Abstract

Systems and Systems Thinking are very much a paradigm change, a revolution in our own world view transforming the way we participate with the universe we live in. This mental revolution is sustainable because we consciously and deliberately choose to evolve our world view through several fundamental changes. The transformation I refer to includes three major introspective changes which are as follows. First, a change from fragmentation to wholeness. Secondly, a shift in our understanding to the root of the phenomena experienced and thirdly a change from the episodic time space view of events and problems towards seeing a timeless dimension of relationships.

To see the world systematically means to see the relationship in the phenomena we experience. The systems view is not just another way of improving an object or a process or even services in and of themselves as so many have stated. Nor should systems and systems thinking be seen as a method that is focused only on the concept of "quality." The traditional quality measurement tools like histograms, pareto charts, and even process control chart may work in a quality universe but are ineffective in the system universe. I am suggesting that the intrinsic value of systems thinking is in the movement of relationships and not in the process of improving objects or services. The purpose of this article will be to share this fundamental meaning of systems and systems thinking through a movement called "Systems Coherence."

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SYSTEMS COHERENCE

A Method for Evolving Relationships and Measuring System Chang

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Paradigm Change to Systems Coherence

> ***Nevertheless, paradigm changes do cause scientists to see the world of their research engagement differently. Insofar as their only recourse to that world is through what they see and do, we may want to say that after a revolution scientists are responding to a different world. What were ducks in the scientist s world before the revolution are rabbits afterwards.*** [1] Thomas S. Kuhn

The mental model of Systems Thinking is a paradigm change, a revolution in our own world view, transforming the way we participate with the universe we live in. Those who have made the journey into the revolution of systems thinking are truly "responding to a different world" as Thomas Kuhn has precisely stated. It is a different world because a system universe operates on a reality of interdependencies and relationships rather than one of fragmentation and independent parts. This fundamental change is aptly described by Kuhn as "what was a duck before is now a rabbit."

This transformation takes more than just a new approach, more than a compromised point of view and more than just a casual journey or the resulting view is of "ducbits," an animal half duck and half rabbit. Rather this paradigm change is through the flexibility in our thinking, the use of intelligence and insight coupled with commitment, discipline and passion. The resulting mental revolution is sustainable because of a conscious and deliberate choice to evolve one's world view through several fundamental changes.

Perhaps the most fundamental and profound mental change is overcoming a view of fragmentation and the transformation to a view of wholeness. A second, equally significant transition is gaining a true understanding of the root of the phenomena experienced. This is not attained through separate and limited cause and effect models but through exploring the process of one's own thinking. A final momentous change is a shift from events and problems towards a process through time and the emerging relationships that exist. If we are to truly attain a worldview that is now seen

"systematically" then this transformation must be complete and in doing so, it is one in which one clearly see things, all things, different from before.

Attaining the systems view brings into question the limited notion of systems and systems thinking as just another model focused on performance improvement. Rather, the systems view is not just another technique for improving an object, process or service as is frequently stated. Nor should systems and systems thinking be limited to a method focused only on the concept of "quality improvement." The traditional quality improvement tools including flow charts, histograms, pareto charts, and even process control charts may work in Kuhn's "duck" universe but find little use in the system universe of "rabbits." For in systems and the practice of systems thinking the focus is not on separate objects, a single process or service but on the movement of relationships, connections, interdependencies and the overall meaning created by this inter-connectedness." Systems thinking has intrinsic value in the movement of relationships and is not limited to the process of improving objects or services. Using this context of systems, I propose the term "Systems Coherence" to define this movement of relationships as follows: *The evolution of relationships in a coherent way such that the process of thinking changes to co-create a new and creative movement of interacting together to bring about a new order*. This evolution of relationships is the essence of systems thinking. The purpose of this article is to share this fundamental meaning of systems and systems thinking through a movement called "*Systems Coherence*."

The Transformation

> **But what do we mean by the American Revolution? Do we mean the American war? The Revolution was effected before the war commenced. The Revolution was in the minds and hearts of the people: a change in their religious sentiments, of their duties and obligations This radical change in the principles, opinions, sentiments, and affections of the people was the real American Revolution.** – John Adams to Hezekiah Niles, 1818.[2]

Just as in John Adam's time the American Revolution was a transformation based on the concept of "representative democracy" which resulted in the Declaration of Independence from England, so to in

our time the concept of “systems thinking” could result in a worldwide revolution; through a “Declaration of Interdependency.” A change of mind and heart, a radical change of principle and assumptions, sentiments and affections towards a new world view based on relationships. But in order to participate in this revolution, to know it, to understand it, to truly be with it, several basic transformations need to take place including shift from fragmentation, shift in process of thought and a focus on relationships.

Fragmentation

The first transformation shift is from a fragmented to a holistic world view. What does fragmentation mean and why is it important? To understand fragmentation and the dysfunction it creates we first need to relate it to the definition of a system. A system is not the sum total of component parts; rather a system is the “interaction” of its component parts. When a system is so defined by its interactions, then a particular component has no independent meaning from the system as a whole except as it relates through other components. In the understanding gained through this definition the statement that a component has a separate significance would fragment that component from the system. In short, components affect systems only through their interrelationship with other components.

As an administrator in a large, American hospital, I offer an example of fragmentation in the health care system. As in any health organization, there are multiple ways to structure the work performed in a hospital. An extreme example would be to structure work by the entry location of patients. If half of all the hospital employees were asked to move to the front lobby and take care of every patient who comes in for medical help and the other half of the employees were asked to move to the emergency department to care for every patient that entered the emergency department, this structure would neither promote or support the care and treatment that patients need in any efficient or effective manner. Rather, it would be total confusion.

Fortunately, hospital care is not structured in this way but is organized in most hospitals through clinical “divisions” (also called clinical departments or sections). Divisions are specialties that perform a particular task or group of tasks in the process of care for every patient receiving hospital care. Hospitals have created divisions of nursing, pathology, radiology, pharmacy, nutrition, housekeeping, etc. While all of these divisions are absolutely necessary to support patient care, over time a consistent phenomenon occurs: people begin to define themselves as part of those divisions and lose sight of the very reason they are at the hospital to care for the patients.

When this occurs, they have regressed from a relationship of wholeness to one of fragmentation. As time passes, fragmented components acting from a sense of incoherence may even see themselves as the most important entity in the organization. When this occurs, it is not uncommon to hear staff and even managers make statements such as, "If we only had less patients to care for we could really do our job much better" or "that's not my job" or "I know what is best for the patient" or "that's his responsibility" or "that's not my patient." These statements are all symptoms of fragmentation and are clear signs of a mental model, which is fundamentally built on a world view focused on fragmentation.

Each day at all levels of every organization, people consistently communicate and think in a fragmented manner. Once this mental model is established and reinforced by others throughout the organization it creates dysfunctional relationships. In the example of the American hospital, this dysfunction results in episodic, independent and thus fragmented treatment of patients. The belief that one exist independence from a system is incoherent because it prevents a person from really "working together" with others.

David Bohm, a quantum scientist and philosopher made reference to this concept in his book "On Dialogue" and called it collective thought. He states, "*The thought would flow, rather than there being a lot of different people each trying to persuade or convince the others*."[3] This concept of "working together" or collective thought is a very powerful one. A mental structure of fragmentation prevents collective thought and working together by directing work relative from the component one identifies with. Rather than a collaborative, sharing network of people interacting together for patient care, each division or specialty persuades and demands actions that, from their own point of view, will benefit the patient. This fragmentation is not only very incoherent but at times potentially harmful to patients. Another incoherence resulting from this view is once it begins it is automatically reinforced by one's own thinking resulting in deeper fragmentation. This occurs by giving one's original fragmented thought incorrect special purpose.

David Bohm defines this as a mental virus. A mental virus of fragmentation typically develops over time and spreads throughout the organization. The self reinforcement of a mental virus results in one tending to disconnect from the system while creating incoherent, dysfunctional relationships throughout the organization as the virus spreads to others who then believe that they too need to have a self fragmented special purpose. If a critical mass of special self-purpose occurs, a breakdown of the entire organization may result.

Symptoms of such a breakdown include insistence that things must be done only one way, belief that one's department is the most important, or that statements that others could not possibly understand or achieve what one is currently doing. Communication of this type affects the behavior of the system through the interaction with others. This mental virus typically sets off a chain reaction of additional fragmentation, unless confronted, it tends to gain great momentum quickly and is self reinforced until some immunity process is established.

A third important understanding of fragmentation is its affect on the system as a whole, which is essential to the resolution of fragmentation. As the definition of a system states, no component can have an independent effect on the outcome of a system. Thus the significance or contribution that any component has to a system is not in the value of its separate work but in the interaction of its work with all other components together. It is the interaction of the components and the ability to "work together" that co-creates coherent relationships. The value of a component's work is how it clusters with others to co-create an outcome.

This process is one where cause becomes effect and effect becomes cause. In a system universe, there is no value to a separate component because any component real value is only in its ability to "work together" with all components. This does not mean that all components must be assimilated in one movement, or that they must be synchronized or moving together in one uniform manner. Rather the process is more one in which A affects B, B affects A, AB affects C, etc. Thus working together is a process of free and open sharing of differences and diversities but in a process where there is trusting and support of another without judgment.

What is needed of course is for those who practice systems thinking to expose this fragmented thinking and explore the meaning of it all. The immunity to this mental virus is in awareness and understanding where people can see their own dysfunction without fear, own it and explore it. If one can maintain this exploration it will, over time, crumble and open the possibility toward meaningful relationships. The very possibility of congruent relationships exists through this learning process, one in which systems coherence begins to evolve.

Process of Thought

The second transformation is the practice of "going up stream" to discover the root or origin of a situation. In traditional thinking, a problem is identified, traced to a particular process and an opportunity for improvement is created. The problem process is analyzed and "fixed." Then one moves on like a fire fighter waiting for the next fire. This behavior is limited as it "fixes" only one particular problematic process, leaving numerous and similar problematic processes in place without resolution, which may emerge at any time. The dilemma with this approach is not in the specific problem under attack, but in the thinking from which the problem emerged. As David Bohm states "*the real problem confronting us is not the immediate problems but the thinking that made it so*."[4] By shifting our thinking away from the particular problem to the process of thought which is responsible for creating the problem we begin to go "up stream" to focus on the very root of the situation. As an example, David Bohm offers a very insightful story on the power of process of thinking about seeing a polluted stream. We do not try to fix the pollution in the stream before us, but first go up stream to the source of the pollution and resolve the situation at its origin.

As in the example of the polluted stream, traditional thinking focuses only on the final content of what we say, resulting in a leap towards unnecessary conflict. The minute one hears another's content that is different or opposite one's own, the natural impulse is to assume that the other person is wrong. It is an impulse that emerges without reflection but one which creates conflict. If one begins to catch oneself in this process and see the rush to conflict, real communication emerges. From quantum physics we know that it is impossible for anyone to know all there is to know about any one situation. We also know that every person holds their own unique view of the phenomena before us. As Werner Heisenberg, a quantum physicist summarizes, "*What we observe is not nature itself, but nature exposed to our method of questioning*."[5] Since no two people see exactly the same reality, why then, when confronted with an opposite point of view would one not wish to explore the other person's content? If we begin to look at our thinking process rather than focus on the immediate problems, we could really begin to make change in the system. Through this process the incoherent relationships would unfreeze and evolve into meaningful relationships.

Relationship

The third and final transformation is the focus on relationships. As J. Daniel Beckham, president of The Beckham Company, aptly stated, "*You can understand the people in the organization only*

through their relationships with each other. If you re really a system, then you ought to be focused more on interactions than actions."[6] Regardless of the definition of systems and systems thinking you prefer (i.e., Peter Senge's, Russell Ackoff's or Fritjof Capra's) each incorporates the importance of interaction between people. The intersection where people come together to do their work, to communicate, is relationships. When this movement is dysfunctional, you have incoherence and when you have incoherence you have failure, distrust, disagreement, delay, breakdown, etc. Coherent relationships, not technology, are the essence for sustainable evolution. Without a coherent relationship, two people, two organizations or two worlds are unable to move together in any meaningful way. The concept of systems thinking and the revolution and the transformation it creates must begin with the focus at the core of its meaning, that being "relationships." If you see this then you can move on to understand that the aim or purpose of what we do with systems thinking is to evolve relationships together. Through this we co-create new frontiers of innovation and creativity, we bring this about through Systems Coherence.

System Thinking is About Relationships, Not Quality

To understand why systems thinking is not synonymous with quality and why traditional quality improvement tools do not work within its context, one first must understand some basic definitions. What is quality and why has this concept held so much of our attention? The word has multiple meaning. Quality originated from the Latin word Qualitat - quali meaning "of a kind," and tat meaning "akin," placing both words together meaning "essential character, nature or kind." Since then a more contemporary definition would be "*degree of conformance to the standard, or intrinsic excellence of character or type*."[7] It is well known that quality has become the center of focus in business and industry due in large part to both W. Edwards Deming and J. M. Juran. Deming's quality theory of "Profound Knowledge" was the cornerstone of his contribution from which he designed what he called "the three corners of quality" which is as follows: *The customer is the most important part of the production line. Without someone to purchase our product, we might as well shut down the whole plant. Neither the building of a product nor tests thereof in the laboratory and on the proving ground are sufficient to describe its quality and how it will perform or be accepted. Quality must be measured by the interaction between three participants (1) the product itself; (2) the user and how he uses the product; (3) instructions for use..* [8]

Juran's contribution can be understood in his definition of quality as follows:

1. *Quality consists of those product features, which meet the needs of customers and thereby provide product satisfaction.*
2. *Quality consists of freedom from deficiencies.* [9]

From Deming and Juran, a quality movement over the second half of this century has focused management delivery towards meeting and delighting customer needs for products and services. This philosophy of quality not only is well defined but also includes methods of measuring its success. In the case of Deming came the PDCA or Plan, Do, Check, Act method. Deming acquired this method from Walter Shewhart and made several improvements. This process identified a problem or dysfunctional process and through the use of statistical measurement, management and staff would analyze problems and implement improvements. The tools used are wide-ranged from flowcharts and histograms to process control charts, all of which focus on how a process or product works and is measured. In essence, the purpose of action was centered on the customer's needs with the creation of products or services free from defects. Paralleling the diffusion of the quality movement emerged a separate movement called systems and systems thinking.

Evolution of Systems Thinking

Systems was focused on an entirely different level of change with a new and different worldview of phenomenon. David Bohm, Peter Senge, Fritjof Capra and Russell Ackoff all contributed definitions of systems and systems thinking which are important to consider in understanding the differences with the quality movement. Fritjof Capra has defined a system as *The systems view looks at the world in terms of relationships and integration. Systems are integrated wholes whose properties cannot be reduced to those of smaller units. Systematic properties are destroyed when a system is dissected into isolated elements.* [10] Peter Senge defines systems thinking as *System thinking is a discipline for seeing wholes. It is a framework for seeing interrelationship rather than things, for seeing patterns of change rather than static snapshots.* [11] Russell Ackoff's definition is: "A *system is a whole that cannot be divided into independent parts or subgroups of parts. A system s essential, defining, properties are the products of the interactions of its parts, not the actions of its parts considered separately. A system is a whole that has one or more defining functions and that consists of a set of two or more essential parts that satisfy three conditions: Each of these parts can affect the defining behavior of the whole and is necessary for it. The way each part affects the whole depends on what the other parts are doing. None of the essential parts or sub groups can have an independent effect on the defining function(s) of the whole* ."[12]

All of these definitions clearly focus on concepts of interdependency, integration, and relationships. Differences between the quality and systems movements are summarized in Table #1. For this comparison, quality is summarized using Shewhart-Deming's PDCA model.

Table 1. Comparison of Shewhart-Deming PDCA model to Systems

Shewart-Deming PDCA	**SYSTEMS**
1. A problem becomes the opportunity statement from which the quality improvement is designed.	1. A problem is a symptom of something larger. The focus is on the relationship in and between the components of the system not a problem in time.
2. The work is identified relative to one's perception to the need of the customer.	2. The work is to evolve the relationship together throughout time.
3. The process or product from which the problem emerges is the extent of the quality improvement.	3. The relationship itself is the focus from which learning and development take place. Here, the focus is on the process of thinking, not a particular process or product.
4. A cause and effect model is used to analyze the defective product or process. The process is where one component affects another but the second one does not affect the first. This is a linear relationship.	4. Cause and effect models are not used. In a system it is how components work together in a reciprocal causality relationship that really matters not a limited cause and effect model.
5. Measured feedback is usually limited to a relational set relative to the particular process or product.	5. Measured feedback is based on the interdependency of relationships throughout the system.

From this comparison several fundamental differences are apparent. First is the concept of a problem. A problem becomes the focus and opportunity for improvement under the quality model. In contrast, in systems thinking, a problem is a symptom of system complexity. In the quality model, an individual perceives a problem based on a fragmented view of his/her place in the organization. Providing attention to problems may improve fragments but usually results in little or no improvement to the outcome of the system. In the systems view, the focus is not to fix a part or fragments but to focus on outcomes. To work backward from the outcome through clusters of relationships, in essence to stay with the system not a particular part.

Cause and effect models are used by the quality movement to measure and analyze problems, taking them apart and improving individual components, based on an orientation where a system is the sum of its parts. The goal of this view is to eliminate defects, discover variations and weed out the bad parts. In essence, this linear process creates a view of the whole through the parts taken separately.

In the system movement the opposite view is taken. The system participates in a non-linear reciprocal causality relationship. This is a relationship where A effects B and B effects A, --where cause behaves both as cause and effect, -- where working together co-creates innovation.

A final fundamental difference is in the use of measured feedback. In the quality movement, measures are limited to the particular problem, product or process which the satisfaction of the customer is measured. In systems thinking, measured feedback is focused on the understanding or the synthesis of interdependencies.

As Deming himself noted about the focus on quality. *This is not easy, and as soon as one feels fairly successful in the endeavor, he finds that the needs of the customer have changed, competitors have moved in, there are new materials to work with, some better than the old ones, some worse; some cheaper than the old ones, some dearer.* [14] This is why I am suggesting that systems should not be focused on just the quality improvement of a product or process.

An understanding of the meaning of relationships can provide further value on the movement of systems thinking and its difference from quality. Relation comes from the latin word relatio and is defined: *an aspect or quality that connects two or more things or parts as being or belonging or working together or as being of the same kind. The state of being mutually or reciprocally interested.* [13] Thus a relation or relationship is centered upon the elements that hold two or more things or people together in a reciprocal interest. With increasing sensitivity to the nature of relationships one may concentrate the necessary attention on the intrinsic value that it holds. Emphasis on advancing relationships with those who we work with as well as those for whom we work for develops a genuine coherence. Through fostering relationships, quality and performance naturally move coherently together as one whole system.

New Measurements for a System Universe

Measurement methods used in the quality movement provide feedback limited to a particular and independent variable over time. These linear tools omit the relationship between variables over time. These traditional measurement tools are thus too limited in providing real insight into relationships which interact as systems. This emphasizes the need for a framework to synthesis our relationships. I wish to theorize that chaos theory provides promise of a measurement for systems and systems

thinking, and may provide a new way of learning and understanding complex systems and the relationships that exist. H. Richard Priesmeyer, professor of management at St. Mary's University in San Antonio, Texas offers this observation on chaos theory, *The new science of chaos suggests that our 17th century view of the world, though it has facilitated significant progress for humankind, is fundamentally limited in its ability to help us understand the enormously complex relationships that characterize most of our systems and organizations. Its limitations follow inevitably from its assumptions that the world is linear, proportional and predictable.* [15] What appears to be random or out of control using traditional measurement tools, chaos theory explains as behavior associated with the morphology of the system resulting in a new view of order.

Chaos theory offers models such as phase plane trajectory, which offer an understanding of relationships between two or three variables over time. This breakthrough in measuring the relationship between variables has tremendous potential in advancing the insight into the dynamics of systems. As chaos theory advances yet new measurement models, this new area of discovery offers a language for the paradigm shift from a universe of ducks to a universe of rabbits.

Endnotes:

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[2] Bailyn Bernard, The Ideological Origin of the American Revolution, Harvard University Press, Cambridge, Massachusetts, London, England, 1992, p.160.
[3] David Bohm, On Dialogue, Routledge, London & New York, 1996, p.26.
[4] David Bohm, On Dialogue Consideration lecture, Mickelton England, 1990.
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[10] Fritjof Capra, The Turning Point, Toronto, New York, London, Sydney, Auckland, p. 266.
[11] Peter Senge, The Fifth Discipline, Doubleday, New York, London, Toronto, Sydney, Auckland, 1990, p. 68.
[12] Russell Ackoff, System Thinking Beyond TQM and Re-Engineering Seminars, 1995.
[13] Merriam Webster's Third New International Collegiate Dictionary Britannica, Inc., Internet.
[14] W. Edward Deming, Quality Productivity and Competition Position, Massachusetts Institute of Technology, Center for Advanced Engineering Study, 1982, p. 227.
[15] Lawrence F. Sharp and H. Richard Priesmeyer, Quality Management in Health Care, Tutorial: Chaos Theory – A primer for Health Care, 1995, p. 84.
[16] David Bohm, On Dialogue, Routledge, 1996, p.34.