A draft book with the profiles from all 14 groups was mailed to all active participants for review.
- Giving methodological conduction to the 14 half-day *Validation Workshops* through which the 258 instrument profiles were reviewed and their final texts were adopted, again with full consensus, by the 200 people who participated.
- Presenting the final version of the book *Santiago cleans Santiago's Air* (CONAMA, 1997), to a wider audience at the project's half-day *Final Seminar*.

This process was linked to the formal Plan in two ways: (a) Members of the Sub-committees attended the participative workshops and (b) lists of instruments from the workshops were delivered to the Plan Sub-committees. About one half of the instruments included in the Plan came from the citizens' proposals (CONAMA, 1997, p. 4). Those not included are available for incorporation at the Plan updating exercises that are scheduled for years 2000 and 2005.

3. Towards participative management (1998)

The participative process to formulate the Plan is leading naturally to establishing in Santiago a full-fledged participative system for air quality management. The Plan would become a part of this management system. The starting point is a measure of the Plan requiring *participative follow-up*: CONAMA should set up a permanent mechanism for interaction between the citizens, environmental specialists, communicators, enforcers and those charged with implementing the measures. Its main duties would be (a) monitoring the measures and goals established in the Plan and (b) identifying, evaluating, proposing and modifying instruments to be included in the Plan updating exercises scheduled for years 2000 and 2005.

Within this context, the most significant features of the participative process in 1998, after the approval and start of implementation of the Plan, have been:

[29] Only three lines of action required a second session; they were those related to controlling emissions of large manufacturing plants, transport system and socio-spatial management.

- CONAMA's work in this area has been addressed to *facilitating citizen participation*, which is understood as the effective capacity of the citizens to have access to the Plan's operation and management for: (a) obtaining timely and relevant information, (b) delivering opinions and proposals, (c) demanding that authorities meet their commitments and (d) undertaking concrete responsibilities by acting in their fields of competence.
- For this purpose three types of *Participative Follow-up Instruments* that may be established by the Government, have been identified and are being developed:
  - ◊ *Global follow-up* of the process by the citizens: Coordinating Group, Documentation system for commitments and goals, Environmental impact indices, Reception and channeling of citizen proposals, Strengthening of participation capabilities, etc.
  - ◊ *Communication*: Plan's idea-force document, Public communication system, Media motivation system, Annual participative follow-up conferences, Web site, etc.
  - ◊ *Program Management*: Mechanism for managerial homogenization among executing agencies, Citizen counterparts in studies, etc.
- The First Participative Follow-up Conference of the Plan was organized jointly with the Coordinating Group (60 members: citizens and public sector) and held in October 1998. At this one-day Conference, which attracted 350 participants, CONAMA accounted for the overall progress of the Plan measures by using a third version of the *action map*,[30] which is updated and more detailed than the previous ones. The public sector agencies in charge of Plan's measures also accounted for their work and the citizens made explicit assessments of the progress made. Citizens also proposed working priorities for the Plan in 1999 and interested ones registered for designing another 5 follow-up instruments.
- The evaluation of this initial follow-up process made with the Coordinating Group, and CONAMA's need to prepare an updated version of the Plan for year 2000, have led to the identification of some working principles that will probably become established gradually: (a) the management system of the Plan and the participative follow-up system should converge into a single system of participative management; (b) the action map should become consolidated as the general structure and logic of this managerial system; (c) continuous work should be done on each line of action, rather than sporadic large-scale conferences; (d) systematic work should be undertaken to set up management systems in the basic lines of action that are still non-established (i.e. in lower-case letters); and (e) remote work through Internet should be applied intensively in this process.

[30] It is available in the Plan's web site, at: www.desinnov.cl.

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COMMUNITY DEVELOPMENT THROUGH PARTICIPATIVE PLANNING

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ABSTRACT
This paper describes the evolution of a community self-development experience, taking place in a mountain range community in northern Mexico, at 20 years of its birth. The project's most salient characteristic is that the community itself designed not only its own educational model, but the programs and their orientation as well. The objective consisted of offering the youth that had finished their elementary schooling an alternative to formal post-elementary education that would prepare them to remain in the community as productive individuals. Previously, if a student wished to continue his formal education, he would need to move to one of the neighboring urban centers. Over time, this would tend to remove the individual from his roots, leading him to suffer a certain loss of identity. The project also responded to other deficiencies: those related to a basic, formal education provided by the state, and those that had to do with the students' social environment. Among the first, a defficient elementary education that was due to constant teacher absenteeism in highly isolated communities. Among the second, the almost complete lack of opportunities for personal development within the community, together with the proximity to areas of illicit activities, like the production and traffic of narcotics. Through a participative process of reflection-action, with the aid of outside advisers, the commmunity embarked on its own educational project, that covered the grades that go from pre to high school in its formal character, as well as training programs for education promoters. The project has expanded now beyond the community's own boundaries to other neighboring settlements.

Introduction.

A group of parents in a small rural community decided to take action concerning a crucial problem related to their local educational system: they needed to provide their children with better quality education without having to send them to urban schools where they would lose their sense of community responsibility, identity, and commitment. This paper reports on the action plans undertaken by the parents of Surutato, in the northern Mexican state of Sinaloa, durign the course of a 20 year period.

One of the important aspects of this experience is the use, within a rural environment, of a participative planning model that is generally applied in urban settings (Ackoff, 1974: 206-207).

Federal educational institutions sponsored for some time the Community Education Project, an action-research oriented program whose main characteristic is the implementation of a participative planning model for education, in several rural communities. Surutato, an isolated mountain settlement, had at the time an operating self-development program when the Community Education Project was introduced.

The participative planning methodology has helped the community reach its educational goals: it has improved the quality of education at the elementary level, and is experimenting an alternative model of post-elementary education, which includes a production cooperative run by the students.

Formal education in Mexico is centrally designed. Distanced physically, intellectually and emotionally from the rural environment, it does not generally take into account the needs and aspirations of its communities (Jiménez and Ramón, 1989: 94). To counteract this shortcoming, Surutato's Educational Planning Committee, formed by local parents, designed in 1978 a program that emphasized learning related to the region's economic activities that was to complement the federal system's standard cognitive requirements. The program included two apparently opposing concepts: self-learning and group work. The entire project speaks of a philosophy of alternative development, expressed in the following terms:

> Basic education's main objective is to help man understand his immediate problems and to provide him with the education that will allow him to solve them through his own effort (Educational Planning Committee, 1980: 2).

Background.

Surutato is a small rural community established deep in the heart of the mountainous range of the state of Sinaloa, in an area of vast natural resources. In addition to a large forest area, the region’s climate is ideal for cattle raising and fruit and flower production, and highly propitious for the storage and preservation of grains as well.

Surutato's population comprises approximately 2500 inhabitants in the town itself, and approximately 4500 in the surrounding smaller villages, occupying an approximate total area of 29,000 hectares. Within these boundaries there are three main communities: Surutato, El Triguito, and Santa Rita, and approximately 30 other small human settlements. Land rights are based on communal empowerment, in a modality known as "ejido". Land is held collectively by the community, and is administered democratically at the local level, with rights and obligations for all its members.

Since the area is highly isolated, none of the settlements enjoy urban services (electricity, piped water, sewage, telephone, mail or telegraph). The nearest urban town,

Guamúchil, was at the beginning of the experience approximately a 7 hour drive's away through dirt roads.

The main economic activities are seasonal agriculture (corn, wheat, beans and potatoes); livestock raising (cattle, pork and chicken); forestry, and fruit production (peach, apricot and apple).

Agricultural land is irrigated naturally by several surrounding streams. The region enjoys a tempered climate, sub-humid, with abundant rain from june to october, less rain during the winter, and frost during part of the fall and winter.

The forest is endowed with pine, oak and "madroño" species, encompassing an area of 18,500 hectares of exploitable forest reserves (roughly 65% of the ejido's territory). Livestock raising is possible due to large extensions of pasture lands, good climate and abundant water sources. Apple and peach production is potentially important. The streams, creeks and the natural scenery, as well as the population's hospitality, are elements which have led the younger members of the community to explore the possibility of developing an ecological tourism program.

Intervention process (Jiménez, 1992: 407-416).

In 1977, Antonio Malacon, a civil engineer from the state's capital, Culiacan, inadvertedly became part of the community while building a weekend cabin in the nearby surroundings of Surutato. As he became closer to the area's inhabitants, his neighbors began expressing the problems they had with their children's education in the three area elementary schools. Mainly, that there were not enough teachers, and not all grades were offered. To make matters worse, teachers were frequently absent, and the quality of education was largely unsatisfactory.

Although a grave situation in itself, this was only the beginning in a long line of problems related to education. Beyond the elementary level, students that wished to continue their education were forced to leave their community and take up residence in the nearest urban center, Guamúchil, representing thus a first obstacle to continuing education, since many families could not bear the expenses implied. Those that were, were not satisfied with the education provided, as their children tended to lose their community identity, and as a result develop social and material needs that were foreign and thus could not be satisfied in Surutato. In their own words:

> Our children come home with different customs. If things continue like this, they will become strangers in their own community, although they continue to live here (Malacón, 1983).

In summary, more education was not helping youth improve the quality of their life in their own community. In addition, acquired skills and knowledge were proving to be scarcely related to the rural environment. Sending their children away to receive

education was an effective way of distancing them from their family and their community.

This is how Malacón started to become involved in the community's educational problems. He has played a crucial role in facilitating the discussion, design, and implementation of this community's educational programs. Initially, Malacón carried out a series of preliminary meetings with several groups and informal leaders with the aid of Proffessor José Luis Nansen, a specialist in rural education. Both men wanted to make sure that "better education" was in fact a felt need, shared by many, and not only by those that had spoken out.

Since the beginning, Nansen and Malacón made sure that a great deal of respect was observed toward the attitudes and decisions taken by the community, being careful not to impose personal views, and accepting the rythm and dynamics established by the community, as well as its own selection of direct participants. This was particularly important, as the community was at the time involved in very delicate internal disputes.

At about the same time, the federal government had launched Operation Condor, a fierce campaign against the production and traffic of narcotics, that affected a good part of the population of the mountain area. As an off-setting measure to thwart the negative effects the operation was having on the local economy, the state government sponsored the construction of a town sawmill that was to be managed by the community. However, control of the sawmill was soon grasped by outsiders, with only a few locals participating in its management, leaving the majority of the community outside of the benefits provided by their own forest products. The conflict soon divided the community into two conflicting groups.

Notwithstanding, the community painstakingly continued its self-development program. After four months of preliminary preparations, a community assembly was held so that members could express their views concerning the most important felt needs. All participants, men, women and children were to write down on one card the problem they considered to be most important affecting them. Illiterates were aided by the younger, schooled participants. Despite the troubled situation described above, the result showed that education was seen as the most important problem affecting the community, as expressed by 95% of the participating members. The greater part of the responses referred to the need to improve elementary education both in terms of quality and quantity. Others referred to the need for some type of post-elementary education, more related to local economic needs.

It was clear to all that something had to be done to improve the delivery of educational services, and that an adequate education would in turn lead to development. They thought that real development could not come from the outside, that it had to be generated from within, and that it had to be a product of collective decisions and actions. With this in mind, the community decided to create the Central Educational Committee, to be in charge of a global project named the Community Self-development Program. The Committee was composed by nine people democratically elected, three for each of

the most important settlements. Proffessor Nansen suggested that each local committee be composed of at least one woman, because: "women are not only the motor of the family, but of the community as well" (Malacon, 1983).

Creation of the School Center and the Cooperative.

With the object of estimating current and future educational demand, the Comiittee carried out a population census. This information would be used to support a demand to federal authorities for more teachers for Surutato. Each local committee conducted a series of workshops with parents to analyze the educational problem. With the resulting conclusions, the committees were able to elaborate a coherent set of demands, consisting essentially of more and better educational services at the elementary level, and in the creation of a post-elementary agricultural education center. The demand was taken up with the local representative of the federal, Secretary of Public Education (SEP) in the state capital, Culiacán, who felt that the innovative nature of the demands should be presented directly to the federal authorities in Mexico City. A commission of three members from the Central Committee, accompanied by Malacon traveled to the nation's capital to discuss the project directly with the Under-Secretary for Planning and his staff.

Federal authorities immediately accepted to provide more and better teachers for the elementary schools. They even suggested to have Surutato's Committee be in charge of their selection. However, authorities rejected the demand of a post-elementary agricultural center on the grounds that there was a long history of failures as to effectivity in this area. In exchange they offered to support other alternatives to post-elementary education that the community wished to propose. The commission proposed a program in which the community participate in the content of courses, and would have complete control of the educational process. Authorities agreed and designated Malacon as an outside adviser. The SPE would provide some funds for program expenses which would be administered by the community itself.

The Post-Elementary Education Program was thus begun in November 1978. The facilities were constructed on a six-hectare lot adjacent to the sawmill, whose powerplant could be used to provide electricity to the "school". The new educational center was christened the "Justo Sierra Study Center (CEJUS)", in honor of the great Mexican positivist educator of the beginning of the century. The name also constitutes a play of words, relating to the center's geographical location, as the terms "justo" and "sierra" literally translate into "just", or "precisely", and "mountain" or "mountain range", thus placing the center "just or precisely at the mountain".

The Central Educational Committee, in a parents' assembly, established the following principles of operation for the Center:

- Availability of courses with the aid of textbooks provided by the distance high-school education system, with compulsory attendance by the student and permanent assistance from a teacher.

- Promotion of self-learning and team work in the educational process, in order to strengthen reciprocal aid and solidarity habits.

- Maintain students' disposition to trade skills, encouraging awareness of their own environment.

- Establishment of workshops and knowledge of technologies oriented toward community development needs (Educational Planning Committee, 1980: 19).

Based on a community decision, the center was built collectively, utilizing local materials and technology.

A year after its creation, the production cooperative was formed within the grounds of the center. It is administered by the students themselves with the object of providing them with the skills necessary to manage productive businesses. A favorable by-product of the formation of the coop is its credit elegibility, as the collective nature of land rights in an "ejido" denies access to this resource to its individual members due to lack of lien property.

The Community Education Project.

The Community Self-Development Program concided in time with the SPE's own efforts to implement the Community Education Project (CEP), in response to known severe deficiencies in formal rural education. Generally, schooling in rural areas does not surpass the elementary level. However, the purpose of education at this level is mainly to prepare students for their insertion into the next level, more than to provide them with the means to develop in their own environment. The CEP, modelled by a group of innovative young alumni of the University of Pennsylvania that had studied under Russel Ackoff, defines rural communities as purposeful systems, in line with Ackoff's and Emery's thesis (1970, p. 215).

A community is also defined as an open system. That is, it is immersed in an environment or context that affects it or is affected by the community's behavior. Usually, rural communities do not behave as such, limiting their activity to reactions to what what they perceive as threats from the outside world. A key question is, how can purposeful behavior be activated in rural communities? The Ministry's response, through the CEP, was to involve them in their own planning process as well as the direct execution of these plans. This process, according to the SPE, must be ***systemic, participative, and prospective***.

Systemic, because in order to substantially contribute to community development, the educational program must consider the community's economic, political, social, and cultural processes. The efectivity of education depends more on the adequacy of its interactions among processes within the community, than on its own qualities or traits.

Participative, because when people are involved in the design of their own education, it is possible to relate individual to collective needs and goals. Those that are involved in

the planning process become more efficient in taking advantage of the benefits provided by education, and therefore are better apt to improve their own quality of life. Furthermore, participation can mobilize local and institutional resources more efficiently, paving the way to guaranteeing continuity in education and growth, as local committment to the program is increased.

Prospective, because the educational plan must open the way toward the fulfillment of individual and collective goals, that in turn improve the community's quality of life. Futhermore, it must consider future opportunities to improve life in the community (Delgado, Prawda and Ramón, 1980: 3-4).

Participative planning paradigms based on a systemic approach have been proposed and proven essentially in urban settings (Ackoff, 1984; Friedmann, 1972; Ozbekhan, 1969; Cope, 1989). However, very little work has been carried out in rural environments. The SPE's project was intended to correct this deficiency. The hypothesis to be proven is:

> as rural communities become more involved in the design and implementation of their own educational system, education will contribute to improve the quality of rural life (Delgado, Prawda and Ramon, 1980: 4).

The project is formalized through an annually renewable, written agreement between the community and the SPE, in which the community is responsible for designating and supervising a democraticaly elected planning committee. The SPE, in turn, is to provide the planning model, a promoter to advise and follow-up on the project, and a revolving fund to support educational projects that are proposed by the Committee. The Committee's members are to control these funds, and ensure that they are utilized for the benefit of all.

The initial model is derived from Ackoff's interactive planning paradigm (Gharajedaghi and Ackoff, 1986: 35). The model has six interdependent stages:

- Diagnostic: description of current situation, the nature and origin of main problems and a future projection.

- Goal planning: proposal of desired futures.

- Means planning: elaboration and selection of educational goals and strategies to reach them.

- Resource planning.

- Implementation.

- Evaluation and control.

The SPE produced a manual for each stage of the planning process, followed-up on each community's progress, organized meetings where participants could share experiences, and kept a log of each community's process that was to serve as a cumulative record of experiences whose purpose was to enrich the model. A principal role of the promoter is to facilitate learning of the planning model in those involved, and put it into practice. The CEP's design stage coincided with the initial steps of Surutato's Self-Development Program, bringing both to a happy marriage.

Results.

The agreement between the SPE and the community to incorporate the Self-Development Program to the Community Education Project was signed in April 1980. The Central Eduational Committe of Surutato became the Educational Planning Committee, adding 4 new members to the existing 9 previously forming the group. This Committee would be in charge of the organization, administration and control of the entire educational process. The Committee became the key piece in the entire project.

Other ten communities were incorporated to the Community Education Project. This paved the way for the exchange of experiences between communities, proving to be a useful resource to all communities involved.

Surutato's community learned the Participative Planning Model and adapted it to their own needs. As a result, the community has successfully planned the curricular structure of the post-elementary facilities, demanded and obtained improved elementary education, organized a production coop, and in general, mobilized the community and obtained control of community resources in the benefit of all. The model has been applied in other communities in the state of Sinaloa by promoters trained in Surutato's center.

The planning model was not only learned and applied by the Committee, but also by the center's students. It helped make the organization of the coop a more participative process. Having previous experience with hierarchical structures, such as the type outlined by the SPE's Coop Manual, the students opted for an horizontal structure, such as the one inspired by Makarenko's teachings (1957).

Collective tasks were carried out by "brigades" of students, under the supervision of a head of brigade. The group formed by these heads, called the Council of Heads of Brigades, meets with a certain frequency to discuss and make operational decisions. The Council periodically reports to the Student General Assembly and to the Parents' Association. The position of head of brigade is rotational, allowing all students to acquire leadership experience as an important part of their education. Each student puts in practice his/her ability to speak in public, conduct assemblies, negotiate with authorities, and in general, assume the responsibility for the well-being of schoolmates.

The rotational leadership structure brings other benefits with it: the students understand more clearly the goals and objectives of the educational project as a whole; they become

more responsible toward their schoolmates and their community; they learn to overcome obstacles, individually and colectivelly, to reach common objectives.

Adults have benefitted also from the use of this planning methodology. They have accomplished the design of a 4 year post-elementary program which includes official curricula, and are experiencing social community work in other communities where they perform as instructors, as well as carrying out other general benefit activities. Currently, the previously defficient elementary education now has six grades in each of the main settlements. The teachers are graduates from the center's own population and have also assumed control of pre-elementary education, experimenting additionally with Montessori educational philosophy and materials.

All students must dominate a specific ability at the end of their 4-year post-elementary program at the center, as well as having gained experience in all of the technical specialties offered by it.

Currently, the Center offers a specialization in Educational Promotion. Students that successfully finish their courses and have credited the specialization are qualified to become promoters in other communities that operate self-development programs. State education authorities have begun a program to promote development in other communities of Sinaloa. Some students from Surutato work now as their promoters. In terms of educational support material, the Center currently enjoys the use of the high-school at a distance system programs, and utilizes their video material as an additional didactical resource.

Another lateral effect of community organization has been greater control over community resources. The sawmill is a case in point. As was mentioned earlier, the distribution of profits became a source of antagonism because outsiders were seen as receiving the greater part of the benefits derived from it. In 1980, several members of the Committee were elected into the most important posts of the "ejido's" organizational structure. The new representatives negotiated total control over the sawmill with governmental authorities. By 1981, the sawmill was re-opened under new conditions: all workers were to be members of the "ejido", and since then the profits generated by the mill have been used in the benefit of all.

Enabling conditions.

The enabling conditions responsible for the success of this project are of three main categories: conceptual, material and human.

Conceptual. The project was supported by a participative planning model that proved its effectiveness “on site”. Surutato’s community has adhered to the model emphasizing its participative nature and open systems approach. The model has been used at all levels of decision making. The promoters who work in other communities carry it as one of the important tools for the implementation of new development and education concepts.

Material. The federal government helped at the initial stages supplying periodically small sums of money to finance the realization of activities proposed by the Educational Committee. This, in addition to voluntary work and material supplies afforded by parents and students set up the basis for a mature, long term development process.

Human. The human component is of paramount importance for the success of development projects. Fist, the initiative came from the people themselves, it was not imposed from without. Parents approached comeone from the "center" to share with him their concern about the quality of education their children were receiving. The "outsider" was sensible enough to channel such preoccupation to the appropriate agencies. This "external element" became rapidly involved with the "problèmatique" and was able to facilitate that the interested people got in touch directly with government officials open to try new educational alternatives. The conjunction of these two elements: a "willing community", and a capable and motivated "external facilitator" is a necessary condition to start change processes of this nature.

We can also add that in the case of Surutato, the ***relative isolation*** in which the experience took place during many years kept the project from being comtaminated by outside, urban interests. Currently the population enjoys telephone service, and the paved road is only one hour away from the settlement, so that travelling to Guamuchil or Culiacan is now accomplished in only three to four hours.

Malacón, the main outside adviser and community promoter, is an example of effective promotion. His handling of the relationship with the community has preempted the establishment of an undesirable degree of dependency on his presence and his views, although he has been in constant contact since the beginning of the Program.

Obstacles to be overcome.

The re-emergence of drug trafficking in the region constitutes a fierce obstacle to the development of the educational project. One particular, common "business" arrangement is a case in point. The product's transportation costs are payed in kind, stimulating a certain amount of consumption by some segments of the population. Another dysfunctional element is by some of the young people involved in the production and distribution of narcotics, whom with minimum effort obtain considerable rewards. The possession and use of firearms associated to this activity is another de-stabilizing factor on the project's sustainability.

All of the above, in addition to no meager levels of alcoholism, have become a serious obstacle to the progress of the Self-Development Program. Many of the young, current members or graduates of the Center, possess enough maturity to allow them to be aware of the risks involved in illicit activities, and are therefore not affected by such negative surroundings.

On the other hand, the atmosphere of learning and collective work observed in the center's facilities does not seem to permeate enough to the rest of the community.

Perhaps as a result, some of the students that live at the center's dorm facilities during the school year, prefer to stay at the center instead of going home during the school breaks. It would seem that the center and the community belonged to different worlds. It is of the utmost urgency to attempt to involve the entire population in collectively beneficial projects, otherwise the center may become isolated.

Furthermore, neither the Program nor the "ejido" itself have been capable of generating jobs at a significant level. This has compelled some of the inhabitants to emigrate to different urban areas in the country or to the United States in search of employment. Several of the businesses started by the students have failed due to a lack of adequate planning. The main causes behind these failures have been higher prices of products *vis-a-vis* the competition, products with low demand, and the lack of capital resources at crucial moments.

Conclusions.

Participative planning is now a part of the community of Surutato, both young and old. They are aware that the community, as a teleological entity, is capable of modifying its future through their decisions and actions. It is in a process of development, not in the conventional meaning of acquisition of higher quantities of goods and services, but in the sense defined by Ackoff:

> Development is the desire and ability to utilize the means at our reach to continually improve our quality of life (Ackoff, 1974: 221-222; Gharajedaghi & Ackoff, 1986: 18).

The SEP terminated the project in 1984. However, Surutato's Community Self-Development Program continues to this day. Collective actions verify the central hypothesis that as more community participation in the planning and implementation of own education takes place, a resulting improved quality of life in the population will be observed.

In conclusion, the Participative Planning model has proven to be useful in rural communities, encouraging not only participation in the design, but in the innovation, adaptation and modification of learning experiences that allow greater local control of the self-development process. As was mentioned earlier, this experience has been disseminated among other settlements.

Further research is necessary on the problem of adaptation of the model in communities where the referred ***enabling conditions*** are not present. In these cases, it will be necessary to search for procedures that lead to the establishment of such conditions before attempting to implement a participative education model.

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APPLICATION OF SOCIAL SYSTEMS NAVIGATION--A MULTILAYER IDEALIZED DESIGN SYSTEM--TO IDEALIZATION OF MANKIND FOR 2050

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Running Title:
Social Systems Navigation for Mankind for 2050

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Abstract

Social Systems Navigation (SSNV) is a multi-layer, stepwise, iterative idealized design developed by Horiuchi, based on Ackoff's idealized design paradigm.

Following the 1997 United Nations Global Warming Summit in Kyoto, the 1998 Buenos Aires Summit produced disappointingly little. One reason for such a slow progress is the incremental nature of our thinking on world ecology; we try to solve the problem based on the present conditions of our lifestyles. One aspect, which seems to be missing in our discussions on global warming, is idealization of our future.

The purpose of this paper is to apply SSNV to idealization of the future of mankind, and see if SSNV sheds a new insight into the systemic problem of global warming countermeasures. With the SSNV process of multilayer, iterative idealized design, we can formulate a series of ultimate ideal images of sustainable ways-of-living scenarios for the mankind for 2050. Then, we can start redesigning our future.

Key words:

Social Systems Navigation (SSNV); Idealized systems design; Ecology; Way of living; Year 2050

1. Statement of the Research Task: Application of SSNV to Global Warming Problem

The task in this paper is to apply to idealization of mankind for 2050 as one of countermeasures against global warming. Most of current discussions on global warming countermeasures are of incremental nature: we try to solve the problem, on the continuation of our current world economic, social and other systems. However, as we will see in the Situation Analysis section, a fundamental change in the world system is urgently needed if we hope to solve global warming before mankind and the earth face various climate-related crises in the 21st century.

Ackoff ((1978), p. 40) states, "To attempt to resolve a conflict is to accept the conditions that create it and to seek a compromise, a distribution of gains and/or losses that is acceptable to the participants." This is what we have been trying to do at Global Warming Summit, with a very slow progress.

On the other hand, "To dissolve a conflict, the conditions that produce it are changed so that it disappears. This can be done by changing either the environment or the opponents." (Ackoff (1978), p. 40) This is what the author proposes in the form of idealizing the future of mankind (and earth, later) for 2050. What kind of life would we like to have in 2050 as mankind? At the least, we can define what we can agree upon, and disagree upon as parts of our idealized future. The year 2050 is close enough for us to relate with, since some of us will still be alive then, yet far enough to allow us open systems thinking. In order to make SSNV for mankind for 2050 work, several necessary tasks to complete were identified.

Social Systems Navigation (SSNV) is a multilayer, step-wise, iterative idealized design incorporating both idealized design (normative, "dissolving") principles and piece-meal engineering (Incremental, "resolving") principles. As the first step, we will try to idealize the future of mankind, rather than the future of the earth and its entire species.

2. Social Systems Navigation (SSNV)

SSNV is a multi-layer idealized design system developed by Horiuchi (1994 and 1995), based on Ackoff's idealized systems design paradigm (Ackoff (1978 and 1991)).

Ackoff's idealized design formulates an ideal point, then, design an interactive path toward such an ideal. However, in reality, as time passes, our ideal point can shift from our earlier ideal. Not only that, if we think about our life goals, we tend to have a multiple layers of ideals. Hence, it seems more realistic and productive to have a periodic review of the ideal point as we go, as well as having intermediate ideal points for

systems planning. SSNV is a new, multi-layer ideal-seeking system with historical inputs as well as deviation measurements.

SSNV is defined as: "A flexible systems planning paradigm with multilayer of ideals, with which the Social Systems Navigator (i.e. stakeholders) design and implement a plan toward their Intermediate Ideal Images (INTID) and an Ultimate Ideal Image (ULTID); and review their progress as well as their intermediate and ultimate ideal points periodically." (Slightly modified from Horiuchi (1994), p. 1232.) The process continues iteratively.

In SSNV, a journey is planned toward an ideal point, with several legs (toward Intermediate Ideals Images) and a final destination (Ultimate Ideal Image/ULTID). At the end of the first leg (leg 1) nearing the Level I Intermediate Ideal Images (INTID-Level I), the Social Systems Navigators decide whether they can and should continue the journey toward the Ultimate Ideal Image (ULTID) and the Level II Intermediate Ideal Images (INTID-Level II) (which is the end of the leg 2). They have a choice of selecting the Level II Intermediate Ideal Images from various options INTID-Level II-2a, 2b, 2c, etc., as well as the choice to divert the final destination (the Ultimate Ideal Image/ULTID) from the original ideal to a new ideal. This is a continuous, iterative process.

SSNV takes the following steps:

Step 1. Problem formulation (Problematique) and situation analysis.

Step 2. Reference Projection. Ackoff states, "(A) reference projection is an extrapolation from the past into the future assuming that the system involved and its environment will develop without intervention, that is, with no change of the trends experienced

over the relevant past. ...(S)uch a projection is not a forecast of what will happen but of what would happen if there were no interventions.... The purpose of a reference projection is to identify when and how a system will break down if there are no interventions.... Planned interventions are more likely to be creative and effective." (Ackoff (1978), p. 128) In a sense, this step provides the Social Systems Navigators with a hypothetical "bottom" cases, before they proceed to idealizing the "high" cases.

Step 3. Formulation of Ultimate Ideal Images (ULTID).

Step 4. Formulation of multiple levels of Intermediate Ideal Images (INTID).

Step 5. Planning and implementation of ULTID and INTID. in the form of tactical planning to be ever closer to the INTIDs of the immediate, nearest leg 1 of SSNV from the present state.

2.1. SSNV Step 1. Problem Formulation (Problematique) and Situation Analysis

In the discussions at Kyoto and Rio Global Warming Summits, it seems that the participants have not yet reached agreement even on what system levels they disagree on. This is a systemic problem to which social systems scientists can make contributions with idealized design.

The author argues (Horiuchi (1990 and 1998) that treatments of contemporary environmental symptoms--which is of an incremental approach--will probably not be sufficient for dissolving the problems. However, if we idealize our future ways of living, we might be able to design our future and dissolve the global warming and other ecological problems. "Way of living," means a lager concept than lifestyle. Way of living is tentatively defined here as: Value systems, lifestyles, and other aspects of life with which a certain social group try to realize their ideal image of life. This concept needs to be refined.

Schumacher (1986) noted over a decade ago that what we need is to redefine wealth and meaning of life for mankind with a holistic, multidisciplinary and long-range perspective, rather than designing tomorrow based on our current state.

Problems of global warming and other ecological issues are of a multidisciplinary nature. They involve not only science, but also values, ways of living and various fundamental aspects of our life/living.

Brown (1997) states that when we deal with world ecology, we have to reconsider our consumption orientation which is the basis of our industrial society. As individuals and as groups, we have to rediscover the value of controlling our consumption of goods. He points out that mankind in rapid growth is reaching a major, dangerous touring point now.

Hence, world ecology is a comprehensive, multidisciplinary matter, which requires dissolution of a problem. We need to redefine the richness, or happiness of life for mankind in order to deal with the world ecological problems.

Contemporary economic systems and consumption society not only cause environmental burdens, but also causing desire of the mankind for reproduction on an enlarged scale, and economic-expansionism. Yet, the earth cannot afford to have such a consumption society of the entire mankind. Therefore, if we continue our current incrementalism without a grand ideal design for the future of mankind as a whole, we will never be able to solve the real problem facing the mankind.

2.2. SSNV Step 2: Reference Projection

According to expert opinions on the world climate, food production, world ecology, etc. the future of mankind will face considerably more serious situations than generally believed.

Brown (1997) summarizes the global climate as, "The atmospheric CO2 level is now at the highest level in the past 150,000 years and it continues to be increasing. The global climate is expected to change ten times faster than the natural climatic changes. Scientists predict that the world climate will probably be less stable, more turbulent, and hard to predict. Sudden changes in local climate patterns are possible. As the global warming continues, floods, droughts, forest fires, heat waves are expected to happen more often. (Translation by the author.)

Konishi (1994) predicts food crises by 2025: "By the year 2010, it is likely that we will have a larger proportion of undernourished population in developing nations. Facing such a food crisis, mankind will try to increase grain production. However, by 2025, food production increases in developed nations cannot match the population explosion at developing nations. Thus, mankind will face major food crises, a catastrophic state of food shortage. (Konishi (1994), p. 226) (Translation by the author.)

From the history, Yasuda (1995) foresees many environmental refugees: "If our contemporary world as the extension of the modern civilization, follows the path of the Greek civilization, we have to conclude that our civilization will perish in the twenty-first century. This means we have less than a hundred years to go. When the catastrophe happens, there will probably be many environmental refugees all over the world." (Yasuda (1995), p. 49)(Translation by the author.)

These facts cast serious doubts about optimism for the future mankind, relying on incrementalism.

2.3. SSNV Step 3. Formulation of Ultimate Ideal Images (ULTID): An Example

What seems to be a mutually agreeable solution by the mankind for the global warming? For idealizing the future of mankind for the year 2050 (hereafter ID2050), we will prepare several idealized scenarios for the mankind first. If we develop multiple scenarios for each social group of each nation, we will have too many scenarios to design a meaningful world design. Therefore, as the IPCC (Inter-governmental Panel on Climate Change) prepared five alternative scenarios for the global warming, we will develop a handful of scenarios for the ways of living of mankind for the year 2050 as the first step. Then, for each scenario, we will calculate necessary foods and resources estimated CO2 emission and calculate the total sustainable total world population for each scenario.

Two authors argue for the need of idealizing the future of mankind.

Ozawa (1996) notes, "Another method is called the `backcast.` This method is based on the condition that the earth has limited resources. Take a certain future time-point such as 2050 or 2100, and think about what our society should look like with what conditions to meet for safe and satisfactory life." (Translation by the author.)

Konishi (1994) urges that it is vital that we write our scenarios for the first quarter of the twenty-first century and change our present action plan." (Konishi (1994), p. 251)

There are many variables related to the ultimate ideal images of mankind for the year 2050. For illustrative purposes of the SSNV process for ID2050, a simplified example is discussed here. With factors such as above, we will define several alternative ideal images for mankind each with a certain combination of populations of several ways of living.

Sample inputs for simplified scenarios for defining Ultimate Ideal Images (ULTIDs) for the Year 2050 are:

2.3.1. Sustainable Global Population calculated from: Per capita necessary calorie intake per year; Annual global food production; and Maximum sustainable global human population based on them, etc.

According to Seto (Seto et al. (1998), p. 55) an average person needs 220kg of starch, and a small amount of essential amino acids for basic survival. While in 1994, 1.95 billion tons of grain was produced worldwide from which 1.46 billion tons of starch and insufficient amount of essential amino acids were produced. A very rough estimate by Seto is that, with such food production, in 1994 mankind could support roughly 6.6 billion people in principle. We can refine such data in order to make a better estimate of sustainable global population.

2.3.2. Total Global Energy Consumption and Pollution Emission without causing much strain to the earth. (Various scenarios with different combination of energy use will be created.)

From these, we will define ways of living for the year 2050 as Ultimate Ideal Images (ULTID). For example, (Again, these are highly simplified examples for illustration purpose of the SSNV process for idealization of the future of mankind.)

ULTID-1. Simple Life. This is a fairly simple life in which the residence and the work are close to each other, and people can live without much energy consumption;

ULTID-2. Moderate Life. This is a life in a medium sized-city in a contemporary industrial nation and farming or fishing villages in its suburbs, fairly well-to-do living;

ULTID-3. Modern Life. This is a life with materialistic abundance, which many residents of modern large cities consider highly desirable.

By combining such scenarios, we will have a comprehensive scenario of the ultimate ideal images of mankind for the year 2050. Once mankind agrees upon such an ultimate ideal image, we can proceed to design the process ideals to soft-land such an ideal state, using the SSNV steps.

2.4. Step 4: Intermediate Ideal Images (INTID) Formulation

After formulating the Ultimate Ideal Images (ULTIDs), several possible paths toward such ULTIDs are formulated as the Level III (could be any level) Intermediate Ideal Images (INTID-Level III). Then, for the Level III INTIDs, the Level II INTIDs are formulated. We repeat this process for several levels.

2.5. Step 5: Planing and Implementation

The Implementation Phase is a practical design process to reach the lowest level of Intermediate Ideals (INTIDs) as formulated. Since the INTIDs at the lowest level (INTID-Level I) is close enough us of the present day to seek as hard to reach, but not impossible ideals, we will design implementation plans to try to become every closer to the Level I INTIDs. As we implement the plan, we will periodically evaluate our progress toward Ultimate Ideal Images (ULTIDs) and several layers of Intermediate Ideal Images (INTIDs), and decide either to continue our path, and/or change one of the ideal images at some of the levels.

3. Discussion: Tasks to Complete Before Idealizing Future of Mankind

Naturally, there are several specific tasks to complete before formulating Ultimate Ideal Images (ULTIDs) for mankind with SSNV:

3.1. Tasks Related to the Ideal Images Themselves: What kind of ideal images? How many groups should we categorize the mankind into? If there are too few categories, we have a problem of representing mankind's various needs and desires of "ways of living." On the other hand, if we have too many scenarios, we cannot proceed to the next steps of seeking such ideal images. Are the ideal images of quantitative or qualitative nature?

3.2. Tasks Related to Consensus-Reaching: Who will be involved in the ideal-image formulation, and with what sort of consensus-reaching systems?

3.3. Difficulties in the Situation Analysis and the Reference Projection: Scientists do not agree upon the prediction of future environmental changes. Hence, for SSNV, we need to prepare several alternative scenarios of the Reference Projection with various future

predictions. This makes the formulation of Ultimate Ideal Images (ULTIDs) more complicated and challenging.

3.4. Relations between Ideal Images and Religion: There has been notable developments in religious organizations, as written by, for example Hope (1994) and Frey (1996).

3.5. Roles of Ideal Images: Suppose we have reached agreement on our future ideal images. What shall we do with such ideal images? Do we seek such ideal images by: (a) Free will of individuals and organizations; (b) Market economy; (c) Enforce them with some kind of enforcement mechanism, etc. Weizsaecker (1995) states that this matter is closely related to personal freedom. Do our generation have a right to make mistakes by not contributing enough for the future generations?

4. Conclusion: What Can We Gain by SSNV for Future of Mankind?

Our contemporary social, economic and other systems have already exceeded the limit of the earth as a closed system. We need to redefine concepts such as "happiness," "richness of life," "development" and other terms of our value systems, and propose a new paradigm instead of the consumption-oriented society and expansion economy. It will be mightily difficult to formulate ultimate ideal images for mankind for the year 2050. However, through such SSNV process overcoming our cultural, social and other differences, mankind might be able to find a new way of living "just in time."

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IDEALIZED DESIGN PROJECT

Moderator: William Roth, Allentown College

Idealized Design I: *Bringing the Process into Perspective*

Idealized Design II: *Defining New Opportunities*

Idealized Design III: *Integration on a Global Scale*

Kent Myers and Bill Roth are co-facilitating an effort to help "tie the systems world together globally." Six teams were initially formed—communications, training/education, industry, government, consultants, integration – with facilitators. Over 60 participants from a wide range of fields joined the effort, as well as organizations including the INTERACT, the ISSS, the ASQ, the AQP, the Deming Institute. The group developed the concept of "regional hubs" networked across the world. Twelve such "hubs" are "dedicated" at this point, including Villanova University, The Catholic University in Peru, The University of Mexico, The Innovative Development Institute in Chile, Sabanci University in Turkey, the University of Shizouka in Japan, Antioch College in Seattle, Madonna University in Detroit, Ryerson Polytechnic University in Toronto, The Fred Emery Institute (and its network of universities).

The design process is, of course, just starting. A lot of work has already been done over email. The Russell L. Ackoff Conference at Villanova University should give us a chance to consolidate and to better define our direction.

SYSTEMS THINKING AND INFORMATION SYSTEMS PRACTICE

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